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The Sense of Coherence and Associated Factors of the Lived Experience of Pregnant Patients Attending Care in a Chiropractic Practice-Based Research Network

Joel Alcantara

BSc, DC

Faculty of Health

Southern Cross University

This thesis is submitted in fulfilment of the degree of Doctor of Philosophy

March 18, 2024

Statement of Originality

I certify that the work presented in this thesis is, to the best of my knowledge and belief, original, except as acknowledged in the text, and that the material has not been submitted, either in whole or in part, for a degree at this or any other university.

I acknowledge that I have read and understood the University's rules, requirements, procedures, and policy relating to my higher degree research award and to my thesis. I certify that I have complied with the rules, requirements, procedures, and policy of the University.

Joel Alcantara

March 18, 2024

Abstract

The World Health Organization defines chiropractic as a healthcare profession concerned with the diagnosis, treatment, and prevention of disorders of the neuromusculoskeletal system, and the effects of these disorders on general health. Although chiropractors have cared for pregnant women since chiropractic's inception, systematic reviews of the literature reveal the research evidence for chiropractic pregnancy care as emergent.

The aims of this thesis are to characterise chiropractic pregnancy care from the perspective of chiropractors versed in pregnancy care, evaluate the sense of coherence and associated health constructs (i.e., quality of life, general self-efficacy, health locus of control, and patient satisfaction) of pregnant and non-pregnant women who are chiropractic patients and assess the lived experience of pregnant women under chiropractic care. Guided by a philosophical framework of pragmatism, this thesis consists of a parallel mixed methods design employing a survey of chiropractors, a survey of pregnant and non-pregnant chiropractic patients, and semistructured interviews of pregnant chiropractic patients.

Chiropractors provide care to pregnant women to address pregnancy-related musculoskeletal complaints such as low back and pelvic girdle pain and complaints of non-musculoskeletal origin such as morning sickness, and gastroesophageal reflux. Towards these efforts, chiropractors modify and utilise a number of chiropractic spinal manipulation techniques and prescribe adjunctive therapies such as exercise, nutrition, and herbal remedies. Chiropractors are of the opinion that their care protocols for pregnant women are safe and collaborate with other healthcare providers when necessary. As chiropractic patients and relative to non-pregnant women, pregnant women have a relatively high sense of coherence, have pain interference and compromised physical

functioning but experience lower levels of depression. Pregnant and non-pregnant women under chiropractic care have similar measures in general self-efficacy and in the domains of the health locus of control and have high ratings with their interpersonal process of care experience. The essence of the lived experience of pregnant women is that with chiropractic care, pregnant women satisfy their need for self-determination, have an enhanced and transformative pregnancy experience towards a natural and conservative approach to pregnancy and childbirth.

Overall, this thesis brought to the forefront the unique role of chiropractors in pregnancy care and insights to pregnant women's sense of well-being, health-related beliefs, and their ability to cope with stress. Chiropractors can help support a pregnant woman's health and wellbeing, provide a positive pregnancy experience, and provide support in promoting a healthy lifestyle during pregnancy and beyond.

Dedication

This thesis is dedicated to Dr Junjoe Alcantara, DC, my brother, my best friend, much loved and very much missed.

Acknowledgement

I want to first thank my supervisors – Professor Stephen Myers, ND, MMed, PhD, Dr. Elizabeth Emmanuel, MN, PhD and Professor Sandra Grace, DC, DO, PhD for their brilliance, generosity of time and in sharing their knowledge and expertise to guide me in my research endeavours and the completion of this thesis.

I want to express my gratitude to the chiropractors and their patients for participating in the studies presented in this research. I am most grateful to Dr Justin Ohm, Dr John Edwards, Dr Drew Rubin, and Dr Lisa Geiger for their unwavering support of chiropractic research and in assisting me in completing my data acquisition.

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I am forever grateful to the International Chiropractic Pediatric Association and Southern Cross University for the tuition and research support in pursuit of my PhD. Special thanks go to Dr Jeanne Ohm, DC, Dr Peter Kevorkian, DC, Dr Tony Carrino, DC, Dr Jim Thompson, DC, Dr Stephen Marini, DC, PhD and Dr Tom Ohm, DC.

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List of Manuscripts Submitted for Publication

1. Alcantara J, Myers SP, Emmanuel E, Grace S. Sense of coherence in pregnancy: a systematic review of the literature. [Submitted for Publication].

2. Alcantara J, Whetten R, Emmanuel E, Grace S, Myers SP. The chiropractic care of pregnant women: a scoping review of the literature. [Submitted for Publication]

3. Alcantara J, Myers SP, Emmanuel E, Grace S. Chiropractic care during pregnancy: a quantitative systematic review of the literature. [Submitted for Publication]

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Statement of Contribution

The signed Statement of Contribution of Co-authors can be found in Appendix A.

Throughout the course of my PhD, I have co-authored a total of three publications included in the thesis.

> **Alcantara J**, Myers SP, Emmanuel E, Grace S. Sense of coherence in pregnancy: a systematic review of the literature. [Submitted for publication].

The above manuscript has been submitted for publication in a peer-reviewed PubMed-indexed journal.

The candidate Joel Alcantra was the primary author. The candidate designed the systematic review, processed the literature review, accessed the relevant literature, analysed the relevant literature, and wrote the original manuscript. The co-authors supported the design, analysis, and preparation of the manuscript. Overall, the candidate contributed greater than 60% to the design, execution of the systematic review, and preparation of the manuscript for publication.

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The candidate Joel Alcantra was the primary author. The candidate designed the systematic review, processed the literature review, accessed the relevant literature, analysed the relevant literature, and wrote the original manuscript. Ryan Whetten performed the statistical analysis, co-wrote the methodology section, and supported the preparation of the manuscript. The co-authors supported the design, analysis, and preparation of the manuscript. Overall, the candidate contributed greater than 60% to the design, execution of the systematic review, and preparation of the manuscript for publication.

> **Alcantara J**, Myers SP, Emmanuel E, Grace S. Chiropractic care during pregnancy: a quantitative systematic review of the literature. [Submitted for publication]

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The candidate Joel Alcantra was the primary author. The candidate designed the systematic review, processed the literature review, accessed the relevant literature, analysed the relevant literature, and wrote the original manuscript. The co-authors supported the design, analysis, and preparation of the manuscript. Overall, the candidate contributed greater than 60% to the design, execution of the systematic review, and preparation of the manuscript for publication.

I, Joel Alcantra, agree that the above descriptions of the contributions of authors to these publications are accurate and correct.

Signed_____Date: _____

I, Stephen P. Myers, agree that the above descriptions of the contributions of authors to these publications are accurate and correct.

Signed: _____ Date: _____

I, Elizabeth Emmanuel, agree that the above descriptions of the contributions of authors to these publications are accurate and correct.

Signed: _____ Date: _____

I, Sandra Grace, agree that the above descriptions of the contributions of authors to these publications are accurate and correct.

Signed: _____ Date: _____

I, Ryan Whetten, agree that the above descriptions of the contributions of authors to these publications are accurate and correct.

Signed: _____ Date: _____

List of Abbreviations

1^0	primary
2^0	secondary
3^0	tertiary
a or α	alpha
AAS	Adult Attachment Scale
AMCT	adverse mechanical cord tension
AMED	Allied and Complementary Medicine
ANOVA	analysis of variance
AOR	adjusted odds ratio
APBS	Attachment in Perinatal Bereavement Scale
APGAR	Adaptability, Partnership, Growth, Affection, Resolution
ActRelTec	active release technique
ART	assisted reproductive technology
AU	Australia
AUDIT	Alcohol Use Disorders Identification Test
BDQ	Bournemouth Disability Questionnaire
BEST	Bio-Energy Synchronization Technique
BP	blood pressure
BSI	Brief Symptom Index
CACCP	Certification from the Academy Council of Chiropractic Pediatrics
CAIM	complementary, alternative, and integrative medicine
CATT	Chiropractor's Assessment and Treatment Tool
CBSEI	Childbirth Self-Efficacy Inventory
CCBC	College of Chiropractors of British Columbia
CEQ	Childbirth Experience Questionnaire
CFA	confirmatory factor analysis
CI	confidence interval
CINAHL	Cumulative Index to Nursing and Allied Health Literature
COREQ	consolidated criteria for reporting qualitative research
COVID	coronavirus disease
CPASS	Child Pain Anxiety Symptoms Scale
CPC	choroid plexus cyst/cysts
CSS	Crisis Support Scale
CST	craniosacral therapy
CSV	comma-separated values
CWS	Cambridge Worry Scale
D or Δ	difference

DACCP	Diplomate from the Academy Council of Chiropractic Pediatrics
DAS	Dyadic Adjustment Scale
DBB	Dynamic Body Balancing techniques
DC	Doctor of Chiropractic
DES-10	Diabetes Empowerment Scale-10
DIF	differential item functioning
DMSES	Diabetes Management Self-Efficacy Scale
DRAM	Distress and Risk Assessment Method
DSRS	Depression Self-Reporting Scale
DVT	deep vein thrombosis
EA	epidural anaesthesia
EFA	exploratory factor analysis
EIP	evidence-informed practice
EMBASE	Excerpta Medica Database
EPDS	Edinburgh Postnatal Depression Scale
EQ-5D	EuroQul Five Dimension Questionnaire
ERCD	elective repeat Caesarean delivery
FABQ-Act	Fear Avoidance Beliefs Questionnaire
FHR	foetal heart rate
FOC	fear of childbirth
GHQ	General Health Questionnaire
GMH	global mental health
GPH	global physical health
GRRs	general resistance resources
GSE	general self-efficacy
GSES	General Self-Efficacy Scale
GSI	Global Severity Index
HAD	Hospital Anxiety and Depression
HbA1c	glycated haemoglobin
HI	Health Index
HIPAA	Health Insurance Portability and Accountability Act (United States)
HLOC	Health Locus of Control
HQD	Havelhoehe Questionnaire on Delivery
HREA	Human Research Ethics Application
HVLA	high-velocity, low-amplitude
ICA	International Chiropractic Association
ICC	intraclass correlation coefficient
ICL	Index to Chiropractic Literature

ICPA	International Chiropractic Pediatric Association
IES-R	Impact of Event Scale-Revised
IPC	interpersonal process of care
IQR	interquartile range
IRB	Institutional Review Board
JBI CAT	Joanna Briggs Institute Critical Appraisal Tool
JW-DEQ	Wijma Delivery Expectancy/Experience Questionnaire
LBP	low back pain
LOC	locus of control
MANTIS	Manual, Alternative and Natural Therapy Index System
MAVIDOS	Maternal Vitamin D Osteoporosis Study
MCID	minimally clinically important difference
MCS	Mental Component Scale
MFAS	Maternal Fetal Attachment Scale
MHLOC	Multidimensional Health Locus of Control
MI	myocardial infarction
MANCOVA	multivariate analysis of variance
MOS	Medical Outcomes Study
MOS-SF12	MOS Short Form 12-Item Health Survey
MOS-FMFM	MOS Family and Marital Functioning Measures
MOS-SSS	MOS Social Support Survey
MRI	magnetic resonance imagining
MSK	musculoskeletal
MPSS	Multidimensional Scale of Perceived Social Support
MSSS	Maternity Social Support Scale
MYOP2	Measure Your Own Medical Outcome Profile
NET	Neuro Emotional Technique
NIH	National Institutes of Health (United States)
NLP	Natural Language Processing
NMS	neuromusculoskeletal
NorAQ	NorVold Abuse Questionnaire
NP	neck pain
NPIS	Nurse–Patient Interaction Scale
NR	not reported
ns	not significant
NRS	pain Numeric Rating Scale
NSA	network spinal analysis
NUCCA	National Upper Cervical Chiropractic Association
NuPDQ	Revised Prenatal Distress Questionnaire

Ob/Gyn	obstetrics/gynaecology
OGTT	oral glucose tolerance test
OMT	osteopathic manipulative therapy
OR	odds ratio
P-LAB	Preparation for Labor and Birth
PBRN	practice-based research network
PCA	principal component analysis
PCQ-C	Pain Coping Questionnaire for Children
PCS	Physical Component Scale
PEER-U	parent's expectations, experiences and reactions to routine ultrasound examination
PGIC	Patient's Global Impression of Change
PGP	pelvic girdle pain
PGS	Perinatal Grief Scale
PhD	Doctor of Philosophy
PHIPA	Personal Health Information Protection Act (Canada)
PIPEDA	Personal Information Protection and Electronic Documents Act (Canada)
POMS	Profile of Mood States
POP	pelvic organ prolapse
PPD	postpartum depressive
PRAMS	Pregnancy Risk Assessment Monitoring System
PRISMA	Preferred Reporting Items for Systematic Reviews and Meta-Analysis
PRISMA-ScR	Preferred Reporting Items for Systematic Reviews and Meta-Analyses for Scoping Reviews
PRLBP	pregnancy-related low back pain
PRO	patient-reported outcome
PROM	patient-reported outcome measure
PROMIS	Patient-Reported Outcomes Measurement Information System
PRPGP	pregnancy-related pelvic girdle pain
PSEQ	Pain Self-Efficacy Questionnaire
PSS-SR	PTSD Symptom Scale
PSS	Perceived Stress Scale
PTB	pre-term birth
PTSD	post-traumatic stress disorder
PVperW	patient visits per week
QDO	Quebec Taskforce Disability Questionnaire
QDR-36	Quality of Dyadic Relationship-36
QoL	quality of life

RCTs	randomised controlled trial
RedCap	Research Electronic Data Capture
RMDQ	Roland-Morris Disability Questionnaire
RMSEA	root mean square error of approximation
ROC	receiver operating characteristic
ROM	range of motion
RR	risk ratio
SAQ	Seattle Angina Questionnaire
SBI	Support Behaviour Inventory
SD	standard deviation
SEM	standard error of measurement
SF-12	12-Item Short Form Health Survey
SF-36	36-Item Short Form Health Survey
sIgA	secretory immunoglobulin A
SIJ	sacro-iliac joint
SLE	lupus erythematosus
SMBG	self-monitoring blood glucose
SMT	spinal manipulative therapy
SOC	sense of coherence
SOS	Spiritual Orientation Scale
SOT	Sacro Occipital Technique
SPD	symphysis pubis dysfunction
SPS	Stress Perception Scale
SPSQ	Swedish Parenting Stress Questionnaire
SR	systematic review
SRR	specific resistance resources
SSc-ILD	systemic sclerosis-associated interstitial lung disease
STAI	State and Trait Anxiety Inventory
Swe-CBSEI	Swedish Childbirth Self-Efficacy Inventory
SWE-DES-10	Swedish Diabetes Empowerment Scale
SWE-HFS	Swedish Hypoglycemia Fear Survey
SWE-PAID20	Swedish Problem Areas in Diabetes-20
TCPS	Tri-Council Policy Statement: Ethical Conduct for Research Involving Humans (Canada)
TLI	Tucker–Lewis Index
TOLAC	trial of labour after Caesarean
US	ultrasound
USA	United States of America
VAS	Visual Analog Scale

VBAC	vaginal birth after Caesarean
VBAI	vertebra basial artery insufficiency
VSQ	Visit-specific Satisfaction Instrument
W-DEQ	Wjima Delivery Expectancy/Experience Questionnaire
WBQ-12	Well-Being Questionnaire-12
WDEO-A	Wjima Delivery Expectancy Questionnaire Version A
WEMWS	Warwick Edinburgh Mental Well-Being Scale
WHO-5	World Health Organization Well-Being Index
WHOQOL-BREF	World Health Organization Quality of Life Instrument - Brief version
WOG	week of gestation
χ^2	chi-square

Chapter 1. Introduction

1.1 Introduction

The World Health Organization recognises chiropractic as a health care profession concerned with the diagnosis, treatment, and prevention of disorders of the neuromusculoskeletal system and the effects of these disorders on general health. [1] A 2019 study estimated that there were 103 469 chiropractors practicing worldwide with direct access by patients in 81 countries with only two countries (i.e., the Bahamas and Saudi Arabia) requiring a medical referral. [2] In the care of patients, a Doctor of Chiropractic (DC) or chiropractor, obtains a detailed health history, perform physical examinations and order tests (i.e., laboratory and imaging) to formulate a working diagnosis and develop/implement a management plan. [3] Their provision of care emphasises primarily the use of manual or hands-on techniques, particularly the use of spinal and extraspinal adjustments (otherwise known as spinal manipulative therapy or SMT) to address dysfunctional or subluxated [4-6] vertebral and extra-vertebral articulations. In addition, chiropractors prescribe adjunctive therapies (e.g., soft tissue work, diet and nutrition, exercise and rehabilitation, and general lifestyle coaching) as part of their care protocol. While there is great variability in the scope of practice of chiropractic in different jurisdictions (i.e., state/province or countries) [7-10], the recent scoping review by Beliveau et al. [11] revealed that chiropractors mostly focused on patient care involving the neuromusculoskeletal (NMS) system such as low back pain (LBP) and neck pain (NP). Furthermore, chiropractic patients are more likely to be female (median 57.0%, interquartile range (IQR): 53.2%–60.0%) with a median age of 43.4 years (IQR: 39.6–48.0). [11]

Following the chiropractic educational reforms of the 1930s to the 1960s, chiropractic specialties began to be offered as postgraduate programs that included special

imaging, orthopaedics, paediatrics, nutrition, neurology, pregnancy care and sports medicine that led to a certification, diplomate, or a master's degree. [12] Of particular interest and focus of this doctoral thesis is chiropractic pregnancy care.

1.2 Chiropractic Pregnancy Care

Pregnancy confers a number of physical and physiological changes upon a woman that can affect her physical, mental, and socio-emotional status in a clinically significant manner. [13] Physiologically, the woman undergoes a number of changes such as peripheral vasodilatation and decrease in systemic vascular resistance due to increased levels of estrogen and progesterone. [14] As a result, their heart rate and stroke volume must compensate to maintain sufficient cardiac output. The pregnant woman's chest wall expands in the anterior to posterior and transverse dimensions, affecting lung mechanics, while the heart displaces up and to the side. Haematologically, the pregnant woman may experience physiological anaemia and lower haematocrit. Of notable consideration for chiropractors is the increased production of platelets with alterations in the coagulation and fibrinolytic pathways that may place the pregnant woman at an increased risk for thromboembolism. [14] The pregnant woman's gastrointestinal and nervous systems are also affected (e.g., acid reflux and increased permeability of the blood–brain barrier respectively).

According to the World Health Organization, almost 1 in 5 women will experience a mental health condition during pregnancy or in the year after giving birth. Among women with perinatal mental health conditions, 20% will experience suicidal thoughts or undertake acts of self-harm. [15] Based on clinical diagnostic tools, 8-12% of pregnant women meet the criteria for a mental disorder. [16] However, this percentage may be underestimated in women experiencing psychological distress given that a large-scale community study found that about 30% of pregnant women reported some type of stress in

their daily lives, including job strain, anxiety, or depressive symptoms. [16] Exposure to maternal stress increases the risk for maternal mental health problems later in life but also adverse neonatal, infant and child outcomes. [16-17] For example, Wei et al. [18] found that maternal perceived stress and negative life-event stress around the time of conception were negatively associated with children's neurodevelopment at two, six, 12, and 24 months of age, while positive maternal life-event experiences were positively associated with children's neurodevelopment.

Increased levels of relaxin results in increased ligament laxity and changes in the pregnant woman's morphology, particularly in the spine and pelvis. [14, 19] This results in altered sitting and standing postures as well as changes in balance and kinematics of the lower extremities. [19-22] During pregnancy, LBP, and pelvic girdle pain (PGP) are common comorbidities and as in the general population, present significant physical, psychological and socio-economic implications. [23-25] The prevalence of pregnancy related LBP has been estimated to range from 24-90% with increasing prevalence as a woman's pregnancy progresses and peaks in the third trimester. [23, 25-28]

The use of complementary, alternative, and integrative medicine (CAIM) [29] during pregnancy continues to rise. [30-31] According to Hall et al. [32], the reasons for CAIM use by pregnant women are varied but include the belief that CAIM therapies are safer alternatives to pharmaceuticals, provide for greater choice and control over their childbearing experiences, recommendation of family and friends, the influence of traditional cultural practices and congruence with a woman's holistic health beliefs. The prevalence of CAIM use by women ranges from 56% to 88% in the United Kingdom, over 50% for middle aged and older Australian women and over 90% of menopausal Canadian women. [32-36] In the United States, Johnson et al. [37] found that 67% of women in their childbearing years reported using some type of CAIM in the previous 12 months with

pregnant women reporting a significantly higher utilisation. LBP, NP, and anxiety were the most commonly reported symptoms motivating CAIM use. During pregnancy, CAIM use has been estimated to range from 1% to 87% to address complaints such as pregnancy-related musculoskeletal (MSK) pain, morning sickness, problems associated with labour and birth, lactation and breastfeeding difficulties along with the need to support their spirituality and emotional needs. [34-36, 38-40] A recent meta-synthesis of the literature by Bowman et al. [33] revealed that women are motivated to use CAIM due to their need for self-determination, desire for a natural childbirth and the philosophical underpinnings of their CAIM therapy resonate with their own world views.

Of the practitioner-based CAIM therapies, chiropractic is popular and highly utilised [41-42], particularly during pregnancy. [43-45] Chiropractors have a long tradition of caring for pregnant women. According to Gibbons [46], the developer of chiropractic, Daniel David Palmer (1845–1913), may have been the first chiropractic accoucher or obstetrician. According to Palmer, chiropractors should be able to care for patients with a variety of health concerns, including pregnancy. [46-47] Despite a long tradition of caring for pregnant women [46], no definitive data exists on the prevalence of use of chiropractic services by pregnant women in the United States or elsewhere. In the most recent publication of the Practice Analysis of Chiropractic 2020 in the United States [48], a representative sample of chiropractors rated the frequency (0 = *never*, 1 = *1-6 times/year*, 2 = *once/month*, 3 = *once/week*, 4 = *once/day*, 5 = *several times /day*) of addressing pregnancy-related conditions in their practices as 1.7 (i.e., between 1-6 times per year to once per month) with 70.8% of the chiropractors indicating a co-management approach. Weiss et al. [49], estimated that 5%-11% of pregnant women with LBP seek chiropractic care.

Given the popularity of chiropractic to address NMS conditions and the propensity for women of childbearing age to seek chiropractic care, it follows that women in the prenatal period would continue or initiate chiropractic care for pregnancy related MSK complaints, particularly when pregnant women have a reluctance to use medication for pain complaints. [50] Although a systematic review concluded that there may be limited evidence to support the use of complementary manual therapies as an option for managing LBP and PGP during pregnancy [51], there is evidence to the contrary that SMT as rendered by chiropractors [50] and osteopaths [52] may benefit pregnant women suffering from LBP and/or PGP and experience high patient satisfaction. [13] There is also evidence that pregnant women seek care from chiropractors for wellness care, to improve their overall quality of life (QoL), and to facilitate a natural childbirth following a diagnosis of foetal malposition or malpresentation. [13, 14, 53-54] Despite these evidentiary publications, there is little published evidence that chiropractic care in pregnancy is unique, effective, or even safe. [55-56] This doctoral thesis aspires to contribute towards evidence-informed practice (EIP) in the care of pregnant women by characterising chiropractic pregnancy care from American and Canadian chiropractors with clinical experience/expertise in pregnancy care and from the viewpoints of pregnant women receiving chiropractic care.

To provide context to this thesis, some background on chiropractic education, healthcare and insurance services in the United States and Canada as it relates to chiropractic care may be appropriate. Chiropractic education is offered in 48 institutions in 19 countries with the majority of educational institutions located in the United States (n = 18) and Australia (n = 5) with 2 institutions in Canada. [2] In the United States and Canada, the education accreditation is provided by an international chiropractic accreditation counsel, a government/federal institution or both. Direct access to

chiropractic services without the need for a medical referral is available in 81 countries with chiropractic services partially or fully covered by government and/or private health insurance in 46 countries. [2].

Through the Canada Health Act (CHA) of 1984, Canada's healthcare system is a government funded insurance system covering the entire population. The Canadian federal government make transfer payments to its provinces and territories from general tax revenues and along with provincial/territorial funding, Canadians are assured inpatient and outpatient hospital care, health maintenance and disease prevention and the diagnosis and treatment of injuries, illnesses, and disabilities along with medically required physician services, regardless of income, age, and health status. [57] However, chiropractic services are not a core part of this universal healthcare system and dependent on an individual's ability to pay out-of-pocket or extended healthcare or insurance plan such as employee benefit plans, the federal public service, worker's compensation boards, the automobile insurance industry, extended healthcare benefits, the Royal Canadian Mounted Police, Canadian Armed Forces and Veteran's Affairs Canada. [58] Unlike Canada, the United States does not have a national healthcare system except for certain groups (i.e., Medicare for people who are ≥65 years, certain younger people with disabilities and individuals with end-stage renal disease). Health insurance is purchased in the private marketplace from a variety of for-profit and non-profit insurance companies. [59-60] Although chiropractic is covered by Medicare, Medicaid, the U.S. Departments of Veterans Affairs and Defense, Federal Employees Health Benefits Program, Federal Workers' Compensation, and all State workers' compensation programs [61], similar to Canada, chiropractic services are paid for out-of-pocket or covered to a certain extent by an individual's private or government-sponsored insurance plan. The level and degree of insurance coverage varies widely dependent on the purchased insurance plans and policies. Insurance coverage may

have certain limitations with chiropractic care such as the dollar amount paid out-of-pocket prior to insurance coverage, co-pays, medical referral requirements, annual claim limit, and annual limit on patient visits. Coverage is often provided for musculoskeletal conditions but not for prevention or maintenance care and not chiropractic pregnancy care as they do for maternity and obstetrical medical care. For the most part, chiropractic pregnancy care in the United States and Canada is paid for out-of-pocket.

Few are aware that one of the underlying principles of chiropractic care is based on wellness (i.e., a set of values and behaviours towards health and enhanced QoL). In a survey of a representative sample of chiropractors in the United States [62], the majority (i.e., 65% of respondents) claimed to provide wellness care and maintenance care, while only 33.3% of the cohort reported a focus on providing nutritional recommendations as part of this care. Wellness chiropractic care has been described as patient-centred (i.e., requires active participation from the patient) and resonates with expectant mothers through a whole systems approach, acknowledging the innate ability of the body to self-heal, respecting a patient's values and beliefs and maintaining their dignity, involving the patient as an active partner in promoting their health and adhering to the principles of EIP. [63-64] An approach to wellness care that focuses on health and not on disease (i.e., pathogenesis) – that is an emphasis on one's internal healing resources and potential for active adaptation to new circumstances is known as salutogenesis. [65]

1.3 Salutogenesis

In the 1970s, Aaron Antonovsky (1923–1994), a medical sociologist, described his framework of salutogenesis. [66] in that health was not merely the absence of disease but falls on a continuum anchored at each end by total ill health (i.e., dis-ease) and total health. He proposed that people's orientation towards life would have an impact on their health.

This salutogenic framework has been proposed as a stress resisting resource. [66] The stress can be biological (e.g., physical and physiological dysfunctions), psychological (e.g., schizophrenia, post-traumatic stress disorder), or socio-emotional (e.g., obsessive compulsive disorder, anxiety, depression). Important constructs within the salutogenesis framework are sense of coherence (SOC), general resistance resources (GRRs), and specific resistance resources (SRRs).

SOC has been defined as an enduring positive outlook on life with the confidence that one's internal and external environments are predictable. [67-68] SRRs and GRRs are those traits and assets (i.e., biological, psychosocial, and material) of a person that facilitate their abilities to effectively cope with stressors. GRRs (e.g., material resources such a money, knowledge, intelligence) are described as generalities while SRRs (e.g., satisfaction with family life and with family finances, frequency of interactions with friends and relatives and number of community resources) are specific resources defined by the particular stressor(s) they are mobilised to manage. [66] Synergistically, SRRs and GRRs strengthen an individual's SOC so that in stressful situations, an individual's level of SOC determines their ability to identify and mobilise their GRRs/SRRs to maintain and develop health. [67-68]

SOC consists of three subdomains comprehensibility, manageability and meaningfulness. [66] In this era of chronic disease epidemiology where the three most common global cause of death are ischemic heart disease, stroke and chronic obstructive pulmonary disease [69], one question commonly arises: why do some individuals take active steps to address their chronic condition while others passively deteriorate? Resonating with prevention and health promotion, Antonovsky's salutogenic concept [66] proposed that individuals must first identify their healthcare needs and wants, satisfy or attain these healthcare needs, be able to cope or adapt to their environment, and have the

ability to manage stress. For an individual faced with a health stressor or health crisis, their level of SOC is said to be proportional to their ability to assess and comprehend their disease and its consequences (i.e., comprehensibility), their ability to mobilise their assets and resources (i.e., SRRs and GRRs) to manage this disease (i.e., manageability), and find meaning in doing so. The literature is replete with studies demonstrating that an individual's level of SOC is proportional to their ability to address various physical [70-71], psychological [72-74] or emotional stressors. [75-77] Not surprisingly, SOC has been found to positively correlate with QoL. [78-80]

A significant proportion of chiropractors believe that physical health and vitality depend upon the maintenance and restoration (i.e., vis a vis correction of subluxation with spinal adjustments) of an optimal alignment of the skeletal system (particularly the spine) so that an individual may experience happiness, spiritual and physical health, and the full expression of life. [81-82] Within this chiropractic theoretical and clinical framework, therefore, are incorporated the elements of comprehensibility (i.e., physical health and vitality depend upon the maintenance and restoration of the optimal alignment of the skeletal system), manageability (i.e., chiropractic care to maintain and restore optimal spinal alignment), and meaningfulness (i.e., full expression of life) as defined by Antonovsky's SOC. [83-84] Despite this alignment between salutogenesis and the framework of chiropractic, only a handful of peer-reviewed studies have examined chiropractic care within a salutogenic framework [83, 85-86], and no studies have explored salutogenesis within the context of chiropractic pregnancy care.

As previously discussed, pregnancy confers profound physical, mental and socio-emotional stressors. Subjective assessment of these stressors provides a measure of a pregnant woman's health related QoL. In a systematic review of the literature to assess the associated sociodemographic, physical and psychological factors of pregnant women's

QoL in developed countries, Lagadec et al. [87] found the following factors associated with poorer QoL: medically assisted reproduction, complications before or during pregnancy, obesity, nausea and vomiting, epigastralgia, LBP, smoking in the months prior to conception, a history of alcohol dependence, sleep difficulties, stress, anxiety, depression during pregnancy and sexual or domestic violence. In another systematic review, Boutib et al. [88] found that pathologies associated with pregnancy had a negative impact on the QoL of pregnant women.

The relationship between QoL and SOC has been well established with detrimental measures of QoL as inversely proportional to SOC. [89-90] Among pregnant women, a low SOC score has been found to be associated with overall poor health outcomes and compromised QoL (i.e., increased levels of anxiety and depression). [91-92] Conversely, pregnant women with strong SOC have been shown to suffer less from depression, anxiety, stress and a number of other pregnancy-related health concerns when compared to those with low SOC. [93] A high SOC and the ability to cope or adapt to one's environment and manage stress therefore confers a protective factor in a woman's journey through pregnancy.

Although the number of studies that explicitly aimed to increase SOC is limited, the results suggest that strengthening SOC is possible. According to Super et al. [94], two mechanisms to strengthen an individual's SOC are: (1) by assisting individuals to identify the appropriate GRRs to deal with their stressors, and (2) by assisting individuals to see stressful situations in everyday life as consistent, socially valuable with a load balance of stimuli between the internal and external environments (i.e., homeostasis). Furthermore, according to Super et al. [94], a sufficient level of comprehensibility, manageability and meaningfulness is required to orient an individual towards a specific stressor and to feel sufficiently self-efficacious to address these stressors. Not surprisingly, related constructs

such as self-efficacy [95], and locus of control [96] have also been measured in pregnancy to detect, predict, and alter a woman's health outcomes. With possible similarities in their underlying principles, two constructs, self-efficacy and health locus of control (HLOC), have also been shown to have demonstrable relationship with SOC during pregnancy. In a cohort of 406 women pregnant at weeks 35-42, Carlsson et al. [97] found that childbirth self-efficacy was positively correlated not only with SOC but also with vigour and maternal support and negatively correlated with a history of mental illness, mood states such as depression, anxiety, as well as fear of childbirth. Kordi et al. [98] showed that among women with gestational diabetes, a significant positive correlation existed between self-care and maternal internal HLOC.

An opportunity therefore exists to examine chiropractic pregnancy care from a salutogenic perspective and similar health constructs such as general self-efficacy (GSE) and HLOC.

1.4 Significance of the Study

The significance of the proposed research is to address an important area of chiropractic practice that is under-researched – the care of pregnant women. While pregnant patients under chiropractic care have been investigated [49, 53-56, 99-102], no comprehensive and coherent characterisation of the chiropractic care of pregnant women from the practitioner and patient perspective has been performed. This type of information is vital to understanding the existing workforce of chiropractors involved in pregnancy care and their patients, support future workforce planning, and inform chiropractic training, education, and research so as to reflect chiropractic practice associated with pregnancy care. As pointed out earlier, while salutogenesis and the theoretical framework of subluxation-based care has become a popular framework adopted by chiropractors [103-105], chiropractic pregnancy care utilising a salutogenic framework remains largely

unexplored. Chiropractors have a unique opportunity to provide patient-centred wellness care to their patients following their traditional chiropractic paradigm of health (i.e., subluxation-based care) within the established framework of salutogenesis. Inquiry into the relationship between the traditional chiropractic paradigm of health, salutogenesis, GSE and HLOC may bridge the gap between chiropractic theory and practice by establishing a possible relationship between the traditional paradigm of chiropractic and a model of health called salutogenesis. This would further strengthen chiropractic EIP and facilitate collaborative care between chiropractors and other healthcare professionals involved in maternity care vis a vis a non-pathogenic approach.

A non-allopathic (i.e., drugless and nonsurgical) approach to pregnancy care such as chiropractic may increase SOC and lead to improved or enhanced health and QoL (i.e., increased physical functioning, decrease pain interference and levels of depression and anxiety). This may positively affect healthcare consumption in this era of value-based care. [106]. Value-based care is where healthcare providers and institutions are reimbursed by 3rd party payors based on patient health outcomes (i.e., improved QoL) rather than based on the delivery of healthcare services (i.e., fee-for-service).

1.5 Research Aims

The aims of the proposed research are three-fold:

1. First, to profile chiropractors, their patients and practice features involved in chiropractic pregnancy care.
2. Second, to obtain measures of SOC, QoL, GSE, HLOC and patient satisfaction (i.e., interpersonal process of care (IPC) experience) among pregnant and non-pregnant women under chiropractic care.
3. Third, to gain an in-depth understanding of patient experiences and the nature of the therapeutic encounter between a pregnant woman and their chiropractor.

1.6 Subquestions

Given the aims of the research, this thesis addressed the follow specific questions:

1. What are practitioner characteristics (i.e., sociodemographic characteristics, clinical experience, postgraduate training) of chiropractors with a focus on pregnancy care?
2. What are the characteristics (i.e., clinical presentations, motivation for care) of women attending chiropractic care during pregnancy?
3. What are the practice characteristics (i.e., patient volume, fee structure, patient referrals) of chiropractors associated with caring for pregnant women?
4. What are the clinical protocols (i.e., chiropractic technique and adjunctive therapies) employed by chiropractors in caring for pregnant women?
5. What are the attitudes of chiropractors on the safety of chiropractic in pregnancy care?
6. What are measures of SOC in pregnant and non-pregnant women under chiropractic care?
7. What are measures of GSE in pregnant and non-pregnant women under chiropractic care?
8. What are measures of HLOC in pregnant and non-pregnant women under chiropractic care?
9. What are measures of interpersonal process of care experience of pregnant and non-pregnant women under chiropractic care?
10. What is the lived experience of pregnant women under chiropractic care?

1.7 Bias and Bias Reduction

Bias has been defined as the lack of internal validity or incorrect assessment of the association between an exposure and its effect on the target population wherein the statistic

estimate does not equal the true value [107]. Simply put, any influence that provides a distortion in the results of a study. [108] As a researcher, I am acutely aware that bias can occur at any phase of a research effort from its onset in terms of study design, to data collection and data analysis and publication. [109] The different types of bias in research can include confirmation bias (i.e., preconceived ideas impact the interpretation of data), selection bias (i.e., using subject not representative of the target group), outlier bias (outliers skew data), observer bias (bias due to observer subjectivity), and recall/reporting bias (i.e., subjects do not remember previous events or experiences accurately or omit/withhold details).

As in the practice of medicine, clinical uncertainty exists in the practice of chiropractic. As a practising chiropractor, clinical uncertainty comes from the limitations in my skills and expertise/knowledge to provide patient care and in the limitations of chiropractic EIP. As a chiropractic researcher, I know too well the insufficiencies of EIP in chiropractic that leads to clinical uncertainty and wide practice variations that may result in little to no health benefit to patients. As with other chiropractors and healthcare professionals, I have developed coping mechanisms to gain the illusion of chiropractic mastery and clinical clarity in the care of my patients. Coping mechanisms may include simply ignoring or denying that clinical uncertainty exists, advocate for chiropractic orthodoxy and adopt the practice of other chiropractors (i.e., perform spinal adjustments regardless of a patient's presenting complaints and diagnosis), or the use of heuristics, a mental shortcut to simplify problems and avoid cognitive overload. Heuristics can have a positive effect on clinical decision-making, but along with chiropractic orthodoxy, negative consequences may result such as cognitive biases. [110]

Cognitive biases may include the framing effect (i.e., decisions made based on how they are framed with different words, settings, and situations), representativeness bias (i.e.,

jumping to conclusions about a clinical scenario or patient(s) based of how representative the particular case is), availability bias (i.e., making clinical decisions based on what is readily available to us), anchoring bias (i.e., prioritising information and data that support one's initial impressions, even when first impressions are wrong), diagnostic momentum (i.e., the acceptance and propagation of a diagnosis with very little appraisal of the underlying evidence for its validity), confirmation bias (i.e., the selective gathering and interpretation of evidence consistent with current beliefs and the neglect of evidence that contradicts them), blind obedience (i.e., blind deference to authority), overconfidence bias, and outcomes bias (i.e., belief that clinical results – good or bad – are attributable to prior decisions). [111-112]

As a chiropractor in clinical practice, I fundamentally believe in the benefits of chiropractic care. I have observed first-hand the relief that pregnant women experience from debilitating LBP and/or PGP with chiropractic care. Along with optimism bias, representative bias, confirmation bias, and outcomes bias, I strongly believe that chiropractic care benefits pregnant women.

Although my dual roles as a clinician and researcher may contribute to bridging the gap between chiropractic research and practice, there is tension in my role as a clinician providing care to the individual patient and my role as a chiropractic researcher to contribute or generate generalisable knowledge. This tension and the many cognitive biases that comes with my clinical experience may lead to errors in judgement in my research efforts. For example, I have observed clinically and in my research that pregnant women present for chiropractic care not only to address symptoms (i.e., LBP and/or PGP) but also for wellness care. [113-114] Chiropractic wellness care embraces the concepts of health promotion and disease prevention to bring patients towards optimal functioning and adaptivity in all aspects of their lives [115-116]. This involves an emphasis on regularly

scheduled care (i.e., beyond the need for symptomatic care) to promote a set of values and behaviors towards health and enhanced QoL. [58, 115-116] Perhaps my interest in examining wellness care during pregnancy reflects my bias as a clinician and researcher.

According to Doherty and Carroll [117], bias-related diagnostic and treatment errors can be reduced if a clinician recognised and acknowledges that cognitive biases contribute to errors, that such errors are inevitable, and that there exist effective solutions to mitigating these biases. [118] To reduce cognitive biases, I practiced reflexivity – reflection of my presumptions, decisions and actions/behaviours and acknowledged biases and how it may lead to errors in my research. In addition to reflexivity, my Doctor of Philosophy (PhD) supervisors have challenged me to search and address for such biases and challenged me to be open to alternative viewpoints. The process has taught me to engage in thoughtful and effortful reasoning and reflection with my PhD supervisors' supportive and challenging feedback [119] and to engage in a similar manner with my research community at large. Additional measures to mitigate biases and errors in my research include ensuring that I follow the data-gathering procedure(s) approved by the ethics board, acknowledging the presence of bias and error and its contribution to the limitations of my proposed studies and the use of proper statistical testing. For example, in multiple regression analysis, the relationship between a dependent variable and many independent covariates can be examined simultaneously. By comparing the results of simple and multiple linear regressions, the degree to which confounders distort the relationship between exposure and outcome can be clarified. In qualitative research, bracketing or epoche is applied to set aside or mitigate one's experiences and any potential biases and preconceived notions about a research subject.

1.8 Research Paradigm

To accomplish the aims of the research proposed, both qualitative and quantitative methods are applied. As such, the proposed research will be guided by a pragmatic paradigm. In the Incompatibility Thesis [120], purists contend that quantitative and qualitative methods arise from different ontologic, epistemologic, and axiologic assumptions about the nature of research and should not be mixed. For example, quantitative approaches are associated with positivist or post-positivist epistemologies (i.e., knowledge is limited by our technologies of knowing, objective measurement is essential and the goal is to discover universal laws governing behaviour) while qualitative approaches resonate more with constructionist or interpretive epistemologies (i.e., knowledge is embedded in values and cultures and locally situated and contextualised understanding comes about through subjective means). [121] Situationalists on the other hand share a similar attitude with the purists in terms of a mono-method approach with an emphasis that certain research questions are more appropriate to address with quantitative approaches and other research questions with qualitative methods. Pragmatists believe that such a dichotomy of qualitative versus quantitative approaches is false and advocate for the adoption/integration of both methods to address research questions in the most appropriate way to aid in understanding the world.

An obvious advantage of a pragmatic paradigm is the flexibility it confers to address a range of research questions arising from the aims of this research. A pragmatic paradigm facilitates a holistic approach to research through (a) triangulation (i.e. convergence and corroboration of data from the same phenomenon), (b) complementarity (i.e. results in elaboration, enhancement, illustration and clarification of research data/method with the other), (c) development (i.e. data from one method informs the other method), (d) initiation (i.e. paradoxes and contradictions may lead to a re-framing of the

research questions), and (e) expansion (i.e. expanding the breadth and depth of inquiry by using different methods for different inquiry components). [122] Lastly, the pragmatic paradigm to the proposed research facilitates the collaboration among clinician-scientists and their patients. For example, I have supervisors with research expertise in quantitative and/or qualitative research approaches and clinical experience/expertise from different healthcare disciplines that include chiropractic, osteopathy, nursing, midwifery, and medicine. [123] This research also necessitates the engagement of pregnant women further increasing its relevance. [124]

1.9 Strategies of Inquiry: The Mixed Methods Approach

To accomplish the aims of the research, a mixed methods approach was implemented. Mixed methods have been defined by Johnson and Onwuegbuzie [125] as research combining quantitative and qualitative research techniques, methods, approaches, concepts or language into a single study. The first aim, to characterise chiropractors, their patients and chiropractic practice in the context of pregnancy care, utilised a survey instrument with chiropractors with clinical experience in pregnancy care as respondents. The second aim, to assess the SOC and associated factors (i.e., QoL, GSE, HLOC and IPC experience) of pregnant and non-pregnant women under chiropractic care, also utilised a survey instrument. The use of self-administered survey instruments is consistent with a quantitative research design. Quantitative research focuses on deduction, confirmation, theory/hypothesis testing, explanation, prediction, standardised data collection, and statistical analysis. [120] The third aim, to assess the lived experience of pregnant women under chiropractic care was performed with semistructured interviews of pregnant women and consistent with a qualitative study design. Qualitative research is characterised by induction, discovery, exploration, generation of theory/ hypothesis, and the researcher as the primary ‘instrument’ of data collection and qualitative analysis. [125]

Strengths associated with a mixed methods research approach [125-126] allows researchers to address a broad range of research aims or questions with the use of multiple approaches rather than being restricted or constrained by one method. In terms of complementarity, one research method can compensate/complement for the weaknesses of another research method (i.e., words or narratives can add meaning to numbers and numbers can add precision to words), allows for validation of the findings through triangulation, and strengthen the generalisability and conclusions of the research findings to produce a more complete knowledge to inform theory and practice. Weaknesses of a mixed methods approach [120-121] may be the requirement of more time and resources (i.e., cost, workforce/expertise), requisite knowledge of multiple methods on the part of the researcher(s), and the challenges associated with integrating data. Lastly, quantitative and qualitative methods are guided by different epistemological and philosophical frameworks, the validity of the research may be threatened based on the importance of ontological-epistemological- methodological congruence. [127]

1.10 Thesis Structure

This thesis is comprised of 8 chapters. This chapter established the background and context of this thesis.

Chapter 2 provides a meticulous summary of all the available peer reviewed publications on specific topics germane to this thesis, identify gaps in the existing literature, and provide guidance and justification of the studies performed. The first review is a systematic review of the literature on quantitative measures of SOC in pregnancy. The second review is a scoping review of the literature on chiropractic care and pregnancy. The third review is a systematic review of quantitative measures in the published literature on chiropractic pregnancy care.

Chapter 3 provides a discussion of the philosophical framework (i.e., pragmatism) guiding the research presented, the use of mixed methods and triangulation. This was followed by a provision of the validity and utility of the various patient-reported outcome measures (PROMs) and address the trustworthiness of the qualitative research applied in this thesis. The chapter ends with a statement of the hypotheses addressed in this thesis.

Chapter 4 provides the essential components of the methods pursued in this study. A clear and precise description of how the studies were performed is provided so that it may be replicated, as well as providing the rationale for the methodologies chosen to provide justification of the validity, trustworthiness, and conclusions of the study findings.

Chapter 5 presents the results of the first quantitative study involving a survey of chiropractors to characterise the chiropractic care of pregnant women.

Chapter 6 presents the results of the second quantitative study assessing the SOC and associated factors (i.e., QoL, GSE, MHLOC, QoL, and IPC experience) in pregnant and non-pregnant women upon study entrance and following a course of chiropractic care.

Chapter 7 presents the results of the qualitative study involving semistructured interviews of pregnant women under chiropractic care to assess the lived experience of pregnant women under chiropractic care guided by a transcendental phenomenological approach.

Chapter 8 provides a discussion of the study findings in the context to the aims and research questions, highlighting the strengths/significance and limitations of the study and its implications to the chiropractic profession, clinical care, and future research. The conclusion provides a summary of the study findings and its significance to the chiropractic profession and offers new insight to chiropractic pregnancy care.

1.11 Concluding Remarks

This introductory chapter established the background, provided the context and rationale and justification of the research. The chapter began with an introduction to what chiropractic is, my interest in pregnancy wellness care and motivation for the research. A brief outline of the many bodily changes that occur during pregnancy was provided as well as the many challenges faced by a pregnant woman. To address these challenges, the use of CAIM and chiropractic wellness care by pregnant women is described. An anchoring principle that resonates with chiropractic wellness care is salutogenesis. This term was described along with its relationship to the theoretical framework of chiropractic care. Finally, this chapter defined the aims and significance of the research.

Chapter 2. Systematic and Scoping Reviews of the Literature

2.1 Introduction

This chapter outlines the literature that underpins the primary research set out in this thesis. Classically, this is the literature review chapter, however in this instance it is composed of three systematic reviews. Each review stands as an independent paper and each review has been submitted for publication. Although tables and figures are often utilised to represent large amount of data in a time- and space-effective manner and reduce the length of the manuscripts, tables and figures are inserted or embedded into the appropriate parts of the manuscripts for ease of reading. This resulted in artificially lengthening the systematic reviews presented in this thesis. Traditionally, manuscripts submitted for publication in most biomedical journals contain the figures and tables at the end of the main text to facilitate the typesetting/layout and do not contribute to the overall word count.

This chapter begins with a presentation of the systematic review of the literature on the quantitative measures of sense of coherence (SOC) in pregnancy, followed by a scoping review of the literature on the chiropractic care of pregnant women; it concludes with a quantitative systematic review of the literature on chiropractic pregnancy care. Following these reviews, a general discussion on the key findings of these systematic reviews has been undertaken.

2.2 Sense of Coherence in Pregnancy: A Systematic Review and Narrative Synthesis of the Literature

This chapter presents a systematic review which, upon completion, was submitted to *BMC Pregnancy and Childbirth*, a peer-reviewed journal, for publication. The contribution of individual authors is outlined in the signed statement of contribution. All of the tables and figures included in this chapter were submitted for publication.

Joel Alcantara,[1*] Stephen P Myers,[2] Elizabeth Emmanuel,[1] Sandra Grace[2]

[1] Facuty of Health, Southern Cross University, Gold Coast Campus, Terminal Drive, Bilinga, QLD, Australia, 4225

[2] Faculty of Health, Southern Cross University, Lismore Campus, Military Rd, Lismore, NSW, Australia, 2480

*Corresponding Author

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Declarations

Ethics approval and consent to participate: Not applicable

Consent for publication: Not applicable

Availability of data and materials: The datasets used and/or analysed during the current study are available from the corresponding author on reasonable request

Competing interests: The authors declare that they have no competing interests

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Authors' contributions: JA performed the literature searches required for this review. All the authors reviewed the full text of the reviewed manuscripts. JA initially performed all assessments of study quality and confirmed by SPM. All the authors participated in the preparation of the manuscript. All authors read and approved the final manuscript.

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Abstract

Background

Pregnancy is acknowledged as a time of physiological, social, and psychological challenges that may compromise a pregnant woman's quality of life. Healthcare advocates have proposed a paradigm shift in maternity services towards a framework that includes the promotion and generation of health such as Antonovsky's framework of salutogenesis. Central to salutogenesis are general resistance resources (GRRs) (i.e., assets and resources available to an individual) and sense of coherence (SOC) (i.e., a measure of their ability to mobilise their GRRs and manage physical, mental, and social stressors). To begin to explore the role of SOC in pregnancy care, we critically analysed, synthesised and summarised studies with quantitative measures of SOC during pregnancy.

Methods

A systematic review of the literature was performed using PubMed & Medline, Allied and Complementary Medicine (AMED), Cumulative Index to Nursing and Allied Health Literature (CINAHL) and PsychInfo between 1997 to 2022. Inclusion criteria for review were manuscripts: (1) of peer-reviewed primary investigation reports, (2) measuring SOC among pregnant women and (3) written in the English language. Manuscripts excluded were: (1) qualitative studies, (2) abstracts from conference proceedings, and (3) dissertations from a Master or PhD degree. Quality assessment used the NIH National Heart, Lung, and Blood Institute Study Quality Assessment Tools. Our systematic review was guided by the Preferred Reporting Items for Systematic Reviews and Meta-analysis (PRISMA).

Results

Our systematic review found 49 studies (i.e., prospective (n = 29) and cross-sectional (n = 17) cohorts) meeting inclusion criteria. Pregnant women (93% of subjects;

n = 27 186) completed primarily the SOC-13 instrument along with 67 other patient-reported outcomes (PROs) of mental and social health domains. Physical health measures were lacking. Overall, a low SOC score was associated with compromised health outcomes during pregnancy, labour, and birth. Cause and effect inferences between measures of SOC and PROs remain largely unexplored.

Conclusion

The findings of this review are that low SOC is associated with poor prenatal health outcomes. Maternity care should focus on a more comprehensive approach that addresses not only morbidities and risks but also protective and stress resisting factors that promote health such as increasing a pregnant woman's sense of coherence.

2.2.1 Background

A pregnant woman undergoes a number of physical/anatomical, physiological, and psychological transformations that may present significant health challenges during pregnancy. [128] During pregnancy, the heart is displaced superiorly and to the left while the chest wall expands in all directions affecting respiratory mechanics. [14] With the cardiovascular system, there are increases in cardiac output, arterial compliance, and extracellular fluid volume and decreases in blood pressure (BP) and total peripheral resistance. [129] As a result of the relative increase in plasma volume, red cells in the blood are 'diluted' and the venous hematocrit drops [130] resulting in physiological anaemia. Pregnancy is also associated with an increase in the production of clotting factors, a decrease in anticoagulants and a reduction in fibrinolytic activity resulting in hypercoagulability and increased risk for thromboembolism. [131]

Pregnant women are also vulnerable to psychiatric disorders. Depression, anxiety, bipolar disorders, psychological distress, post-traumatic disorder and eating disorders have an estimated prevalence of 1%-37% during pregnancy. [132] Anthropomorphically, a pregnant woman's body mass significantly increases, particularly in the third trimester. Their center of gravity migrates forward resulting in increased spinal lordosis and kyphosis, the anterior and posterior width of her pelvis as well as her anterior pelvic tilt increases with compensatory movement of the head posteriorly [133-134] and increases in the amount and speed of her postural sway. [20, 135-136] This affects her balance and increases her risk of experiencing falls. [137-138] Physical transformations also predispose the pregnant woman to a variety of physical symptoms and complaints (e.g., low back pain [LBP] and pelvic girdle pain [PGP]). Pregnancy-related LBP has an estimated prevalence of 30% to 78% in the United States, Europe, and some parts of Africa [139] while PGP has

an estimated prevalence of 4% to 76.4%. [140] Pregnancy therefore places the woman at risk for compromised health and quality of life. [88]

As a means to prevent and ameliorate the negative impact of pregnancy-related morbidities, a number of healthcare advocates have proposed a paradigm shift in maternity care away from morbidity and risk towards promoting normal birth and the generation of health. [66, 92-93, 141, 142] The framework of Antonovsky's salutogenesis has been proposed as such a method. [92-93, 141-142] Antonovsky proposed that health was not merely the absence of disease but falls within a spectrum anchored at the extreme of total ill-health and total health. Central to the construct of salutogenesis are the concepts of general resistance resources (GRRs) and sense of coherence (SOC). GRRs are assets and resources available to an individual to facilitates their ability to cope effectively with stressors (i.e., physical, mental or emotional) and contribute to the development of SOC. [66] SOC is a positive outlook on life [66, 143] and a stress resisting resource that reflects an individual's ability to comprehend their stressor, their ability to mobilise GRRs and to manage their stressor and find meaning in doing so. Salutogenesis therefore focuses on the origins and assets to promote health. Given the potential role that SOC may play during pregnancy, we performed a systematic review of the literature to critically analyse, synthesise and summarise the state of knowledge of SOC during pregnancy to inform prenatal care.

2.2.2 Methods

The authors performed a literature search (January 1, 1997, to November 24, 2022) using PubMed and Medline, Allied and Complementary Medicine (AMED), Cumulative Index to Nursing and Allied Health Literature (CINAHL), and PsychInfo. The search terms were 'sense of coherence AND pregnancy or pregnant or prenatal or antenatal or perinatal or maternal' with the search mode to 'apply related words.' Titles and abstracts

were screened by the principal author, based on the inclusion and exclusion criteria for review and confirmed by the co-authors. Disagreements were resolved by debate and discussion. Inclusion criteria for our systematic review were: (1) the study was a primary investigation/report (i.e., case reports, case series, case control, randomised controlled trials and survey or surveillance studies), (2) part or all of the study subjects involved pregnant responder(s), (3) SOC was measured quantitatively in the prenatal period, and (4) the manuscript was written in the English language. Exclusion criteria for review were: (1) manuscripts of qualitative study design, (2) abstracts from conference proceedings, and (3) dissertations from a Master or PhD degree. The reference lists of obtained articles were also searched for additional manuscripts satisfying the inclusion criteria. Our reporting followed the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) protocol [144] (see Figure 2.1). Our protocol for systematic review was not reported with the International Prospective Register of Systematic Reviews (PROSPERO) [145]

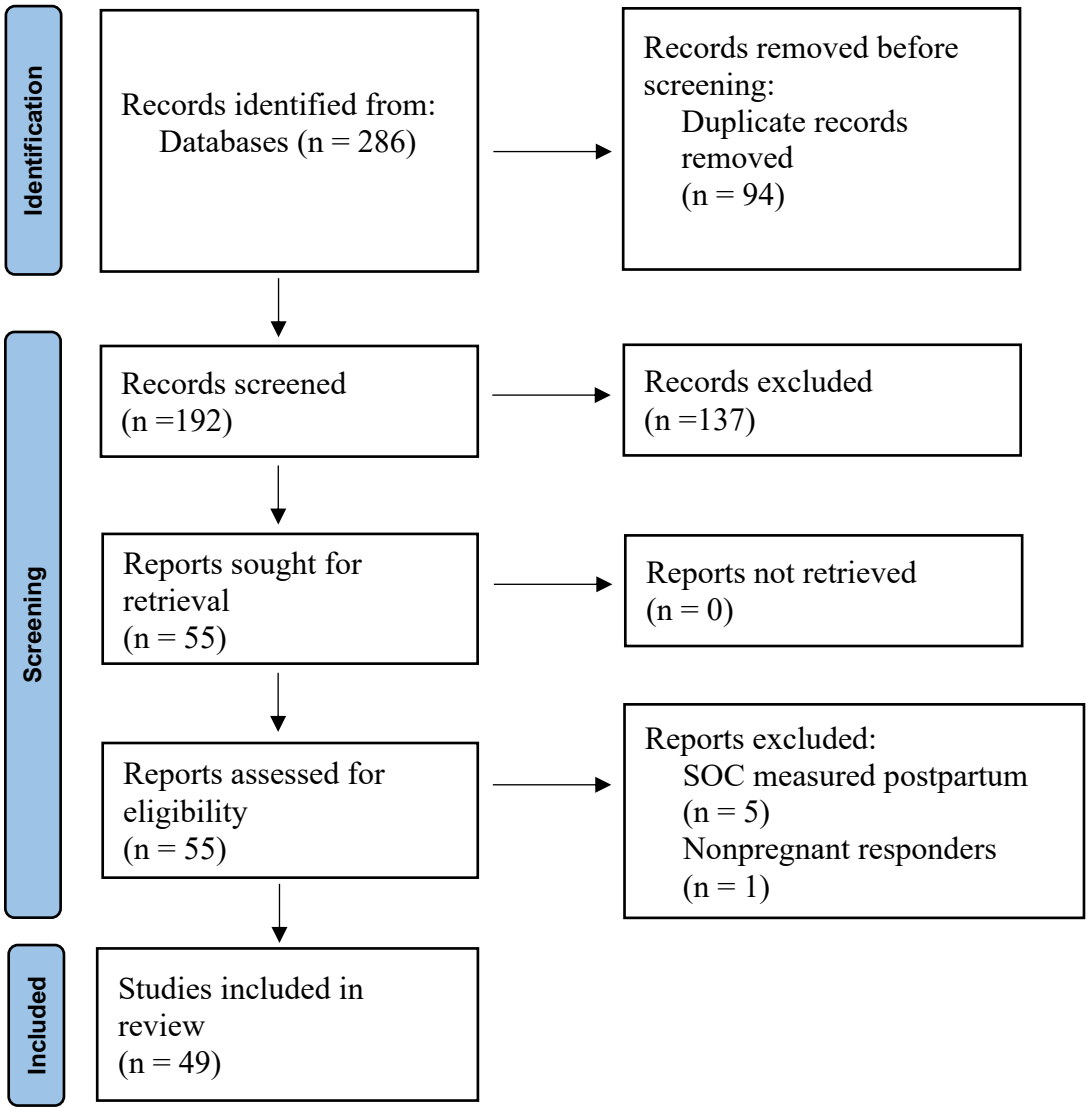

Figure 2.1. Flow Diagram of the Systematic Review of the Literature on Measures of SOC in Pregnancy

2.2.3 Data Extraction

The following variables were recorded in Excel: study reference, study aim or purpose, country of origin, type of SOC questionnaire, number of study responders, number of pregnant responders, weeks of gestation of pregnant responders, study design, validated and nonvalidated patient-reported outcomes (PROs) along with their relationship/association (i.e., correlation) with SOC.

2.2.4 Quality Assessment

The NIH National Heart, Lung, and Blood Institute Study Quality Assessment Tools [146] was applied for quality assessment, dependent on study design (i.e., observational cohort and cross-sectional study). A formative table was specifically created for this purpose with items for the quality assessment incorporated based on a specific study design. Responses to the quality assessment items for each manuscript of a specific study design were noted in this table. JA, SPM and EE independently applied the appropriate quality assessment tool for each manuscript. JA, SPM and EE discussed their findings as a group with discrepancies resolved by discussion and consensus among team members.

2.2.5 Results

2.2.5.1 Studies Meeting Inclusion Criteria

Our initial search revealed a total of 286 titles. After screening, 94 duplicate titles were removed. Of the remaining 192 titles, 137 papers were excluded based on the inclusion and exclusion criteria. A detailed examination of the full manuscripts (n = 55) eliminated 6 papers due to measurements of SOC in the post-partum period (n = 5) [147-151] and one paper involved fathers/partners only as responders. [152] Forty-nine papers remained for analysis. [91, 97 153-199]

2.2.5.2 General Characteristics of Included Studies

The data extracted are summarised in Tables 2.1 and 2.2. The majority of the studies recruited subjects from free-standing clinics (n = 21; 42.9%) of various types (i.e., antenatal, fertility, ultrasound imaging, midwifery), hospital maternity wards (n = 20; 40.8%), combination of clinics and social media (n = 2; 4.1%), pregnancy and parenting online platforms (n = 4; 8.2%), and newsletter support group and magazines (n = 2; 4.1%).

The PROs and their relationship with SOC are provided in Tables 2.3 and 2.4, based on study design. Of the 49 manuscripts reviewed, the majority (n = 31; 63.3%) of the studies were prospective cohort in design while the remainder (n = 18; 36.7%) were cross-sectional cohorts. A combined total of 28 990 subjects (i.e., pregnant responders and their partners or controls) were counted with 93.8% (n = 27 186) involving pregnant women completing a SOC questionnaire.

Table 2.1. Study Aims, Country of Origin, Research Design, SOC Instrument, and Sample Size of Manuscripts Reviewed

Reference	Study aim	Country of origin	SOC instrument	Study design	Total responders	Pregnant responders
Yu et al. (2022) [153]	To estimate differences in levels of health-promoting behaviour during the trimesters, identify distinct patterns of health-promoting behaviour trajectories and evaluate predictors of these trajectory group memberships.	China	SOC-13	Prospective cohort	158	158
Pasricha et al. (2021) [91]	To investigate the associations of expecting mothers' SOC, perceived social support, and maternal-foetal attachment with mental health outcomes.	India	SOC-13	Cross-sectional cohort	122	122
Muggleton et al. (2021) [154]	To compare outcomes for women/people attending a conventional childbirth education program with those attending a salutogenic childbirth education program.	Australia	SOC-13	Prospective cohort	206	153
Hildingsson et al. (2021) [155]	To evaluate women's experiences of pregnancy and antenatal care, gauge their emotional well-being and satisfaction in a continuity of midwifery care project.	Sweden	SOC-29	Prospective cohort	226	226
Hildingsson et al. (202) [156]	To assess the relationship between birth outcome and birth experience with a woman's emotional health, continuity with a known midwife, and their birth experience.	Sweden	SOC-13	Prospective cohort	243	243
Einav et al. (2020) [157]	To examine whether the marital experience of individuals changes and develop according to various phases in their family unit, particularly those related to their personal, parental, and marital practice.	Israel	SOC-13	Cross-sectional cohort	137	38
Finnbogadottir et al. (2020) [158]	To explore childbirth outcomes in women with a history of violence including domestic violence during pregnancy.	Sweden	SOC-13	Prospective cohort	1694	1694
Voogand et al. (2020) [159]	To assess the relationship between FOC and SOC, and their components in women expecting their first child.	Sweden	SOC-13	Cross-sectional cohort	414	414

Reference	Study aim	Country of origin	SOC instrument	Study design	Total responders	Pregnant responders
Asif et al. (2020) [160]	To assess the association between severe obstetric perineal lacerations and PPD symptoms and among women with low resilience.	Sweden	SOC-29	Cross-sectional cohort	2026	2026
Neerland et al (2020) [161]	To develop and assess the reliability and validity of the P-LAB instrument during the third trimester of pregnancy.	USA	SOC-13	Prospective cohort	206	206
Bratt et al. (2019) [162]	To evaluate the influence of time of diagnosis of foetal congestive heart failure on parental distress.	Sweden	SOC-13	Prospective cohort	232	232
Mohamamdirizi et al. (2018) [163]	To determine the SOC and fear of childbirth in high- and low-risk pregnancies.	Iran	SOC-29	Cross-sectional cohort	440	440
Bäckström et al. (2018) [164]	To evaluate the factors associated with quality of couple relationship among first-time mothers and partners during pregnancy and the first six months of parenthood.	Sweden	SOC-13	Prospective cohort	207	207
Przestrzelska et al. (2018) [165]	To evaluate the factors affecting SOC among women during pregnancy.	Poland	SOC-29	Cross-sectional cohort	400	400
Staneva et al. (2018) [166]	To examine the relationship of psychosocial factors during pregnancy to adverse birth outcomes.	Australia & New Zealand	SOC-13	Prospective cohort	285	285
Hildingsson (2017) [167]	To investigate changes in SOC from early pregnancy to one year after birth and the role of background characteristics, birth outcome and parental stress.	Sweden	SOC-13	Prospective cohort	3058	3058
Linden et al. (2016) [168]	To explore well-being and diabetes management in women with type 1 diabetes mellitus in early pregnancy.	Norway	SOC-13	Cross-sectional cohort	168	168
Ngai & Ngu (2016) [169]	To examine the relationship of family and marital functioning and family SOC among Chinese couples during pregnancy, at 6 weeks and 6 months postpartum.	China	Family SOC-12	Prospective cohort	404	202

Reference	Study aim	Country of origin	SOC instrument	Study design	Total responders	Pregnant responders
Ferguson et al. (2016) [170]	To explore associations between pregnant women's SOC and their birthing outcomes and identify factors that influence a change in women's SOC scores from the antenatal to the postnatal period.	Australia	SOC-13	Prospective cohort	753	753
Staneva et al. (2016) [171]	To explore various factors that contribute to increased distress for women during pregnancy and the role of SOC and maternal orientations.	Australia & New Zealand	SOC-13	Cross-sectional cohort	293	293
Ferguson et al. (2015) [172]	To investigate the relationship between SOC and women's pregnancy and anticipated labour choices.	Australia	SOC-13 & SOC-9	Cross-sectional cohort	1074	1074
Carlsson et al. (2015) [97]	To examine the relationship between women's childbirth self-efficacy beliefs to aspects of well-being in the third trimester of pregnancy and associations between childbirth self-efficacy and obstetric factors.	Sweden	SOC-13	Cross-sectional cohort	406	406
Ferguson et al. (2015) [173]	To examine the validity and reliability of the SOC-13 among pregnant Australian women and the relationship between SOC and a woman's childbirth choices and outcomes.	Australia	SOC-13 & SOC-9	Cross-sectional cohort	718	718
Sekizuka-Kagami et al. (2015) [174]	To examine the association of pregnant women's SOC scores with threatened premature birth.	Japan	SOC-13	Cross-sectional cohort	43	43
Ngai & Ngu (2014) [175]	To investigate the risk factors associated with postnatal depression in mothers and fathers, the predictive role of family SOC, stress, social support, and family and marital functioning during pregnancy and the effect of changes in these factors during the perinatal period.	China	Family SOC-12	Prospective cohort	400	200
Finnbogadóttir et al. (2014) [176]	To explore the prevalence of domestic violence among pregnant women in southern Sweden and its association with background factors.	Sweden	SOC-13	Cross-sectional cohort	1939	1939

Reference	Study aim	Country of origin	SOC instrument	Study design	Total responders	Pregnant responders
Ngai & Ngu (2014) [177]	To investigate the predictive role of family SOC, social support, and stress during pregnancy among Chinese parents and the effect that any changes in these factors may have on family and marital functioning at 6 weeks postpartum.	China	Family SOC-12	Prospective cohort	404	202
Takegata et al. (2014) [178]	To determine the relationship between antenatal FOC and SOC among healthy Japanese pregnant women.	Japan	SOC-13	Cross-sectional cohort	240	240
Ngai & Ngu (2014) [179]	To examine the relationship between family SOC, stress, family and marital functioning, and depressive symptoms among Chinese childbearing couples.	China	Family SOC-12	Cross-sectional cohort	448	224
Swartz et al. (2013) [180]	To investigate whether SOC varies between groups of parents with three different lifestyles (anthroposophic, partly anthroposophic and non-anthroposophic) and assess whether parental SOC is related to the diurnal cortisol levels and to the levels of their infants at the age of 6, 12, and 24 months.	Sweden	SOC-13	Prospective cohort	556	284
Ngai & Ngu (2013) [181]	To investigate the relationship between family SOC, social support, stress, QoL, and depressive symptoms in first-time Chinese childbearing women and the mediating role of family SOC on stress, QoL, and depressive symptoms.	China	Family SOC-12	Cross-sectional cohort	267	267
Jeschke et al. (2012) [182]	To determine whether the previous use of EA or a low SOC are independent predictors of a delivery with EA.	Germany	SOC-29	Cross-sectional cohort	193	193
Larsson et al. (2009) [183]	To evaluate parents' worry and SOC before and after a routine second-trimester ultrasound examination and to compare groups with normal and abnormal findings.	Sweden	SOC-13	Prospective cohort	2049	1197
Ekelin et al. (2009) [184]	To investigate parents' expectations, experiences and reactions, SOC, and degree of anxiety before and after a second-trimester routine ultrasound examination with normal findings.	Sweden	SOC-13	Prospective cohort	5964	1258

Reference	Study aim	Country of origin	SOC instrument	Study design	Total responders	Pregnant responders
Sekizuka et al. (2009) [185]	To assess the validity of s-IgA and SOC as predictors of threatened premature birth.	Japan	SOC-13	Prospective cohort	72	72
Larsson et al. (2009) [186]	To compare parents' experience of a routine ultrasound examination in the second trimester of pregnancy when CPC was found and evaluate how the SOC, STAI, and PEER-U differed before and after the ultrasound examination within and between the study and control groups.	Sweden	SOC-13	Prospective cohort	88	52
Oz et al. (2009) [187]	To explore the relationship between SOC and perceived stress and uncomplicated labour.	Israel	SOC-13	Prospective cohort	145	145
Hibino et al. (2009) [188]	To assess the health impact of stress on women who were pregnant during, or immediately after, a major earthquake and were living in the disaster area.	Japan	SOC-13	Prospective cohort	99	99
Ekelin et al. (2008) [189]	To develop and test a specific questionnaire to measure parents' expectations, experiences, and reactions to routine ultrasound examinations during pregnancy.	Sweden	SOC-13	Prospective cohort	126	63
Hellmers et al. (2008) [190]	To evaluate the preferred mode of birth among first-time mothers in Germany and USA and its relationship to maternal wellbeing and SOC.	USA & Germany	SOC-L9	Prospective cohort	374	374
Hildingsson et al. (2008) [191]	To investigate the proportion of women dissatisfied with partner support in early pregnancy, identify the characteristics of women dissatisfied with partner support, and to follow up on these women's situation 2 months and 1 year after childbirth.	Sweden	SOC-13	Prospective cohort	2430	2430
Habroe et al. (2007) [192]	To assess whether childbirth after ART results in high SOC and whether baseline SOC influences the association between childbirth after ART and SOC at 1-year follow-up.	Denmark	SOC-9	Prospective cohort	1934	1025

Reference	Study aim	Country of origin	SOC instrument	Study design	Total responders	Pregnant responders
Rudman et al. (2007) [193]	To investigate women's satisfaction with intrapartum care along three distinct dimensions (interpersonal care, information and involvement in decision-making, and physical birth environment) and describe the characteristics of women with different patterns of satisfaction.	Sweden	SOC-13	Prospective cohort	2605	2605
Sekizuka et al. (2006) [194]	To evaluate postpartum stress reactions using a postpartum depression scale and by measuring the level of a stress-related substance.	Japan	SOC-29	Prospective cohort	50	50
Almedom et al. (2005) [195]	To examine SOC and salivary cortisol levels at immediate prenatal and postnatal periods.	Eritrea	SOC-13	Prospective cohort		50
Sjöström et al. (2004) [196]	To describe pregnant women's perception of wellbeing during pregnancy and after delivery and to explore a possible relationship with their SOC.	Sweden	SOC-13	Prospective cohort	120	120
Engelhard et al. (2003) [197]	To explore the relationship between SOC in early pregnancy and PTSD after pregnancy loss, the relationship between SOC and post-loss depressive symptoms, and the role of crisis support as a mediator between SOC and PTSD.	Holland	SOC-13	Prospective cohort	117	117
Abrahamsson & Ejlertsson (2002) [198]	To examine the relationship between SOC, smoking, and health variables.	Sweden	SOC-13	Prospective cohort	337	337
Uren & Wastell (2002) [199]	To assess the degree to which the phenomenological experience of perinatal bereavement is consistent with both attachment theory and the theoretical account in trauma research of coping as meaning-making; the extent to which current grief acuity is related to attachment security and the search for meaning; and the predictive power of SOC to current grief acuity.	Australia	SOC-29	Cross-sectional cohort	84	84

Note. ART = assisted reproductive technology; CPC = choroid plexus cyst/cysts; EA = epidural anaesthesia; FOC = fear of childbirth; PEER-U = Parent's Expectations, Experiences and Reactions to routine Ultrasound examination; P-LAB = Preparation for Labor and Birth; PPD =

postpartum depressive; PTSD = posttraumatic stress disorder; SOC = sense of coherence; QoL = quality of life; sIgA = secretory immunoglobulin A; STAI = State-Trait Anxiety Inventory; USA = United States of America.

Table 2.2. Patient Outcomes, Weeks of Gestation/Trimester of Pregnancy, and Summary Findings of SOC and Patient Outcomes in the Reviewed Manuscripts

Reference	Validated PRO and/or outcome measures	Weeks of gestation	Trimester	Summary of findings of SOC with respect to PROs
Yu et al. (2022) [153]	• Family Adaptability, Partnership, Growth, Affection, Resolution (APGAR) Index • Chinese version of General Self-Efficacy Scale (GSES) • Health-Promoting Lifestyle Profile	12, 24, 36	1, 2, 3	Low-increase health promoting behaviour trajectory was associated with low maternal SOC.
Pasricha et al. (2021) [91]	• Edinburg Postnatal Depression Scale (EPDS) • Multidimensional Scale of Perceived Social Support • Short Warwick Edinburgh Mental Well-Being Scale • Maternal Fetal Attachment Scale	NR	2, 3	SOC and perceived social support were found to uniquely contribute to the variance in antenatal depressive symptoms while SOC and maternal–foetal attachment uniquely contributed to the variance in antenatal well-being.
Muggleton et al. (2021) [154]	SOC-13	NR	NR	The new program demonstrated statistically significant increases in each component of the SOC.
Hildingsson (2021) [155]	• Edinburg Postnatal Depression scale (EPDS) • Fear of childbirth (FOC) • Cambridge Worry Scale	Mid-pregnancy (39 WOG) 2 months postpartum		Cluster 1 (women who had a known midwife during labour and birth [reference group]) showed low levels of depressive symptoms, fear of birth, and major worries; and high levels of SOC. Cluster 2 (women who did not have a known midwife during labour and birth) showed the opposite pattern, with higher levels of depressive symptoms, fear, and worries; and lower SOC.

Reference	Validated PRO and/or outcome measures	Weeks of gestation	Trimester	Summary of findings of SOC with respect to PROs
Hildingsson et al. (2021) [156]	• Cambridge Worry Scale (CWS) • Edinburgh Postnatal Depression Scale (EPDS) • Fear of childbirth (FOC) • Childbirth Experience Questionnaire (CEQ)	Mid-pregnancy (39 WOG) 2 months postpartum		Women in the 'emotionally unhealthy' cluster (those afraid of birth, having depressive symptoms, low SOC, and major worries, who did not have a known midwife during birth) scored lowest in all domains of the CEQ.
Einav et al. (2020) [157]	• Parental Self-Efficacy Scale • Future Parental Self-Efficacy Scale • Parental Satisfaction Questionnaire • Relationship Assessment Scale	NR	NR	As the level of SOC increased, the levels of maternal and relationship satisfaction also increased, and vice versa. There was no link found between maternal efficacy and SOC and no differences between the groups in their SOC ($F_{(2,107)} = 0.77$, $p = .46$, partial g92 = 0.01).
Finnbogadottir et al. (2020) [158]	• NorVold Abuse Questionnaire (NorAQ) • Edinburgh Postnatal Depression Scale (EPDS) • The Alcohol Use Disorders Identification Test (AUDIT)	Q1: 2nd trimester Q2: late pregnancy ($M = 33.9$; $SD = 2.20$)		Women reporting a history of violence also reported a significantly lower SOC score and higher EDS scores than women who did not.
Voogand et al. (2020) [159]	• Wijma Delivery Expectancy Questionnaire Version A (WDEQ-A)	NR	NR	The analysis of FOC and SOC showed a significant negative correlation ($N = 414$, $p < .001$). In the analysis of the three components of SOC; only comprehensibility showed a significant correlation with FOC ($N = 414$, $p < .001$). Pearson's $r = -.376$, $p < .001$.
Asif et al. (2020) [160]	• Depression Self-Reporting Scale (DSRS) • Swedish version of Edinburgh Postnatal Depression Scale (EPDS)	32		A strong association was detected with depression among women with low resilience. The study also showed that resilience (as measured by SOC-29) was involved in moderating the risk for postpartum depression after an obstetric adverse outcome.

Reference	Validated PRO and/or outcome measures	Weeks of gestation	Trimester	Summary of findings of SOC with respect to PROs
Neerland et al. (2020) [161]	• Preparation for Labor and Birth (P-LAB)	34 0/7 to 38 6/7 weeks gestation		Pearson's correlation coefficient was .22 (p . .05) between P-LAB and SOC-13
Bratt et al. (2019) [162]	• Hospital Anxiety and Depression Scale (HAD) (Swedish version) • Life Satisfaction Scale • Dyadic Adjustment Scale (DAS)	T1: 22+ T3: 2-6 months postnatal	2	Parents with a foetus prenatally diagnosed with congenital heart disease scored lower life satisfaction and SOC than parents with a postnatal diagnosis.
Mohamamdirizi et al. (2018) [163]	Fear of Childbirth Questionnaire (FCQ)	*M* = 28.5 (*SD* = 1.33)	3	High SOC scores found in high-risk pregnancies compared to low-risk pregnancies, but no differences in FOC between the two groups. No significant correlation between SOC and FOC in the two groups.
Bäckström et al. (2018) [164]	• Quality of Dyadic Relationship-36 (QDR-36) • Multidimensional Scale of Perceived Social Support (MSPSS)	25	2	Among first-time mothers, better perceived couple relationship quality 6 months after childbirth was statistically significantly associated with higher SOC at 25 WOG and more positive change in SOC between 25 WOG and 6 months postpartum.
Przestrzelska et al. (2018) [165]	Edinburgh Postnatal Depression Scale (EPDS)	≥ 30	3	The deficit of social support, especially the lack of support from the husband/partner and risk of depression was noticeably correlated with a low SOC.

Reference	Validated PRO and/or outcome measures	Weeks of gestation	Trimester	Summary of findings of SOC with respect to PROs
Staneva et al. (2018) [166]	• Pregnancy Risk Assessment Monitoring System (PRAMS). • Revised Prenatal Distress Questionnaire (NuPDQ) • Edinburgh Postnatal Depression Scale (EPDS) • Multidimensional Scale of Perceived Social Support (MSPSS) • Antenatal Maternal Orientation Measure-Revised	T1: 12-26 T2: > 26 T3: 3-6 months postpartum	Not specified	SOC was not associated with birth outcome. Negative relationships between higher depressive and anxiety symptoms and a Regulator orientation were correlated with lower SOC; having a strong social support was correlated with a higher SOC.
Hildingsson (2017) [167]	• Edinburgh Postnatal Depression Scale (EPDS) • Cambridge Worry Scale • Swedish Parenting Stress Questionnaire (SPSQ)	10-13	1	Low SOC was associated with women who were single, not born in Sweden, younger than 25 years, low level of education, tobacco users, having unplanned pregnancies, less positive attitude towards being pregnant, less positive attitude towards the birth and the newborn baby, and lacking support from their partner. Women with depressive symptoms, those who preferred a Caesarean section, and women with major worries about giving birth, the baby's health, and going to hospital also reported lower scores on SOC compared to women without these characteristics.
Linden et al. (2016) [168]	• Well-Being Questionnaire (WBQ-12) • Swedish Diabetes Empowerment Scale (SWE-DES-10) • Swedish-Problem Areas in Diabetes Scale (SWE-PAID-20) • Swedish Hypoglycemia Fear Survey (SWE-HFS) • Hemoglobin A1c (HbA1c)	M = 11.2 (SD = 4.8)	1	High SOC was associated with high/positive scores for self-efficacy in diabetes management, a high total score for well-being, and self-rated overall health and low total scoring for diabetes distress and hypoglycemia fear. Correlation of HbA1c in early pregnancy with SOC-13 (r = -.23, p < .01) was statistically significant.

Reference	Validated PRO and/or outcome measures	Weeks of gestation	Trimester	Summary of findings of SOC with respect to PROs
Ngai & Ngu (2016) [169]	Medical Outcomes Study Family and Marital Functioning Measures (MOS-FMFM)	NR	NR	High correlation of prenatal SOC and prenatal family and marital functioning. Strong family SOC correlated significantly with better functioning during pregnancy and at 6 weeks and 6 months postpartum in both subgroups.
Ferguson et al. (2016) [170]	• Support Behaviour Inventory (SBI) Scale • Edinburgh Postnatal Depression Scale (EPDS)	*M* = 18.6 (*SD* = 7.4)	2	Women with high SOC were less likely to experience Caesarean sections and more likely to experience assisted vaginal birth, and were more likely to be older, have higher SBI scores, and lower EPDS scores. Antenatal SOC scores were not associated with induction of labour, epidural use, spontaneous vaginal birth, or birth satisfaction.
Staneva et al. (2016) [171]	• Prenatal Distress Questionnaire • Edinburgh Postnatal Depression Scale (EPDS) • Antenatal Maternal Orientation Measure-Revised	*M* = 18.6 (*SD* = 0.21)	2, 3	Lower SOC was highly and significantly associated with pregnancy-specific distress, depressive symptoms, impaired interpersonal relationships with both partners and a woman's own mother, and with maternal orientations (i.e., negatively correlated with a Regulator mothering style and positively correlated with the Facilitator mothering).
Ferguson et al. (2015) [172]	• Support Behaviour Inventory (SBI) Scale • Edinburgh Postnatal Depression Scale (EPDS)	*M* = 18.6 (*SD* = 7.4)	2	SOC scores were not associated with the pregnancy or anticipated labour choices of women. As age and SBI scores increased, the likelihood of a high SOC score increased. As EPDS scores increased, the likelihood of high SOC decreased.
Carlsson et al. (2015) [97]	• Swedish Childbirth Self-Efficacy Inventory (Swe-CBSEI) • Wijma Delivery Expectancy/Experience Questionnaire (JW-DEQ) • Maternity Social Support Scale (MSSS) • Profile of Mood States (POMS)	35-42	3	Those with high childbirth self-efficacy also had higher SOC scores. SOC was positively correlated with MSSS, Swe-CBSEI, and POMS Vigour. SOC was negatively correlated with JW-WEDQ, POMS fatigue, POMS confusion, POMS tension, and POMS depression.

Reference	Validated PRO and/or outcome measures	Weeks of gestation	Trimester	Summary of findings of SOC with respect to PROs
Ferguson et al. (2015) [173]	Edinburgh Postnatal Depression Scale (EPDS)	< 30	NR	There was a significant negative relationship between SOC-13 scores and EPDS scores and between SOC-9 scores and EPDS scores.
Sekizuka-Kagami et al. (2015) [174]	Stress Perception Scale	*M* = 18.1 (*SD* = 3.1)	2	A low SOC-13 score was associated with threatened premature birth.
Ngai & Ngu (2014) [175]	• General Health Questionnaire (GHQ) • Social Readjustment Rating Scale (SRRS) • Medical Outcomes Study Social Support Survey (MOS-SSS) • Medical Outcomes Study Family and Marital Functioning Measures (MOS-FMFM)	NR	NR	A low Family SOC score, poor social support, and depressive symptoms during pregnancy correlated significantly with high depressive symptoms at 6 months postpartum in both mothers and fathers. Prenatal family and marital functioning had a high correlation with prenatal Family SOC.
Finnbogadóttir et al. (2014) [176]	• Abuse assessment screen: 'Have you been exposed to abuse during current pregnancy?' • NorVold Abuse Questionnaire (NorAQ) • Edinburgh Postnatal Depression Scale (EPDS) • Alcohol Use Disorders Identification Test (AUDIT)	13	2	A low SOC score indicated an inability of women to use their own resources to maintain and improve their health in stressful situations and were 9.1 times more likely to be exposed to domestic violence during pregnancy.
Ngai & Ngu (2014) [177]	• Medical Outcomes Study Family and Marital Functioning Measures (MOS-FMFM) • Medical Outcomes Study Social Support Survey (MOS-SSS) • Social Readjustment Rating Scale (SRRS)	NR	NR	Prenatal Family and Marital Functioning and prenatal Family SOC were strongly correlated. Among mothers, significant factors associated with better family and marital functioning at 6 weeks postpartum was greater family SOC, higher social support, less stress during pregnancy, and less changes in family SOC and stress from pregnancy to 6 weeks postpartum.

Reference	Validated PRO and/or outcome measures	Weeks of gestation	Trimester	Summary of findings of SOC with respect to PROs
Takegata et al. (2014) [178]	Wijma Delivery Expectancy/Experience Questionnaire	37	3	Higher SOC was correlated with lower fear of childbirth (FOC) in women in the 3rd trimester.
Ngai & Ngu (2014) [179]	• Medical Outcomes Study Family and Marital Functioning Measures (MOS-FMFM) • Social Readjustment Rating Scale (SRRS) • General Health Questionnaire (GHQ)	NR	NR	Stronger family SOC correlated significantly with better family and marital functioning, less stress, and fewer depressive symptoms among couples.
Swartz et al. (2013) [180]	Salivary cortisol	NR	3	SOC scores did not differ between the three lifestyle groups (anthroposophic, partly anthroposophic, and non-anthroposophic), and there were no correlations between SOC scores and salivary cortisol concentrations in separate analyses of mothers, fathers, and children at any sampling age or at any sampling time during the day (morning, afternoon, bedtime).
Ngai & Ngu (2013) [181]	• Medical Outcomes Study Social Support Survey (MOS-SSS) • Social Readjustment Rating Scale (SRRS) • Medical Outcomes Study Short Form 12-Item Health Survey (SF-12) • General Health Questionnaire (GHQ)	NR	NR	Family SOC and social support had a direct effect on the mental health component of QoL and depressive symptoms, but not on the physical component of QoL.
Jeschke et al. (2012) [182]	• Havelhoehe Questionnaire on Delivery • Visual Analog Scale for Pain	34-40	3	SOC was not recognised as an independent predictor for epidural anaesthesia (EA) use. However, women with high SOC scores more often had the desire to deliver without EA.
Larsson et al. (2009) [183]	Parent's expectations, experiences and reactions to routine ultrasound examination (PEER-U) questionnaire	NR	2	No significant differences between those with normal findings and abnormal findings groups regarding SOC scores or their status before and after their ultrasound examinations.

Reference	Validated PRO and/or outcome measures	Weeks of gestation	Trimester	Summary of findings of SOC with respect to PROs
Ekelin et al. (2009) [184]	• Parent's expectations, experiences, and reactions to routine ultrasound examination (PEER-U) questionnaire • State-Trait Anxiety Inventory (STAI) scale (6-item version)	NR	2	PEER-U values were significantly higher in the group with low SOC scores, indicating that parents with low SOC scores had a higher level of worried state of mind, which confirmed that vulnerable parents reacted to routine ultrasound examinations with more worry than others.
Sekizuka et al. (2009) [185]	Stress Perception Scale (SPS)	12.0 ± 0.6 30.0 ± 0.2	1, 3	The percentage of women with threatened premature birth was significantly higher in women with low SOC scores. Low SOC scores and low s-IgA levels were associated with threatened premature birth.
Larsson et al. (2009) [186]	• Parent's expectations, experiences and reactions to routine ultrasound examination (PEER-U) questionnaire • State-Trait Anxiety Inventory (STAI) scale (6-item version)	NR	2	No significant difference between parents with choroid plexus cyst/cysts identified during routine ultrasound and matched controls. No difference was found when comparing before and after routine ultrasound within each group with respect to SOC scores.
Oz et al. (2009) [187]	Perceived Stress Scale (PSS)	37- 41	3	A statistically significantly higher score in the SOC-13 was found in the uncomplicated delivery group compared with the complicated delivery group. No statistically significant difference was found between groups for the PSS score. Maternal labour complications were significantly associated with lower SOC-13 scores.
Hibino et al. (2009) [188]	Edinburgh Postnatal Depression Scale (EPDS)	13.1 ± 6.7	2	The SOC during pregnancy moderated between depression after delivery and 'existing anxiety about an earthquake' and tended to moderate between 'physical abnormality during pregnancy or childbirth' and 'evacuation.' All other earthquake-related factors were not moderated by the SOC during pregnancy.

Reference	Validated PRO and/or outcome measures	Weeks of gestation	Trimester	Summary of findings of SOC with respect to PROs
Ekelin et al. (2008) [189]	• Parent's expectations, experiences and reactions to routine ultrasound examination (PEER-U) questionnaire • State-Trait Anxiety Inventory (STAI) scale (6-item version)	NR	2	The SOC and STAI instruments correlated with each other in the before-ultrasound and after-ultrasound groups.
Hellmers et al. (2008) [190]	• WHO-5 Well-Being Index • Edinburgh Postnatal Depression Scale (EPDS)	28-35	3	Women with higher SOC tended more strongly towards spontaneous birth while women with a lower SOC tended more strongly toward a Caesarean. A correlation between the choice of mode of birth in pregnancy (at T1) and SOC was not found.
Hildingsson et al. (2008) [191]	• Edinburgh Postnatal Depression Scale (EPDS) • Cambridge Worry Scale (Swedish version) • Physical Wellbeing Scale	16	2	Women dissatisfied with partner support were more likely to have a lower SOC. Women dissatisfied with partner support were more likely to be multiparas, not living with their partner in early pregnancy, and more likely to report unfavourable timing of pregnancy. These women also experienced more physical symptoms and less emotional wellbeing in terms of more depressive symptoms, more major worries, and a lower SOC. One year after childbirth, women dissatisfied in early pregnancy had higher rate of divorce and disappointment with their partner's participation in childcare and household chores and understanding from partner.
Habroe et al. (2007) [192]	Achieved childbirth following successful assisted reproductive technology (ART)	NR	NR	Achieving childbirth after ART was associated with a significant increase in SOC at 1-year follow- up. This change happened more frequently among those who had a low SOC at baseline.

Reference	Validated PRO and/or outcome measures	Weeks of gestation	Trimester	Summary of findings of SOC with respect to PROs
Rudman et al. (2007) [193]	Edinburgh Postnatal Depression Scale (EPDS)	16	2	Depressive symptoms and low SOC were associated with the dissatisfied clusters of women who had dissatisfied and very dissatisfied interpersonal personal care, dissatisfied in information and decision-making, and very dissatisfied in their intrapartum care.
Sekizuka et al. (2006) [194]	• Secretory Immunoglobulin A (s-IgA) • Self-assessed depression scale • Satisfaction with intrapartum care	36	3	The depression score was higher and the s-IgA level was lower in the low-SOC scoring group, indicating that stress reactions were more intense in the low-SOC score group.
Almedom et al. (2005) [195]	Salivary cortisol	NR	3	Mothers who delivered in hospital had significantly higher SOC scores compared to those who opted for home birth. There were no significant associations between pre- or postnatal salivary cortisol concentrations and total SOC score. However, postnatal cortisol levels were lower in mothers with higher SOC scores, and significantly lower in those with higher 'comprehensibility.'
Sjöström et al. (2004) [196]	• Health Index (HI) • Hospital Anxiety and Depression (HAD) scale	10-12 34-36	1, 3	The strongest predictor of the women's ratings on the HI and HAD scales was an individual's SOC. Thus, the stronger their SOC, the better the individual's well-being and less anxiety and depression.
Engelhard et al. (2003) [197]	• Posttraumatic stress disorder (PTSD) symptom scale • Beck Depression Inventory • Crisis Support Scale	≤ 12	1	A strong SOC predicted fewer depressive symptoms and less PTSD symptoms after pregnancy loss. The SOC was related positively to crisis support, particularly to confiding in others and emotional support.
Abrahamsson & Ejlertsson (2002) [198]	Smoking status: nonsmokers, quitters, decreasers, continuers, relapsers	NR	NR	The smoking relapsers had the lowest SOC level. Low SOC level was also associated with women who did not have good subjective health, smokers, had two or more symptoms of depression, of tension or of musculoskeletal symptoms, or who had a history of visiting a medical general practitioner.

Reference	Validated PRO and/or outcome measures	Weeks of gestation	Trimester	Summary of findings of SOC with respect to PROs
Uren & Wastell (2002) [199]	• Attachment in Perinatal Bereavement Scale • Perinatal Bereavement as Trauma • Spiritual Orientation Scale (SOS) • Perinatal Grief Scale (PGS) • Global Severity Index (GSI) • Impact of Event Scale Revised (IES-R) • Adult Attachment Scale (AAS)	20-25 26-30 31-35 36-39 40	2, 3	SOC remained the most significant predictor of perinatal grief.

Note. AUDIT = The Alcohol Use Disorders Identification Test; CEQ = Childbirth Experience Questionnaire; CWS = Cambridge Worry Scale; DAS = Dyadic Adjustment Scale; DSRS = Depression Self-Reporting Scale; EPDS = Edinburgh Postnatal Depression Scale; FOC = Fear of Childbirth; GHQ = General Health Questionnaire; HAD = Hospital Anxiety and Depression Scale; HbA1c = Hemoglobin A1c; JW-DEQ = Wijma Delivery Expectancy/Experience Questionnaire; M = mean; MOS-FMFM = Medical; Outcomes Study Family and Marital Functioning Measures; MOS-SSS = Medical Outcomes Study Social Support Survey; MSPSS = Multidimensional Scale of Perceived Social Support; MSSS = Maternity Social Support Scale; NorAQ = NorVold Abuse Questionnaire; NR = not reported; NuPDQ = Revised Prenatal Distress Questionnaire; POMS = Profile of Mood States; PRAMS = Pregnancy Risk Assessment Monitoring System; PRO = patient-reported outcome; QDR-36 = Quality of Dyadic Relationship-36; SD = standard deviation; SBI = Support Behaviour Inventory; SOC = sense of coherence; SPSQ = Swedish Parenting Stress Questionnaire; SRRS = Social Readjustment Rating Scale; Swe-CBSEI = Swedish Childbirth Self-Efficacy Inventory; SWE-DES-10 = Swedish Diabetes Empowerment; SWE-HFS = Swedish Hypoglycemia Fear Survey; SWE-PAID-20 = Swedish-Problem Areas in Diabetes Scale; WBQ-12 = Well-Being Questionnaire; WDEQ-A = Wijma Delivery Expectancy Questionnaire Version A (WDEQ-A); WOG = weeks of gestation.

Table 2.3. The Relationship between SOC and PROs in the Cross-Sectional Studies

PRO	Reference	PRO Mean (*SD*)	SOC instrument	SOC Mean (*SD*)	Relationship of SOC to PRO
Abuse Assessment Screen: 'Have you been exposed to abuse during current pregnancy?'	176	NR	SOC-13	NR	Multiple logistic regression found marginal association between domestic violence during pregnancy and low SOC score ($p = .075$)
Adult Attachment Scale	199	NR	SOC-29	NR	Reported as 'correlated' with both closeness ($r = .49$, ns) and anxiety ($r = -.44$, ns).
Alcohol Use Disorders Identification Test (AUDIT)	176	NR	SOC-13	NR	NR
Antenatal Maternal Orientation Measure-Revised	171	Regulator: 2.49 (0.70) Facilitator: 4.59 (0.66)	SOC-13	NR	Significantly correlated ($p < .001$) with mothering styles: Regulator ($r = -.20$) Facilitator ($r = .22$)
Attachment in Perinatal Bereavement Scale	199	Numbness: 3:99 (0.90) Disorientation: 3:51(1.14) Yearning: 4:25 (0.74) Despair: 4:14 (0.86)	SOC-29	NR	NR
Global Severity Index (GSI)	199	0.81 (0.66)	SOC-29	NR	Weak negative correlation with GSI ($r = -.69$, ns)
Swedish Childbirth Self-Efficacy Inventory (Swedish (CBSEI)	97	NR	SOC-13	NR	Correlated with CBSEI ($r = .306$, $p < .01$)
Swedish Diabetes Empowerment Scale (SWE-DES-10)	168	3.9 (0.5)	SOC-13	68.9 (9.7) Range: 13-91	Significantly correlated with SWE-DES-10 ($r = .33$, $p < .001$)
Depression Self-Reporting Scale	160	NR	SOC-29	NR	NR

PRO	Reference	PRO Mean (*SD*)	SOC instrument	SOC Mean (*SD*)	Relationship of SOC to PRO
Edinburgh Postnatal Depression Scale (EPDS)	91	1.152 (0.56)	SOC-13	4.335 (1.06)	Significant negative correlation with EPDS (r = -.62, p < .001)
	165	6.5 (2.1)	SOC-29	NR	EPDS was a significant predictor for SOC; pregnant women with low SOC scores achieved higher EPDS scores.
	171	6.41 (4.80)	SOC-13	48.48 (8.20)	Negative correlation with EPDS (r = -.64, p < .01)
	172	6.46 (4.4)	SOC-13 & SOC 9	SOC-9: 47.4 (8.0) SOC-13: 67.0 (11.1)	As EPDS scores increased, the likelihood of high SOC decreased.
	173	NR	SOC-13 & SOC-9	67.5 (10.9)	Significant negative correlations (p < .001) SOC-13 and EPDS (r = -.659) SOC-9 and EPDS (r = -.666)
	176	NR	SOC-13	NR	NR
Fear of Childbirth (FOC)	163	High-risk pregnancy: 42.2 (6.0) Low-risk pregnancy: 41.7 (6.0)	SOC-29	High-risk pregnancy: 119 (16.8) Low-risk pregnancy: 108.2 (6.0)	No significant correlation between FOC and the SOC in the low- or high-risk pregnant women.
General Health Questionnaire (GHQ)	179	2.2 (4.5)	Family SOC-12	65.0 (9.2)	Negatively correlated with GHQ (r = -.37, p < .006)
	181	24.1 (4.8)	Family SOC-12	64.6 (9.4)	Negatively correlated with GHQ (r = -.38, p < .01)
Havelhoehe Questionnaire on Delivery	182	NR	SOC-29	151.2 (17.2)	Significant correlation with more confidence in delivery (r = .349, p < .001)
Hemoglobin A1c	168	NR	SOC-13	68.9 (9.7)	Negative correlation with early pregnancy HbA1c (r = -.23, p < .01)

PRO	Reference	PRO Mean (*SD*)	SOC instrument	SOC Mean (*SD*)	Relationship of SOC to PRO
Swedish Hypoglycemia Fear Survey (SWE-HFS)	168	26.6 (11.8)	SOC-13	68.9 (9.7)	NR
Impact of Event Scale -Revised (IES-R)	199	Intrusion: 1.64 (1.02) Avoidance, 0.66 (0.70) Hyperarousal: 0.95 (1.03)	SOC-29	NR	Weak negative correlation with IES-R subscales: Intrusion (r = -.42, ns) Avoidance (r = -.52, ns) Arousal (r = -.53, ns)
Maternal Fetal Attachment Scale (MFAS)	91	3.960 (0.45)	SOC-13	4.335 (1.06)	Correlated with MFAS (r = .10, p < .05)
Maternity Social Support Scale (MSSS)	97	NR	SOC-13	NR	Correlation with MSSS (r = .436, p < .01)
Medical Outcomes Study Family and Marital Functioning Measures (MOS-FMFM)	179	40.2 (4.8)	Family SOC-12	65.0 (9.2)	Significant correlation with MOS-FMFM (r = .73)
Medical Outcomes Study Short Form 12-Item Health Survey (MOS- SF12)	181	Physical Component Scale (PCS): 43.3 (7.9) Mental Component Scale (MCS): 48.2 (8.7)	Family SOC-12	64.6 (9.4)	Weak correlation with PCS (r = .04, ns) Correlated with MCS (r = .26, p < .01)
Medical Outcomes Study Social Support Survey (MOS-SSS)	181	74.4 (14.6)	Family SOC-12	64.6 (9.4)	Correlated with MOS-SSS (r = .38, p < .01)
NorVold Abuse Questionnaire (NorAQ)	176	NR	SOC-13	NR	Women with low SOC score were 9.1 more likely to be exposed to domestic violence during pregnancy (p < .001)
Parental Self-Efficacy Scale	157	Overall: 4.14 ± 1.33 Pregnant: 2.30 ± 0.72	SOC-13	Pregnant: 4.37 ± 0.75	Weak correlation with Parental Self-Efficacy (r = .08, ns)
Parental Satisfaction Questionnaire	157	Overall: 6.14 ± 0.76 Pregnant: NR	SOC-13	Pregnant: 4.37 ± 0.75	Significant correlation with Parent Satisfaction (r = .29, p < .001)

PRO	Reference	PRO Mean (*SD*)	SOC instrument	SOC Mean (*SD*)	Relationship of SOC to PRO
Perinatal Bereavement as Trauma	199	Meaning = 2.53 (1.39) Search = 2.50 (1.07) Coping = 2.57 (1.21).	SOC-29	NR	Weak correlation with Search (r = -.37, ns) Meaning (r = .27, ns) Coping (r = .07, ns)
Multidimensional Scale of Perceived Social Support (MSPSS)	91	5.719 (0.93)	SOC-13	4.335 (1.06)	Significant correlation with MSPSS (r = .51, p < .001)
Perinatal Grief Scale (PGS)	199	3.37 (.72)	SOC-29	NR	Significant negative correlation with PGS (r = -.71, p < .001)
Prenatal Distress Questionnaire (NuPDQ)	171	9.16 (5.15)	SOC-13	48.48 (8.20)	Significant negative correlation with NuPDQ (r = -.51, p < .001)
Swedish Problem Areas in Diabetes- 20 (SWE-PAID-20) Scale	168	27.1 (15.9)	SOC-13	68.9 (9.7)	NR
Profile of Mood States (POMS)	97	NR	SOC-13	NR	Significant negative correlation with POMS subscales (p < .01): Vigour (r = .238) Fatigue (r = -.469) Confusion (r = -.454) Tension (r = -.472) Depression (r = -.517) Anger (r = -.519)
Relationship Assessment Scale	157	Overall: 5.65 ± 1.29 Pregnant: 6.04 ± 1.23	SOC-13	Pregnant: 4.37 ± 0.75	Significant correlation with Relationship Assessment Scale (r = .36, p < .001)
Social Readjustment Rating Scale (SRRS)	179	232.7 (149.1)	Family SOC-12	65.0 (9.2)	Not correlated with SRRS (r = -.15, ns)

PRO	Reference	PRO Mean (*SD*)	SOC instrument	SOC Mean (*SD*)	Relationship of SOC to PRO
	181	231.7 (146.5)		64.6 (9.4)	Negative correlation with SRRS (r = -.19, p < .01)
Spiritual Orientation Scale (SOS)	199	Beliefs: 3.52 (0.98)	SOC-29	NR	Not correlated with SOS Beliefs r = -.01, ns)
Stress Perception Scale (SPS)	174	NR	SOC-13	NR	Significant negative correlation with SPS (r = -.351, p < .01)
Support Behaviour Inventory (SBI) scale	172	NR	SOC-13 & SOC 9	SOC-9: 47.4(8.0) SOC-13: 67.0(11.1)	Adjusted odds ratio for SBI scale and SOC = 1.056 (95% CI = [1.033, 1.078], p < .000)
Visual Analog Scale (VAS) for pain	182	NR	SOC-29	151.2 (17.2)	NR
Warwick Edinburgh Mental Well-Being Scale (short form) (WEMWS)	91	3.375 (0.63)	SOC-13	4.335 (1.06)	Significantly correlated with WEMWS (r = .39, p < .001)
Well-Being Questionnaire- 12 (WBQ-12)	168	22.6 (5.7)	SOC-13	68.9 (9.7)	Significant correlation with WBQ-12 (r = .59, p < .001)
Wijma Delivery Expectancy Questionnaire Version A	159	Mild fear of childbirth (FOC): 0-84 Severe FOC: 85-165	SOC-13	Low SOC: 13-60 High SOC: 61-91	Significant negative correlation with FOC (N = 414, p < .001)

PRO	Reference	PRO Mean (*SD*)	SOC instrument	SOC Mean (*SD*)	Relationship of SOC to PRO
Wijma Delivery Expectancy/Experience Questionnaire (W-DEQ)	160	Mild fear of childbirth (FOC): 60.5 (± 14.4) Severe FOC: 102 (± 14.6)	SOC-13	SOC: 69.3 ± 11.8 Mild FOC • Comprehensibility: 26.30 ± 5.00 • Manageability: 21.69 ± 3.97 • Meaningfulness: 22.94 ± 3.59 Severe FOC • Comprehensibility: 22.71 ± 6.08 • Manageability: 19.02 ± 5.03 • Meaningfulness: 21.29 ± 4.21	Pearson's *r* between DEQ-A and SOC-13 ($r = -.376$, $p < .001$)
	97	NR	SOC-13	NR	Significant negative correlation with JW-DEQ ($r = -.468$, $p < .01$)
	178	NR	SOC-13	62.52 (10.62)	Significant negative correlation with JW-DEQ total score ($r = -.44$, $p < .01$)

Note. AUDIT = Alcohol Use Disorders Identification Test; CBSEI = Childbirth Self-Efficacy Inventory; DES-10 = Diabetes Empowerment Scale-10; EPDS = Edinburgh Postnatal Depression Scale; FOC = Fear of Childbirth; GHQ = General Health Questionnaire; GSI = Global Severity Index; HbA1c = Hemoglobin A1c; IES-R = Impact of Event Scale -Revised; MCS = Mental Component Scale; MFAS = Maternal Fetal Attachment Scale; MOS-FMFM = Medical Outcomes Study Family and Marital Functioning Measures; MOS- SF12 = Medical Outcomes Study Short Form 12-Item Health Survey; MOS-SSS = Medical Outcomes Study Social Support Survey; MSPSS = Multidimensional Scale of Perceived Social Support; MSSS = Maternity Social Support Scale; NR = not reported; ns = non-significant; NorAQ = NorVold Abuse

Questionnaire; NuPDQ = Prenatal Distress Questionnaire; PCS = Physical Component Scale; PGS = Perinatal Grief Scale; POMS = Profile of Mood States; SBI = Support Behaviour Inventory; SOC = Sense Of Coherence; SOS = Spiritual Orientation Scale; SPS = Stress Perception Scale; VAS = Visual Analog Scale; WBQ-12 = Well-Being Questionnaire- 12; W-DEQ = Wijma Delivery Expectancy/Experience Questionnaire; WEMWS = Warwick Edinburgh Mental Well-Being Scale; SRRS = Social Readjustment Rating Scale; SWE-HFS = Swedish Hypoglycemia Fear Survey; SWE-PAID-20 = Swedish Problem Areas in Diabetes-20; WOG = weeks of gestation.

Table 2.4. The Relationship between SOC and the PROs in the Prospective Studies

PRO	Reference	PRO Mean (*SD*)	SOC instrument	SOC Mean (*SD*)	Relationship of SOC to PRO
Antenatal Maternal Orientation Measure-Revised	166	Regulator: 2.52 (0.70) Facilitator orientation: 4.56 (4.56)	SOC-13	30 (-)	SOC and Regular Orientation:r = -.19, (p < .001) SOC and Facilitator Orientation: r = .21, (p < .001)
Alcohol Use Disorders Identification Test (AUDIT)	158	NR	SOC-13	NR	NR
Beck Depression Index (BDI)	197	Early pregnancy: 7.9 (5.4) After pregnancy loss: 6.6 (6.3)	SOC-13	Early pregnancy only: 65.1 (9.6)	Early pregnancy SOC and BDI after pregnancy loss r = -.37, (p < .01)
Cambridge Worry Scale	155	NR	SOC-29	NR	NR
	156	NR	SOC-13	NR	NR
	167	NR	SOC-13	Early pregnancy: 69.41 (11.29) 2 months after birth: 70.01(11.29) 1 year after birth: 67.29 (12.75)	Women with major worries about giving birth, the baby's health, and going to the hospital had lower scores on SOC

PRO	Reference	PRO Mean (*SD*)	SOC instrument	SOC Mean (*SD*)	Relationship of SOC to PRO
Childbirth Experience Questionnaire (CEQ)	156	Emotionally healthy cluster • Own capacity: 2.80 (0.67) • Professional support: 3.60 (0.63) • Perceived safety: 3.24 (0.66) • Participation: 3.26 (0.89) • Total CEQ: 3.14 (0.63) Emotionally unhealthy cluster • Own capacity: 2.60 (0.71) 0.048 • Professional support: 3.44 (0.67) 0.082 • Perceived safety: 2.87 (0.70) • Participation: 2.98 (0.89) 0.033 • Total CEQ: 2.89 (0.64) 0.006	NR	NR	NR
Crisis Support Scale (CSS)	197	One month after pregnancy loss Partner: 29.8 (4.8) Family/friends: 27.0 (5.2) Health care workers: 24.6 (7.6) Overall: 27.2 (4.0)	SOC-13	In early pregnancy: 65.1 (9.6)	Prenatal SOC and overall CSS score after pregnancy loss were correlated ($r = .22$, $p < .01$)
Dyadic Adjustment Scale (DAS)	162	Prenatal DAS: 116.6 (9.9) Postnatal DAS: 115.3 (14.8)	SOC-13	Prenatal SOC: 66.6 (9.6) Postnatal SOC: 59.6 (12.6)	Decrease in SOC from prenatal to postnatal was statistically significant for SOC ($p < .001$) but not for DAS (p = ns)
Edinburgh Postnatal	155	NR	SOC-29	NR	NR
	156	NR	SOC-13	NR	NR

PRO	Reference	PRO Mean (*SD*)	SOC instrument	SOC Mean (*SD*)	Relationship of SOC to PRO
Depression Scale (EPDS)	158	NR	SOC-13	NR	NR
	166	At T1 only: 6.23 (4.65)	SOC-13	At 12-26weeks of gestation: SOC = 48.46 (7.86)	Significant correlation ($p < 0.001$) between EPDSand SOC at T1 ($r = -.64$) and T2 ($r = -.52$)
	167	Low EPDS: 0-12 High EPDS: 13-30	SOC-13	Early pregnancy (Low versus High EPDS): 70.76 (10.20) versus 54.92 (12.09) 2 months after birth (Low versus High EPDS): 71.18 (11.12) versus 58.50 (13.38) One Year After Birth (Low versus High EPDS): 68.77 (11.88) versus 55.54 (13.46)	Women with EPDS scores 13-30 reported lower SOC scores compared to women with EPDS scores 0-12 at all time points.
	170	30th week of pregnancy EPDS: 6.46 (4.4) Week 8 postpartum EPDS: 5.74 (4.2)	SOC-13	30th week of pregnancy: SOC = 48.05 (7.582) Week 8 postpartum: SOC = 49.85 (7.861)	Women with high antenatal SOC scores were more likely to have lower EPDS scores (Adjusted OR = .572 (95% CI:.508–.644; $p < 0.001$)
	188	Before childbirth: 3.9 (4.1) After childbirth: 3.8 (4.1).	SOC-13	Before childbirth: SOC = 59.2 (10.3) After childbirth: SOC = 60.5 (9.5)	SOC and EPDS before delivery: ($r = -.21$, $p < .05$); SOC before delivery and EPDS after delivery: $r = -.09$, $p < .05$)

PRO	Reference	PRO Mean (*SD*)	SOC instrument	SOC Mean (*SD*)	Relationship of SOC to PRO
	190	During pregnancy: American responders: 7.54 (5.57) German data not provided Postpartum American women vs 6.88 (5.74) German women: 4.80 (4.07)	SOC-L9	NR	NR
	191	Satisfied with partnersupport: EPSD = 7.4 Not satisfied with partnersupport: EPSD = 11.8	SOC-13	Satisfied with partner support69.7 Not satisfied with partner support: SOC = 58.1	NR
	193	NR	SOC-13	NR	NR
Family Adaptability, Partnership, Growth, Affection, Resolution (APGAR) Index	153	NR	SOC-13	NR	NR
Fear of Childbirth	155	NR	SOC-29	NR	NR
	156	NR	SOC-13	NR	NR

PRO	Reference	PRO Mean (*SD*)	SOC instrument	SOC Mean (*SD*)	Relationship of SOC to PRO
General Health Questionnaire (GHQ)	175	During pregnancy: 2.2 (2.4) 6 months postpartum :1.6 (2.2)	Family SOC-12	During pregnancy: 65.7 (8.1) 6 months postpartum: 65.9 (9.1)	< Prenatal GHQ and prenatal SOC (r = -.25) GHQ at 6 months postpartum and prenatal SOC (r = -.21). All correlations were statistically significant at $p < 0.01$
General Self-Efficacy Scale (GSES) (Chinese version)	153	NR	SOC-13	NR	NR
Health Index (HI)	196	Gestation 34-36 weeks: 26.8 (3.9) 8 weeks postpartum: 28.8 (2.7) 10-12 weeks postpartum 28.5 (_3.2)	SOC-13	Gestation 34-36 weeks: 67 (12) 8 weeks postpartum: 68 (11) 10-12 weeks postpartum: 67 (10)	The strongest predictor of the women's ratingson the HI at 12 weeks gestation was SOC (Beta coefficient = 0.28, $p < .01$) and at 34-36 weeks gestation (Beta coefficient = 0.26, $p < .01$) and at 8 weeks postpartum (Beta coefficient = 0.39, $p < .001$)
Health-Promoting Lifestyle Profile	153	NR	SOC-13	NR	NR

PRO	Reference	PRO Mean (*SD*)	SOC instrument	SOC Mean (*SD*)	Relationship of SOC to PRO
Hospital Anxiety and Depression (HAD) Scale	196	Gestation 34-36 weeksHAD-Anxiety: 4.9 HAD-Depression: = 4.4 8 weeks postpartum HAD-Anxiety: 5.2 HAD-Depression: 3.9 10-12 weeks postpartum HAD-Anxiety: 5.4 HAD-Depression: 4.3	SOC-13	Gestation 34-36 weeks: SOC = 67 (12) 8 weeks postpartum: SOC = 68 (11) 10-12 weeks postpartum: SOC = 67 (10)	NR
	162	Prenatal Anxiety: 6.11 (3.9) Prenatal Depression: 3.96 (2.85) Postnatal Anxiety: 7.60 (4.69) Postnatal Depression: 5.73 (4.18)	SOC-13	Prenatal SOC = 66.6 (9.6) Postnatal SOC = 59.6 (12.6)	NR
Secretory Immunoglobulin A (sIgA)	185	First half of pregnancy < 24 years: 13.9 (4.1) ≥ 25 years: 15.6 (4.8) ≥ 35 years: 16.2 (6.3) Second half of pregnancy: < 24 years: 21.0 (5.5) ≥ 25 years: 22.5 (8.7) ≥ 35 years: 21.6 (5.7)	SOC-13	First half of pregnancy: SOC = 60.7 (11.8) Second half of pregnancy: SOC = 59.5 (10.9)	The s-IgA level determined in the first half of pregnancy was lower in the low SOC group (14.4 ± 4.7 lg/ml) than in the high SOC group (16.3 ± 5.1 lg/ml), but the difference was not significant (p = .080).
Life Satisfaction Scale	162	Prenatal group at T2: 44.9 (9.9) Postnatal group at T2: 56.5 (5.0)	SOC-13	Prenatal group at T2: SOC = 59.6 (12.6) Postnatal group at T2: SOC = 72.5 (7.5)	NR

PRO	Reference	PRO Mean (*SD*)	SOC instrument	SOC Mean (*SD*)	Relationship of SOC to PRO
Medical Outcomes Study Family and Marital Functioning Measures (MOS-FMFM) Scale	169	Pregnancy MOS-FMFM = 40.3 (4.6) 6 weeks postpartum MOS-FMFM: 37.2 (4.3) 6 months postpartum MOS-FMFM: 37.0 (4.9)	Family SOC-12	Pregnancy SOC = 65.8 (8.1) 6 weeks postpartum SOC = 65.9 (9.1) 6 months postpartum SOC = 65.7 (9.2)	Prenatal SOC correlated withprenatal MOS-FMFM ($r = .70$, $p < .01$) MOS-FMFM at 6 weeks postpartum ($r = .40$, $p < .01$) MOS-FMFM at 6 months postpartum ($r = .27$, $p < .01$) SOC at 6 weeks postpartum correlated with: MOS-FMFM 6 weeks postpartum ($r = .60$, $p < .01$) and SOC at 6 months postpartum correlated with MOS-FMFM at 6 months postpartum $r = .62$, $p < .01$)
	175	During pregnancy: 40.3 (4.6) 6 months postpartum: 36.9 (4.9)	Family SOC-12	During pregnancy: 65.7 (8.1) 6 months postpartum: 65.9 (9.1)	Prenatal MOS-FMFM and prenatal SOC ($r = .70$, $p < .01$)
	177	Pregnancy: 40.3 (4.6) Postpartum: 38.0 (4.2)	Family SOC-12	Pregnancy: 65.8 (8.1) Postpartum: 65.9 (9.1)	Prenatal SOC correlated significantly with prenatal MOS-FMFM ($r = .70$, $p < .01$) and MOS-FMFM at 6 weeks postpartum ($r = .36$, $p < .01$)

PRO	Reference	PRO Mean (*SD*)	SOC instrument	SOC Mean (*SD*)	Relationship of SOC to PRO
Medical Outcomes Study Social Support Survey (MOS-SSS)	175	During pregnancy: 74.8 (13.3) 6 months postpartum: 73.9 (19.50)	Family SOC-12	During pregnancy: 65.7 (8.1) 6 months postpartum: 65.9 (9.1)	Prenatal MOS-SSS and Prenatal SOC (r = .33, p < .01)Prenatal MOS-SSS and Change in SOC (r = -.09, p = ns)Change in MOS-SSS and Change in SOC (r = .21, p < .01)
	177	Pregnancy: 750 (13.3) 6 weeks postpartum: 728 (20.5)	Family SOC-12	Pregnancy: 658 (8.1) 6 weeks postpartum: 659 (9.1)	Prenatal MOS-SSS and Prenatal SOC (r = .33, p < .01)
Multidimensional Scale of Perceived Social Support (MSPSS)	164	Q1 MSPSSFamily: 24.2 (5.0) Friends: 23.5 (4.6) Significant others: 26.5 (3.0) Q2 MSPSS Family: 26.3 (3.2) Friends: 25.6 (3.5) Significant others: 27.6 (1.4) Q3 MSPSS Family: 24.3 (4.5) Friends: 23.6 (4.6) Significant others: 26.6 (2.5)	SOC-13	Q1 SOC = 66.0 (12.3) Q2 SOC = 71.7 (11.5) Q3 SOC = 70.7 (12.2)	NR
	166	MSPSS: 70.66 (12.89)	SOC-13	T1: 48.46 (7.86)	MSPSS and SOC was significantly correlated (r = .48, p < .001)
NorVold Abuse Questionnaire (NorAQ)	158	NR	SOC-13	NR	NR
Preparation for Labor and Birth (P-LAB) instrument	161	NR	SOC-13	NR	Correlation between P-LAB and SOC was r = .22, p < .05).

PRO	Reference	PRO Mean (*SD*)	SOC instrument	SOC Mean (*SD*)	Relationship of SOC to PRO
Pregnancy Risk Assessment Monitoring System (PRAMS)	166	NR	SOC-13	At T1: SOC = 48.46 (7.86)	NR
PEER-U Questionnaire	183	Before ultrasound • AF Group(n = 66) Median PEER-U: 22.9 (Interquartile range: 15.1) • NF Group (n = 1983) Median PEER-U: 20.8 (Interquartile range: 16.7) After ultrasound • AF Group (n = 66) Median PEER-U: 20.5 (Interquartile range: 19.5) • NF Group (n = 1983) Median PEER-U: 10.3 (Interquartile range: 12.8)	SOC-13	Before ultrasound • AF Group (n = 66) Median SOC: 72 (Interquartile range: 12) • NF Group (n = 1983) Median SOC: 72 (Interquartile range: 14) After ultrasound • AF Group (n = 66) Median SOC: 72.5 (Interquartile range: 10.2) • NF Group (n = 1983) Median SOC: 73.0 (Interquartile range: 13.0)	NR
	184	Before ultrasound • Primivara PEER-U: 25.0 (18.8) • Multivara PEER-U: 20.8 (18.8) After ultrasound • Primivara PEER-U: 10.3 (11.5) • Multivara PEER-U: 7.7 (10.3)	SOC-13	Before ultrasound: SOC = 70.2 (10.6) After ultrasound: SOC = 70.3 (10.7)	NR

PRO	Reference	PRO Mean (*SD*)	SOC instrument	SOC Mean (*SD*)	Relationship of SOC to PRO
	186	Before ultrasound: 18.8 (12.5) After ultrasound: 25.6 (20.5)	SOC-13	Before ultrasound: 73.5 (12.0) After ultrasound: 74.0 (13.8)	NR
	189	NR	SOC-13	NR	NR
Perceived Stress Scale (PSS)	187	Complicated delivery: 18.8 (0.59) Uncomplicated delivery 17.98 (0.62)	SOC-13	Complicated delivery: 67.74 (1.19) Uncomplicated delivery: 72.18 (1.32)	A negative correlation was found between SOC and PSS (r = -.627, p < .01)
Post-traumatic Stress Disorder (PTSD) Symptom Scale	197	After pregnancy loss Only: Mean (SD) = 18.3 (9.0)	SOC-13	Early pregnancy only: 65.1 (9.6)	SOC in early pregnancy was related negatively to PTSD symptoms one month after pregnancy loss. More specifically, the SOC was related significantly to PTSD avoidance (r = -.24, p = .008) and arousal symptoms (r = -.27, p = .004), but not to re-experiencing symptoms (r = -.10, p = ns)

PRO	Reference	PRO Mean (*SD*)	SOC instrument	SOC Mean (*SD*)	Relationship of SOC to PRO
Quality of Dyadic Relationship-36 (QDR-36)	164	Q1 QDR-36 Consensus = 5.2 (0.5) Cohesion = 4.8 (0.7) Satisfaction = 5.1 (0.5) Sensuality = 5.5 (0.6) Sexuality = 4.1 (0.7) Q2 QDR-36 Consensus 5.4 (0.5) Cohesion = 5.2 (0.7) Satisfaction = 5.3 (0.4) Sensuality = 5.5 (0.6) Sexuality = 4.0 (0.7) Q3 QDR-36 Consensus 5.2 (0.5) Cohesion = 4.8 (0.9) Satisfaction = 5.0 (0.6) Sensuality = 5.1 (0.8) Sexuality = 3.9 (0.7)	SOC-13	Q1: SOC = 66.0 (1.3) Q2: SOC = 71.7 (11.5) Q3: SOC = 70.7 (12.2)	Perceived quality of couple relationship (QDR-36) six months after childbirth was associated with higher scores at gestational week 25 (p = .013) and more positive change in SOC between gestational week 25 and six months after childbirth (p = .002).
Reproductive outcome of Assisted Reproductive Technology (ART) at 1-year follow-up (Yes or No)	192	62.6% (n = 642) of the 1,025 women reported a treatment-related pregnancy during the follow-up period	SOC-9	High SOC score = ≥850 points LOW SOC score = ≤850 points	Among the women, an Odds ratio of 1.81 (CI: 1.202.74) for those with high SOC at follow-up and having delivered after ART.
Revised Prenatal Distress Questionnaire (NuPDQ)	166	T1 NuPDQ: 9.04 (4.88) T2 NuPDQ: 6.00 (4.46)	SOC-13	At T1 only: SOC = 48.46 (7.86)	SOC was negatively correlated with NuPDQ at T1 (r = -.54, p < .001) and T2 (r = -.50, p < .001)

PRO	Reference	PRO Mean (*SD*)	SOC instrument	SOC Mean (*SD*)	Relationship of SOC to PRO
Salivary cortisol	180	NR	SOC-13	Anthroposophic (*n* = 75): Mean = 67.2, *SE* = 1.1 Partly anthroposophic (*n* = 113): SOC = 67.0, *SE* = 0.9 Nonanthroposophic (*n* = 96); SOC = 67.5, *SE* = 1.0	NR
	195	Prenatal cortisol: 1.337 µg/day Postnatal cortisol: 1.068 µg/day	SOC-13	NR	No significant associations between prenatal or postnatal salivary cortisol concentrations and total SOC score. However, postnatal cortisol levels were lower in mothers with higher SOC scores ($p < .0171$)
Secretory Immunoglobulin A (sIgA)	194	Prepartum • Primipara (*n* = 24): sIgA = 23.84 µg/ml (11.40) • Para (*n* = 30): sIgA = 20.30 µg/ml (12.89) Postpartum • Primipara (*n* = 24): sIgA = 26.20 µg/ml (11.90) • Para (*n* = 30): sIgA = 26.90 µg/ml (13.90)	SOC-29	Prepartum period based on birth history • Primipara (*n* = 24): SOC = 139.3 (22.5) • Para (*n* = 30): SOC = 139.5 (24.6)	s-IgA level was significantly lower (15.84 µg/ml [8.98]) versus 27.74 µg/ml [12.95]) in the low-SOC scoring group (≤139) than in the high-SOC score group (≥140)

PRO	Reference	PRO Mean (*SD*)	SOC instrument	SOC Mean (*SD*)	Relationship of SOC to PRO
Self-Assessment Depression Scale	194	Prepartum Only Primipara (*n* = 24): 28.7 (7.6) Para (*n* = 30): 29.0 (6.6)	SOC-29	Prepartum period based on birth history: Primipara (*n* = 24): SOC = 139.3 (22.5) Para (*n* = 30): SOC = 139.5 (24.6)	The Mann-Whitney *U* test showed no significant difference in the SOC score between those with high depression (i.e., score ≥40) and low depression scores (i.e., score < 40 scores)
Smoking status (i.e., non-smokers, quitters, decreasers, continuers, relapsers)	198	Smoking status (i.e., non-smokers, quitters, decreasers, continuers, relapsers) assessed before and after birth	SOC-13	SOC measured early pregnancy only: non-smokers (SOC = 72.8 (11.2) quitters (SOC = 71.9 (11.2) decreasers (SOC = 70.8 (11.9)) continuers (SOC = 69.3 (12.1) relapsers (SOC = 64.2 (12.0)); Differences are statistically significant	Relapsers had the lowest SOC scores
Social Readjustment Rating Scale (SRRS)	175	During pregnancy: 221.6 (135.8) 6 months postpartum: 226.8 (165.0)	Family SOC-12	During pregnancy: SOC = 65.7 (8.1) 6 months postpartum: SOC = 65.9 (9.1)	Prenatal SRRS and Prenatal SOC was negatively correlated with *r* = -.10, ns)
	177	During pregnancy: 75.0 (13.3) 6-weeks postpartum: 72.8 (20.5)	Family SOC-12	During pregnancy: SOC = 65.8 (8.1) 6-weeks postpartum: SOC 65.9 (9.1)	Correlation between prenatal SOC and prenatal stress was not significant (*r* = -.11, *p* = ns)

PRO	Reference	PRO Mean (*SD*)	SOC instrument	SOC Mean (*SD*)	Relationship of SOC to PRO
State and Trait Anxiety Inventory (STAI) Scale (6-item version)	184	Before ultrasoundSTAI-S: 33.1 (10.9) STAI-I: 34.0 (8.7) After ultrasound STAI-S: 31.2 (9.8) STAI-I = 33.5 (8.7)	SOC-13	Before ultrasound: SOC = 70.2 (10.6) After ultrasound: SOC = = 70.3 (10.7)	NR
	186	Before ultrasound STAI-S: 30.0 (16.7) STAI-T: 30.0 (13.8) After ultrasound: STAI-S: 36.7 (18.3) STAI-T: 33.0 (12.2)	SOC-13	Before ultrasound: SOC = 73.5 (12.0) After ultrasound: SOC = 74.0 (13.8)	NR
	189	NR	SOC-13	NR	The SOC and STAI Instruments correlated with each other "before ultrasound" (r = -.606, p < .001) and "after ultrasound" (r = -.627, p < .001)
Stress Perception Scale (SPS)	185	First half of pregnancy: 21.1 (10.4) Second half of pregnancy: 21.6 (11.6)	SOC-13	First half of pregnancy: SOC = 60.7 (11.8) Second half of pregnancy: SOC = 59.5 (10.9)	NR
Support Behaviour Inventory (SBI) Scale	170	NR	SOC-13	30th week of pregnancy: (SOC) = 48.05 (7.582) Week 8 postpartum: (SOC) = 49.85 (7.861)	The odds ratio between SBI and high SOC was 1.074 (95% CI:1.0441.105 p < .001

PRO	Reference	PRO Mean (*SD*)	SOC instrument	SOC Mean (*SD*)	Relationship of SOC to PRO
Swedish Parenting Stress Questionnaire (SPSQ)	167	SPSQ Incompetence: 2.2 (0.66) Role restriction: (3.5 (0.77) Social isolation: 2.0 (0.69) Spouse relation problem: 2.4 (0.88) Health problem: 2.5 (0.75) Total stress: 2.5 (0.54)	SOC-13	Early pregnancy: SOC = 69.41 (11.29) 2 months after birth:SOC = 70.01(11.29) 1 year after birth: SOC = 67.29 (12.75)	The total SPSQ and the three SOC measures were significantly negatively correlated: Low SOC (r = -.40), Moderate SOC (r = -.49) and High SOC (r = -.64)
Cambridge Worry Scale (Swedish version)	191	Satisfied with partner support - CWS = 15.3 Not satisfied with partner support - CWS = 23.4	SOC-13	Satisfied with partner support: SOC = 69.7 Not satisfied with partner support: SOC = 58.1	NR
World Health Organization Well-Being Index (WHO-5)	190	During pregnancy German women 16.04 (3.85) American women = 16.44 (3.98) Postpartun German women = 15.37 (4.20) American women = 14.56 (5.58)	SOC-L9	NR	NR

PRO	Reference	PRO Mean (*SD*)	SOC instrument	SOC Mean (*SD*)	Relationship of SOC to PRO
Women's satisfaction with intrapartum care along three distinct dimensions (interpersonal care, information and involvement in decision-making and physical birth environment	193	Nine clusters of women with different profiles of satisfactionwith intrapartum care were identified: A. Very satisfied B. Satisfied Inf/ C. Satisfied Env D. Average E. Dissatisfied Env F. Dissatisfied Int pers G. Very dissatisfied Int pers H. Dissatisfied Inf/Dec I. Very dissatisfied	SOC-13	NR	Depressive symptoms and low SOC in early pregnancy were associated with the dissatisfied clusters F (Dissatisfied Interpersonal care) G (Very dissatisfied Interpersonal care), H (Dissatisfied Information/decision-making) and I (Very dissatisfied)

Note. APGAR = Adaptability, Partnership, Growth, Affection, Resolution; ART = Assisted Reproductive Technology; BDI = Beck Depression Index; CEQ = Childbirth Experience Questionnaire; CSS = Crisis Support Scale; DAS = Dyadic Adjustment Scale; EPDS = Edinburgh Postnatal Depression Scale; GSES = General Self-Efficacy Scale; GHQ = General Health Questionnaire; HAD = Hospital Anxiety and Depression; HI = Health Index; MOS-FMFM = Medical Outcomes Study Family and Marital Functioning Measures; MOS-SSS = Medical Outcomes Study Social Support Survey; MSPSS = Multidimensional Scale of Perceived Social Support; NorAQ = NorVold Abuse Questionnaire; NuPDQ = Revised Prenatal Distress Questionnaire; NR = Not Reported; ns = not significant; OR = odds ratio; P-LAB = Preparation for Labor and Birth; PEER-U = Parent's Expectations, Experiences and Reactions to routine Ultrasound examination; PRAMS = Pregnancy Risk Assessment Monitoring System; PRO = patient-eported outcome; PSS = Perceived Stress Scale; PTSD = Post-traumatic Stress Disorder; QDR-36 = Quality of Dyadic Relationship-36; SBI = Support Behaviour Inventory; sIgA = Secretory Immunoglobulin A; SOC = Sense of Coherence; SPS = Stress Perception Scale; SPSQ = Swedish Parenting Stress Questionnaire; SRRS = Social Readjustment Rating Scale; STAI = State and Trait Anxiety Inventory; WHO-5 = World Health Organization Well-Being Index; WOG = weeks of gestation.

2.2.5.2 Research Locations

The majority of the studies reviewed were from Sweden (n = 19; 38.9%) [97, 155, 156, 158-160, 162, 164, 167, 176, 180, 183-184, 186, 189, 191, 193, 196, 198] followed by Australia (n = 7; 14.2%) [154, 166, 170-173, 199], Hong Kong/China (n = 6; 12.2%) [153, 169, 175, 177, 179, 181], and Japan (n = 5; 10.2%) [174, 178, 185, 188, 194]. There were two studies each (4.1%) from Israel [157, 187] and Germany [182, 190]. The countries of Denmark [192], Eritrea [195], Holland [197], Iran [163], India [91], Norway [168], Poland [165] and USA [161] were represented with one (2.0%) study.

2.2.5.3 Cross-Sectional Studies

Among the cross-sectional studies (Table 2.3), seven studies [97, 160, 165, 171, 174, 176, 199] provided no explicit measures of SOC. Three studies reported multiple SOC scores. [163, 165, 172] Mohamamdirizi et al. [163] reported significantly different SOC measures in high risk versus low-risk pregnancies and Przestrzelska et al. [165] reported that SOC scores did not significantly differ in women with physiological versus complicated pregnancies. Ferguson et al. [172] reported different SOC scores as measured by the SOC-9 and the SOC-13.

Pasricha et al [91] found positive correlations ($p < .05$) with measures of wellbeing and social support and negative correlation ($p < .05$) with depression. Einav et al. [157] reported correlations between Relationship Satisfaction and Maternal Satisfaction that were statistically significant ($p < .001$).

2.2.5.4 Prospective Studies

While 9 studies [153, 155-156, 158, 161, 189-190, 193, 195] provided no explicit measures of SOC, the majority of the prospective studies (n = 19; 38.8%) (Table 2.4) provided multiple measures of SOC [162, 164, 167, 169-170, 175, 177, 180, 183-188, 191,

192, 194, 196, 198]. The study by Muggleton et al. [154] provided measures of SOC-13 only without validated PRO measures. Two of the prospective studies [166, 197] provided measures of SOC at only one time point with single measures of SOC. Four prospective studies measured SOC at three different time points. [164, 167, 169, 196] Six studies [154, 162, 170, 175, 177, 188] measured SOC in the prenatal and postnatal period while 4 studies [183-186] measured SOC twice in the prenatal period. SOC scores at multiple time points were significantly different in three studies [162, 164, 167] but not in 8 studies. [154, 169, 177, 183-186, 196] The study by Ngai and Ngu [169] and Hibino et al. [188] did not report the significance of the measured SOC at different time points.

2.2.5.5 Weeks of Gestation at Completion of SOC Instrument

Eighteen studies did not specify the week(s) of gestation of pregnancy when the pregnant subjects completed the questionnaires. Of these 18 studies, four studies [183-184, 186, 189] indicated SOC measures in the 2nd trimester and two studies [180, 195] specified SOC measures in the 3rd trimester. One study [153] completed questionnaires at 12, 24 and 36 weeks of gestation while one study [155] had responders completing the questionnaire at 39th week of gestation and 2 months postpartum. One study specified the 2nd and 3rd trimester as when the questionnaires were completed. The remaining studies (n = 11; 22%) [91, 157, 159, 169, 173-174, 177, 179, 181, 192, 198] were nonspecific about the weeks of gestation or trimester when SOC was measured. Thirteen of the 18 studies were prospective cohorts [153, 155, 169, 175, 177, 180, 183, 184, 186, 189, 192, 195, 198] while the remaining five [157, 159, 173, 179, 181] were cross-sectional in study design. Of the studies specifying a trimester of pregnancy when SOC was measured, 4 studies [91, 158, 171, 199] involved subjects in their second and third trimesters while two studies [185, 196] involved pregnant responders at the first and third trimester. Three studies [167-168, 197] involved pregnant subjects in the first trimester, 13 studies [162,

164, 170, 172, 174, 176, 183-184, 186, 188-189, 191, 193] in the second trimester and 13 studies [97, 156, 160-162, 165, 178, 180, 182, 187, 190, 194-195] in the third trimester. One study [173] characterised the responders as < 30 weeks pregnant and categorised the study as not specifying the weeks of gestation when SOC was completed. The study by Uren and Wastel [199] involved responders in the second and third trimester with stillbirths but nonetheless were chosen to be included in our analysis (Table 2.2).

2.2.5.6 Types of SOC Questionnaires

The type of SOC questionnaire used differed between studies. The most utilised SOC instrument was the SOC-13, having been used in 35 studies (i.e., 71%) with two of these studies utilising SOC-13 concurrent with SOC-9. [168, 170] This was followed with studies using the Family SOC Short Form (FSOC-S) (n = 5; 10%), the SOC-29 (n = 7; 14%), the SOC-9 (n = 1, 2%), and SOC-L9 (n = 1, 2%).

2.2.5.7 Relationship of PRO with SOC

In addition to the use of various SOC instruments, an additional 67 PROs were reported in the reviewed studies. The majority of these (n = 61; 91%) utilised a validated instrument while six measures (8.9%) did not. Three studies utilised laboratory measures as outcomes. [180, 194-195] A number of the validated PROs were utilised in multiple studies. For example, the Medical Outcomes Study Family and Marital Functioning Measures was applied in 4 different studies [169, 175, 177, 181] as was the PEER-U questionnaire. [183-184, 186, 189]

Seventeen (25%) of the 67 PROs were specific to pregnancy. Those PROs specific to pregnancy included the Maternal Fetal Attachment Scale (MFAS) [91], the Antenatal Maternal Orientation Measure (Revised) [171], the Maternity Social Support Scale (MSSS) [97], Fear of Childbirth Questionnaire [155, 163], the Wijma Delivery

Expectancy/Experience Questionnaire (JW-DEQ) [97, 159, 178], Attachment in Perinatal Bereavement Scale (APBS) [199], Perinatal Bereavement as Trauma [199], Perinatal Grief Scale (PGS) [199], the Swedish Childbirth Self-Efficacy Inventory (Swe-CBSEI) [97], the Havelhoehe questionnaire on delivery (HQD) [180], the Pregnancy Risk Assessment Monitoring System (PRAMS) [166], the Prenatal Distress Questionnaire [166, 171], the Childbirth experience Questionnaire [156] and the Preparation for Labor and Birth (P-LAB) instrument. [161] The PEER-U questionnaire [183-184, 186, 189] is not unique to the pregnant women per se but rather developed to measure parents' expectations, experiences and reactions in connection with routine ultrasound examinations during pregnancy. For the purpose of this review, it was included. The Edinburg Postnatal Depression Scale (EPDS) [91, 155-156, 158, 160, 165-166, 170-173, 176, 188, 190-191, 193] was commonly used in the postnatal period but can be applied throughout the perinatal period but included here as pregnancy-specific in addition to the nonvalidated PRO measuring women's satisfaction with intrapartum care. [193]

Eight of these pregnancy-specific measures (i.e., EPDS [155, 166-167, 170, 188, 190-191, 193], PEER-U [183-184, 186, 189], the NuPDQ [166], PRAMS [166], the Preparation for Labor and Birth (P-LAB) instrument [161], the Childbirth Experience Questionnaire [156] and Women's Satisfaction with Intrapartum Care [193]) were used in the prospective cohort studies while the remainder were utilised in cross-sectional study designs. In these pregnancy-specific PROs, their correlation with SOC were as expected. For example, measures of compromised health or functioning were negatively correlated with SOC so that depression as measured by the EPDS, difficult life events as measured by the PEER-U questionnaire, prenatal distress as measured by NuPDQ, fear of childbirth (FOC), perinatal grief and distress, and delivery expectancy/experience as measured by the JW-DEQ were negatively correlated. Conversely, measures of optimum health or

increasing functioning were positively correlated with SOC so that childbirth self-efficacy (i.e., using the CBSEI), delivery as measured by the Havelhoehe questionnaire, maternal social support were positively correlated. With other measures, such as the Perinatal Bereavement as Trauma [199], Antenatal Maternal Orientation Measure-Revised [166], Satisfaction with Intrapartum Care [193] along with other multiple domain measures, SOC was negatively or positively correlated (see Tables 2.3 and 2.4).

PROs specific to pregnancy also examined a number of birth-related variables and birth outcomes in relation to SOC. Some studies found no relationship with SOC while others document a relationship with low, high, and changing (i.e., decreasing or increasing measures of SOC; see Table 2.5). Interestingly, these studies document varied relationships indicating birth outcomes are related to both low and high SOC scores or decreasing and increasing SOC scores within the same studies. The study by Asif et al. [160] examined birth outcomes such as the use of the epidural analgesia or vacuum extraction but did not relate their findings to SOC measures. Similarly, Hildingsson et al. [156] described birth outcomes of women in two clusters (i.e., 'emotionally healthy' versus 'emotionally unhealthy') and found that overall, women in the 'emotionally unhealthy' cluster had a less positive birth experience.

Table 2.5. Summary of Findings of Studies Examining Birth-Related Variables and Birth Outcomes with Respect to SOC

Reference	Study design	Pregnant responders	Statistical analysis	Summary findings	Study strength and limitations
Studies with no relationship of SOC scores to birth-related variables and outcomes					
Neerland et al (2020) [161]	Prospective cohort	206	Descriptive statistics, Cronbach's alpha, ICC, and exploratory factor analysis	No convergent validity between P-LAB an SOC-13	A convenience sample of participants characterised as lacking heterogeneity and therefore challenged the generalisability of the results.
Staneva et al. (2018) [166]	Prospective cohort	285	Descriptive statistics, ANOVA, hierarchical multiple regression analysis with variance inflation factor statistic, Pearson's correlation	Poor correlation between SOC and adverse birth outcomes index. Therefore, SOC was not included in the final regression analyses	Women experiencing PTB was 5% of total sample thus d may have inadequate statistical power to detect significant associations with adverse birth outcomes. Sampling bias resulting in poor generalisability.
Hildingsson (2017) [167]	Prospective cohort	3058	Descriptive statistics, ANOVA, and *t*-test (paired and independent)	Onset of labour, oxytocin augmentation, use of EA, and mode of birth were not associated with SOC scores at any time point	Study design with a large sample size and high response rates (i.e., range: 85%-88%). Limited generalisability due to observational nature of study without accounting for confounding factors in the analysis.
Ferguson et al. (2016) [170]	Prospective cohort	753	Descriptive statistics, odds ratio, Pearson's *r*, paired *t*-test, and logistic regression analysis	Experiencing an induction of labour, Caesarean section, or spontaneous vaginal birth was not associated with SOC score changes from the antenatal to postnatal period	Sampling bias resulting in questionable generalisability. Regression analysis performed to infer causal relationship between SOC and variables of interest.

Reference	Study design	Pregnant responders	Statistical analysis	Summary findings	Study strength and limitations
Ferguson et al. (2015) [172]	Cross-sectional cohort	1075	Descriptive statistics, odds ratio, logistic regression analysis	Logistic regression found SOC scores were not associated with pregnancy or anticipated labour choices such as planned birth type and anticipated epidural use in labour	Study strengths include a large sample size with use of regression analysis. Limitations include use convenience and snowball sampling, resulting in selection bias.
Carlsson et al. (2015) [97]	Cross-sectional cohort	406	Descriptive statistics, χ^2 test or Fisher's exact test, logistic regression analysis	No differences in women with low or high SOC score with respect to cervix dilatation at admission, mode of delivery and birth outcomes such as duration of labour, hemorrhage, infant Apgar score and length of hospital stay	Cross-sectional study design cannot make cause-and-effect inferences. Also, the sample was collected from one part of Sweden and from more prosperous responders. Therefore, generalisability is hampered.
Jeschke et al. (2012) [182]	Cross-sectional cohort	193	Student's *t* -test, test, odds ratio, Pearson's *r*, multiple logistic regression analysis	Multiple logistic regression found SOC was not an independent predictor for epidural analgesia.	Lacks genralisability as subjects from a single hospital. Regression analysis performed but the authors cautioned that some residual confounding factors may be unmeasured
Hellmers & Schuecking (2008) [190]	Prospective cohort	374	Descriptive statistics, Student's *t*-test, ANOVA, Pearson's *r*, and χ^2 test, paired *t*-test	Among German women, correlation between the choice of mode of birth in pregnancy and SOC was not found	A convenience sample was utilised with a small sample size of USA responders.
Studies with low SOC scores in relation to birth-related variables and outcomes					
Hildingsson (2017) [167]	Prospective cohort	3058	Descriptive statistics, ANOVA, and *t*-test (paired and independent	A less positive birth experience was associated with lower levels of SOC	Study design with a large sample size and high response rates (.e., range: 85%%-88%). Limited generalisability due to observational nature of study without accounting for confounding factors in the analysis.

Reference	Study design	Pregnant responders	Statistical analysis	Summary findings	Study strength and limitations
Carlsson et al. (2015) [97]	Cross-sectional cohort	406	Descriptive statistics, χ^2 test or Fisher's exact test, logistic regression analysis	Significant group differences found in epidural analgesia as pain relief in women with low childbirth self-efficacy if considered as proxy measure for SOC	Cross-sectional study design cannot make cause-and-effect inferences. Also, the sample was collected from one part of Sweden and from more prosperous responders. Therefore, generalisability is hampered.
Sekizuka-Kagami et al. (2015) [174]	Cross-sectional cohort	43	Descriptive statistics Pearson's or Spearman's correlation coefficient, χ^2 test, *t*-test, ANOVA, receiver operating characteristic (ROC) analysis, and logistic regression analysis	Logistic regression showed SOC-13 scale score affected threatened premature birth ($p < .001$) and that a low SOC-13 scale score was associated with threatened premature birth	Limitation of small sample size and factors for causal relationship between SOC and threatened premature birth may be questionable. Regression analysis performed to make the association.
Sekikuza et al. (2009) [185]	Prospective cohort	72	Descriptive statistics, paired *t* test and Pearson's *r*, χ^2 test, ANOVA, Student's *t* test, Kruskal–Wallis *H* test, Mann-Whitney *U* test, and logistic regression analysis	Logistic regression analysis demonstrated that low SOC scores and low s-IgA levels were associated with threatened premature birth	Small sample size and selection bias compromise causal inference between SOC and s-IgA to threatened premature birth. Cause-and-effect inferences made from regression analysis.
Hellmers and Schuecking (2008) [190]	Prospective cohort	374	Descriptive statistics, Student's *t*-test, ANOVA, Pearson's *r*, and χ^2 test, paired *t*-test	Among German women, those with lower SOC tended more strongly toward a Caesarean birth	A convenience sample was utilised with a small sample size of USA responders.

Reference	Study design	Pregnant responders	Statistical analysis	Summary findings	Study strength and limitations
Studies with high SOC scores in relation to birth-related variables and outcomes					
Ferguson et al. (2016) [170]	Prospective cohort	753	Descriptive statistics, odds ratio, Pearson's *r*, paired *t*-test, and logistic regression analysis	High SOC scores were associated with age, higher Support Behaviour Index scores and lower EPDS scores, less likely to experience Caesarean sections and more likely to experience assisted vaginal birth	Sampling bias resulting in questionable generalisability. Regression analysis performed to infer causal relationship between SOC and variables of interest.
Carlsson et al. (2015) [97]	Cross-sectional cohort	406	Descriptive statistics, χ^2 test or Fisher's exact test, logistic regression analysis	High SOC scores associated with less epidural anaesthesia and high childbirth self-efficacy	Cross-sectional study design cannot make cause-and-effect inferences. Also, the sample was collected from one part of Sweden and from more prosperous responders. Therefore, generalisability is hampered.
Oz et al. (2009) [187]	Prospective cohort	145	Descriptive statistics, χ^2 test, Student *t*-test, multiple logistic regression analysis	Using multiple logistic regression modelling with uncomplicated delivery as the outcome variable, SOC-13 was found to be an independent factor predicting uncomplicated delivery. A high SOC score was correlated with uncomplicated delivery	Generalisability compromised by small sample size and selction bias. Regression analysis performed to decrease effects of cofounding variables.
Hellmers & Schuecking (2008) [190]	Prospective cohort	374	Descriptive statistics, Student's *t*-test, ANOVA, Pearson's *r*, and χ^2 test, paired *t*-test	Among USA women, those with higher SOC did not tend more strongly towards spontaneous birth than women with lower SOC	A convenience sample was utilised with a small sample size of USA responders.
Engelhard et al. (2003) [197]	Prospective cohort	117	Descriptive statistics Pearson's *r*, Cronbach's alpha, multiple logistic regression analysis	Stronger SOC in early pregnancy predicted less PTSD symptoms after pregnancy loss. However, correlations were modest and weaker relative to earlier retrospective studies, particularly with SOC	Limitations included use of self-report, recall bias, simultaneous assessment of crisis support, and PTSD symptoms. Strengths included prospective design, adequate sample size and relatively homogeneous traumatic events.

Reference	Study design	Pregnant responders	Statistical analysis	Summary findings	Study strength and limitations
Studies with decreasing SOC in relation to birth-related variables and outcomes					
Ferguson et al. (2016) [170]	Prospective cohort	753	Descriptive statistics, odds ratio, Pearson's *r*, paired *t*-test, and logistic regression analysis	Logistic regression found change in women's SOC scores were associated with assisted vaginal birth, use of EA, and birth satisfaction. Decrease in women's SOC scores resulted in use of EA and dissatisfaction with their birth experience	Sampling bias resulting in questionable generalisability. Regression analysis performed to infer causal relationship between SOC and variables of interest.
Studies with increasing SOC in relation to birth-related variables and outcomes					
Mugggleton et al. [154]	Prospective cohort	153		The present study did not identify any statistically significant differences between groups in mode of birth, though this was not the focus of the study	
Ferguson et al. (2016) [170]	Prospective cohort	753	Descriptive statistics, odds ratio, Pearson's *r*, paired *t*-test, and logistic regression analysis	An increase in postnatal SOC was associated with birth satisfaction	Sampling bias resulting in questionable generalisability. Regression analysis performed to infer causal relationship between SOC and variables of interest.

Note. ANOVA = analysis of variance; EA = epidural anaesthesia; EPDS = Edinburg postnatal depression score; ICC = Intraclass Correlation; P-LAB = Preparation for Labor and Birth; PTB = pre-term birth; PTSD = posttraumatic stress disorder; ROC = receiver operating characteristic; s-IgA = secretory Immunoglobulin A; SOC = sense of coherence; USA = United States of America.

Spontaneous labour (as opposed to induction and a vaginal birth) was less prevalent in the 'emotionally unhealthy' group while there was a higher prevalence in the 'emotionally unhealthy' group in the use of epidural analgesia or augmentation of labour and babies born to have a severe neonatal diagnosis.

The most utilised PRO was the Edinburgh Postnatal Depression Scale (EPDS) **[200] to assess** depression in approximately one-third (*n* = 15; 31%) of the 49 manuscripts reviewed involving both cross-sectional [160, 165, 171-173, 176] and prospective studies. [156, 158, 166-167, 170, 188, 190, 191, 193] Although designed originally to assess postnatal depression, it has been commonly used in the prenatal period and is well validated to do so. [**201**] Of the 17 studies measuring EPDS, eight studies [155, 156, 158, 160, 167, 173, 176, 193] did not report EPDS scores while seven studies [156, 158, 160, 165, 176, 190, 193] did not provide measures of SOC. Not surprisingly, none of the seven studies [156, 158, 160, 165, 176, 190, 193] reported relationship between EPDS and SOC measures. The study by Przestrzelska et al. [165] only commented on the inverse relationship between EPDS and SOC scores (i.e., high EPDS in pregnant women with low SOC scores). Three studies [165, 170, 176] reported significant odd ratio values with an inverse relationship between EPDS and SOC. Nine studies indicated a significant negative correlation between SOC and EPDS [91, 155, 166, 171, 173] or made inferences on their inverse relationship [167, 172, 188, 193]. This association of low SOC score with higher depression (EPDS) scores in pregnancy have also been confirmed with the subscale of depression of the Profile Mood States (POMS) questionnaire [97], General Health Questionnaire [175, 179, 181], the Hospital Anxiety and Depression (HAD) scale [162, 196] and the Beck Depression Index (BDI) [197] and the Depression Self-Reporting Scale (DSRS). [160]

In a series of papers, Ngai and Ngu [169, 175, 177, 179, 181] utilised PROs developed from the Medical Outcomes Study (MOS). The MOS was a 2-year observational study of patients with chronic conditions involving 22 462 patients in a cross-sectional phase and 2349 patients in a longitudinal phase. The purpose of the study was to determine causes of variations in patient outcomes by differences in systems of care, clinician specialty, and clinicians' technical and interpersonal styles. The MOS was also implemented to develop more practical tools for routine monitoring of physical, social, and role functioning in everyday living based on patients' perceptions of their general health and well-being and satisfaction with care. [202]

Ngai and Ngu [169, 175, 177, 179] found that a strong family SOC (i.e., as measured by the Family SOC-12) correlated significantly with better prenatal family and marital functioning, social support, and the mental health component of QoL among pregnant women as measured by the MOS Family and Marital Functioning Measures (MOS-FMFM). The MOS Social Support Survey (MOS-SSS) [175, 177, 181] to assess a pregnant woman's support network and the availability of social support involving the emotional, tangible, affectionate, and positive social interaction domains significantly positively correlated with Family SOC-12. [181] A low score on the family sense of coherence, poor social support and depressive symptoms during pregnancy correlated significantly with high depressive symptoms and decline in family and marital functioning at 6 weeks postpartum. [175, 177] Ngai and Ngu [181] also found greater correlation between SOC and the mental health component (versus physical health) of the SF-12. The relationship between a high SOC and better social support were also demonstrated with the use of the Support Behaviour Inventory (SBI) scale [170, 172], the Multidimensional Scale of Perceived Social Support (MSPSS) [164, 166], the Maternity Social Support Scale (MSSS) [97] and the Crisis Support Scale (CSS). [197] Pregnant women with high

antenatal SOC scores were more likely to have higher SBI scores. [170, 172] First-time mothers who stated a higher SOC during pregnancy and at six months postpartum reported higher perceived quality of couple relationship which in turn was significantly associated with higher perceived social support at gestational week 25 (p = .037). [164] Using multivariate analysis of variance (MOANCOVA), Einav et al. [157] reported a significant difference among the pregnant women, primiparous mothers and multiparous mothers with respect to their SOC, maternal efficacy, and marital satisfaction. However, univariate analysis revealed significant differences in maternal efficacy, partial and marginally significant differences in relationship satisfaction.

Staneva et al. [166] reported that having a strong social support as measured by the MSPSS was correlated with a higher SOC. Carlsson et al. [97] found a significant correlation between SOC and MSSS, acknowledging that SOC and social support are known factors to buffer stress when dealing with stressful situations during pregnancy. Engelhard et al. [197] found that SOC was related positively to crisis support (particularly to confiding in others and emotional support (r = 0 .23, p = 0 .017). Similar to the findings by Przestrzelska et al. [165], Rudman et al. [193] found that low SOC was associated with lack of social support using a nonvalidated self-report questionnaire inquiring about type and extent of social support received by a pregnant woman.

Other components of mental health and its relationship with SOC in pregnancy were also investigated. Women having low SOC were reported with the highest levels of parental stress. [167] A significant negative correlation was reported between SOC and stress as measured by the Stress Perception Scale [174], the Perceived Stress Scale (PSS) [187], and the Social Readjustment Rating Scale (SRRS). [181] SOC and SRSS were not significantly correlated in three studies [176-177, 179] while Sekizuka et al. [185] did not report the relationship between SOC and the Stress Perception Scale.

The revised version of the Prenatal Distress Questionnaire that measures anxiety and distress were also negatively correlated with SOC. [168, 171] The State-Trait Anxiety Inventory Mood Scale to assess state anxiety (i.e., anxiety about an event) and trait anxiety (i.e., anxiety level as a personal characteristic) were applied in three studies involving the development and use of the PEER-U instrument. [184, 186, 189]

Concurrent validity was established by correlating the state of mind index component of the PEER-U instrument to two established PROs – the State and Trait Anxiety Inventory Scale or STAI Scale and SOC. A statistically significant negative correlation was reported between STAI and SOC by Ekelin et al. [189] before and after ultrasound imaging. Ekelin et al. [189] and Larsson et al. [186] provided no report on the relationship between STAI and SOC. Anxiety was also measured by the Hospital Anxiety and Depression (HAD) scale [162, 196] and the Prenatal Distress Questionnaire. [166, 171] Bratt et al. [162] and Sjostrom et al. [196] found that HAD did not change significantly from the prenatal to the postnatal period. Unfortunately, the authors did not report the relationship between SOC and HAD scores. Anxiety as measured by the NuPDQ was significantly negatively correlated with SOC scores. [166, 171] Despite no report on the relationship (i.e., correlation) between SOC and the Cambridge worry Scale [167, 191], pregnant women with major worries reported lower SOC. Other studies have found that SOC in early pregnancy was found to be significantly negatively correlated to post-traumatic stress disorder (PTSD) symptoms one month after pregnancy loss as measured by the PTSD Symptom Scale (PSS-SR) [197] and mood as measured by the Profile of Mood States (POMS) instrument. [97]

To assess parents' expectations, experiences and reactions to an ultrasound examination, the Parents' Expectations, Experiences and Reactions to an Ultrasound or

PEER-U instrument was used in 4 studies. [183-184, 186, 189] Unfortunately, all 4 studies provided no analysis with respect to PEER-U scores' relationship to SOC.

Mohamamdirizi et al. [163] found no significant correlation between SOC and Fear of Childbirth while Asif et al. [160], Carlsson et al. [97] and Takegata et al. [178] found a significant negative correlation between fear of childbirth and delivery and SOC as measured by Wijma Delivery Expectancy/Experience Questionnaire (W-DEQ). The use of the NorVold Abuse Questionnaire (NorAQ) questionnaire found that women with low SOC scores were more likely to be exposed to domestic violence during pregnancy compared to those indicating no history of violence. [158, 176] A positive correlation between SOC-13 and wellbeing has been found using the Well-Being Questionnaire (WBQ12) [168] and the Health Index. [196] However, Hellmers and Schuecking [190] provided no analysis on the relationship between SOC and wellbeing as measured by the WHO-5 Well-Being Index. In terms of diabetes management during pregnancy, SOC scores were found to be positively correlated with self-efficacy in diabetes management as measured with the Swedish Diabetes Empowerment Scale (SWE-DES-10). [168] However, no analysis was provided on the relationship between SOC and the Swedish Hypoglycemia Fear Survey (SWE-HFS) [160] and Swedish Problem Areas in Diabetes Scale (SWE-PAID-20). [168]

In a study on perinatal bereavement for women, Uren and Wastell [199] found that SOC was significantly correlated with the Perinatal Grief Scale (PGS) and strongly negatively correlated with the Global Severity Index, a global health measure that is a summation of all the Brief Symptom Index (BSI) items. A higher GSI score indicates poorer global health. SOC was not significantly negatively correlated with the Impact of Event Scale Revised (IES-R) [199] and the Adult Attachment Scale (AAS). [199] An increase in SOC from the prenatal to the postpartum period paralleled an increased in life

satisfaction (as measured by Life Satisfaction). [162] No measures of childbirth self-efficacy as measured by the Swedish Childbirth Self-Efficacy Inventory (Swe-CBSEI) [97] and SOC were reported by Carlsson et al. [97] but reported a significant correlation between the two variables. In terms of attitudes towards the use of epidural anaesthesia during labour, SOC was found to positively correlate significantly with the statement 'feeling well prepared for delivery' and 'joyful expectation of delivery' as measured by the Havelhoehe Questionnaire on Delivery (HQD). [182]

The Antenatal Maternal Orientation Measure-Revised differentiates between two distinct styles of mothering (i.e., Facilitator or Regulator). Lower SOC was highly and significantly associated with styles of mothering – negatively with a Regulator and positively with a Facilitator maternal orientation. [166, 171] No direct correlation or association with SOC was reported with the variables of the Pregnancy Risk Assessment Monitoring System (PRAMS) [166], the Visual Analog Scale (VAS) for pain [182], the Hospital Anxiety and Depression (HAD) Scale [162, 196], Multidimensional Scale of Perceived Social Support (MSPSS) [164], State and Trait Anxiety Inventory Scale or STAI Scale (6-item version) [184, 186], Stress Perception Scale (SPS) [185], the Edinburgh Postnatal Depression Scale (EPDS) [156, 158, 160, 176, 190-191, 193], Attachment in Perinatal Bereavement Scale [195], the Cambridge Worry Scale (Swedish version) [167, 191], the WHO-5 Well-Being Index [186] and the Alcohol Use Disorders Identification Test (AUDIT). [158, 176]

2.2.5.8 Relationship of SOC with Other Outcomes or Laboratory Measures

A handful of the reviewed manuscripts did not utilise a validated PRO instrument. Przestrzelska et al. [165] utilised a nonvalidated self-report questionnaire to examine the type and extent of social support received by the pregnant women. Staneva et al. [166] applied the Pregnancy Risk Assessment Monitoring System (PRAMS) to collect

information on previous pregnancies, mode of conception, previous and current pregnancy complications, current gestation type (one or more), history of medical or psychological and psychiatric problems, current psychiatric diagnoses (bipolar, generalised anxiety, and major depressive disorders), and whether the current pregnancy was planned and/or wanted. The validity of PRAMS in terms of sensitivity, specificity and positive predictive value for maternal and infant health indicators remains to be fully defined. [203] Hildingsson et al. [191] measured physical wellbeing by asking responders to rate on a Likert scale (0 = *no problem* to 5 = *serious problem*) seven common symptoms in early pregnancy (i.e., headache, neck and shoulder pain, low back pain, stomachache, dysuria, sleeping problems, and fatigue) with the sum of scores as the index of physical wellbeing. Habroe et al. [192] examined achieved childbirth as an outcome measure following ART and found that achieving childbirth after ART and high SOC at 1-year follow-up was significant among women who had low baseline SOC (OR = 1.81, 95% CI: [1.20, 2.74]). Rudman et al. [193] examined women's satisfaction with intrapartum care using the three dimensions of interpersonal care, information and involvement in decision-making and physical birth environment. The investigators found 9 clusters of women with different profiles of satisfaction with intrapartum care. Rudman et al. [193] found that depressive symptoms and low SOC in early pregnancy were associated with the dissatisfied clusters *F* (Dissatisfied Interpersonal care) G (Very dissatisfied Interpersonal care), H (Dissatisfied Information/decision-making), and I (Very dissatisfied). Zekizuka et al. [194] utilised a self-assessment depression scale in the prepartum and postpartum period and women's satisfaction with intrapartum care. The authors found no significant difference (i.e., $p <$ .664) in the SOC scores in the postpartum period between the groups with high depression (i.e., ≥ 40 score; $n = 5$; SOC = 133.2 ± 23.0) and low depression scores (< 40 scores; $n =$ 49; SOC = 140.1 ± 23.7). Assessing the smoking status of pregnant women (i.e.,

nonsmokers, quitters, decreasers, continuers, relapsers), Abrahamsson and Ejlertsson [198] found that the level of SOC may have a mediating effect in relation to smoking behaviour such that the level of SOC might influence the strength required for smoking cessation.

In total, we found 5 studies correlating SOC measures with laboratory analysis. Linden et al. [168] found that SOC scores were significantly negatively correlated with high hemoglobin (Hb) A1c levels (i.e., ≥ 49 mmL/mol). In the third trimester, Swartz et al. [180] found no correlation between the women's SOC scores with salivary cortisol samples collected from the whole family (mother, father, children) when their child was 6 months, 12 months and 24 months of age, regardless of sampling time (i.e., morning, afternoon, bedtime). Furthermore, Swartz et al. [180] found that SOC scores did not differ between the three different lifestyle groups (i.e., anthroposophic, partly anthroposophic and nonanthroposophic) of the pregnant women. Sekizuka et al. [185] found no association secretory between s-IgA and SOC but found that low SOC scores in the first half of pregnancy was associated with threatened premature birth. Sekizuka et al. [185] found that lower SOC scores were associated with higher depression scores and lower s-IgA levels. Almedon et al. [195] examined maternal SOC scores and salivary cortisol levels in Eritrean mothers during the immediate prenatal and postnatal period. Mothers who delivered in a hospital had significantly higher SOC scores and lower postnatal cortisol levels compared to those with home births. This difference was more pronounced in the comprehensibility subscale of the SOC scores.

2.2.5.9 Studies without Observed Changes or Significant Differences in SOC Scores

Przestrzelska et al. [165] found no difference in SOC measures in women experiencing 'physiological' or complicated courses of pregnancy. Ngai and Ngu [169, 177] reported the nonsignificant changes in family SOC from pregnancy to the postpartum period(s). Larsson et al. [183] reported no significant differences in SOC scores before and

after ultrasound examination in those subjects with normal or abnormal findings. Sense of coherence scores were stable prior to and following ultrasound examination regardless of no abnormalities detected [184] or when choroid plexus cyst/cysts were detected. [186] Sekizuka et al. [185] found that the differences between SOC scores in the first half of pregnancy and those in the latter half of pregnancy were not significant. Sekizuka et al. [194] found no statistically significant difference in SOC scores based on postpartum depression scores. Finally, Sjöström et al. [196] found no significant differences in SOC scores at gestation weeks 10-12, gestation weeks 34-36, and 8 weeks postpartum.

2.2.6 Quality Assessment

The quality assessment tools for observational cohort and cross-sectional studies were utilised for this purpose (see Table 2.6). Overall, the majority of the studies were of good methodological quality. All the reviewed manuscripts clearly stated the research question or objective of the study, the population of subjects were clearly defined and recruited from the same or similar populations. The inclusion/exclusion criteria for study participation were clearly specified and it was determined that there was sufficient timeframe to reasonably expect to observe an association between exposure and outcome. In all of the manuscripts reviewed, the exposure of interest (i.e., pregnancy) was clearly defined and valid and measured prior to the outcomes being measured. In the prospective studies, the exposure was measured more than once except in three studies. [184, 187, 189] In these studies, ultrasound examination was performed in pregnant women during the second trimester. A number of the cross-sectional studies examined different exposures of pregnancy in terms of pregnant or non-pregnant [157, 173], low risk versus high-risk pregnancy [163], pregnancy complications [165], presence or absence of pregnancy complication [172, 174, 178] and trimester of pregnancy. [179, 181, 199] In a majority of the reviewed manuscripts (n = 34; 76%), the participation rate of eligible persons was at

least 50%. However, only 7 (15%) manuscripts [161, 163, 170, 172-173, 176, 187] provided a sample size justification. Of the prospective studies (n = 28; 62%), five studies had greater than 20% lost to follow-up. Only half (n = 24; 53%) of the reviewed manuscripts addressed confounding by statistical adjustments for their impact on the relationship between exposure(s) and outcome(s).

Table 2.6. Quality Assessment of Reviewed Manuscripts

	Response to Quality assessment criteria													
Reference	1	2	3	4	5	6	7	8	9	10	11	12	13	14
Yu et al. (2022) [153]	Y	Y	Y	Y	N	Y	Y	Y	Y	Y	Y	N	Y	Y
Pasricha et al. (2021) [91]	Y	Y	O-NA	Y	Y	Y	Y	Y	Y	Y	Y	N	O-NA	N
Muggleton et al. (2021) [154]	Y	Y	N	Y	N	Y	Y	O-NR	Y	O-NR	Y	N	N	Y
Hildingsson et al. (2021) [155]	Y	Y	O-NA	Y	N	Y	Y	O-NR	Y	O-NR	Y	N	Y	N
Hildingsson et al. (2021) [156]	Y	Y	O-NR	Y	N	Y	Y	Y	Y	Y	Y	N	Y	N
Einav et al. (2020) [157]	Y	Y	O-NR	N	N	Y	Y	Y	Y	N	Y	N	O-NA	Y
Finnbogadottir et al. (2020) [158]	Y	Y	Y	Y	N	Y	Y	Y	Y	Y	Y	N	Y	Y
Voogand et al. (2020) [159]	Y	Y	N	Y	N	Y	Y	N	Y	N	Y	N	Y	N
Asif et al. (2020) [160]	Y	Y	N	Y	N	Y	Y	N	Y	Y	Y	N	0-NA	Y
Neerland et al (2020) [161]	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	N	Y	N
Bratt et al. (2019) [162]	Y	Y	Y	Y	N	Y	Y	Y	Y	Y	Y	N	N	N
Mohamamdirizi et al. (2018) [163]	Y	Y	O-NR	Y	Y	Y	Y	Y	Y	N	Y	N	O-NA	N

	Response to Quality assessment criteria													
Reference	1	2	3	4	5	6	7	8	9	10	11	12	13	14
Bäckström et al. (2018) [164]	Y	Y	Y	Y	N	Y	Y	Y	Y	Y	Y	N	Y	Y
Przestrzelska et al. (2018) [165]	Y	Y	O-NR	Y	N	Y	Y	Y	Y	N	Y	N	O-NA	Y
Staneva et al. (2018) [166]	Y	Y	Y	Y	N	Y	Y	Y	Y	Y	Y	N	Y	Y
Hildingsson (2017) [167]	Y	Y	Y	Y	N	Y	Y	Y	Y	Y	Y	N	Y	N
Linden et al. (2016) [168]	Y	Y	Y	Y	N	Y	Y	Y	Y	Y	Y	N	Y	N
Ngai & Ngu (2016) [169]	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	N	N	N
Ferguson et al. [170]	Y	Y	O-NA	Y	N	Y	Y	N	Y	N	Y	N	O-NA	Y
Staneva et al. (2016) [171]	Y	Y	Y	Y	N	Y	Y	Y	Y	Y	Y	N	N	N
Ferguson et al. (2015) [172]	Y	Y	Y	Y	Y	Y	Y	Y	Y	N	Y	N	O-NA	Y
Carlsson et al. (2015) [97]	Y	Y	O-NA	Y	N	Y	Y	N	Y	N	Y	N	O-NA	Y
Ferguson et al. (2015) [173]	Y	Y	Y	Y	Y	Y	Y	Y	Y	N	Y	N	O-NA	N
Sekizuka-Kagami et al. (2015) [174]	Y	Y	Y	Y	N	Y	Y	Y	Y	N	Y	N	O-NA	Y
Ngai & Ngu (2014) [175]	Y	Y	Y	Y	N	Y	Y	Y	Y	Y	Y	N	Y	Y

	Response to Quality assessment criteria													
Reference	1	2	3	4	5	6	7	8	9	10	11	12	13	14
Finnbogadóttir et al. (2014) [176]	Y	Y	Y	Y	Y	Y	Y	N	Y	N	Y	N	O-NA	Y
Ngai & Ngu (2014) [177]	Y	Y	Y	Y	N	Y	Y	Y	Y	Y	Y	N	Y	Y
Takegata et al. (2014) [178]	Y	Y	Y	Y	N	Y	Y	Y	Y	N	Y	N	O-NA	Y
Ngai and Ngu (2014) [179]	Y	Y	Y	Y	N	Y	Y	Y	Y	N	Y	N	O-NA	Y
Swartz et al. (2013) [180]	Y	Y	Y	Y	N	Y	Y	Y	Y	Y	Y	N	Y	N
Ngai and Ngu (2013) [181]	Y	Y	Y	Y	N	Y	Y	Y	Y	N	Y	N	O-NA	Y
Jeschke et al. (2012) [182]	Y	Y	Y	Y	N	Y	Y	N	Y	N	Y	N	O-NA	Y
Larsson et al. (2009) [183]	Y	Y	N	Y	N	Y	Y	Y	Y	N	Y	N	N	N
Ekelin et al. (2009) [184]	Y	Y	Y	Y	N	Y	Y	N	Y	N	Y	N	N	N
Sekizuka et al. (2009) [185]	Y	Y	Y	Y	N	Y	Y	Y	Y	Y	Y	N	Y	N
Larsson et al. (2009) [186]	Y	Y	Y	Y	N	Y	Y	N	Y	N	Y	N	Y	N
Oz et al. (2009) [187]	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	N	Y	Y
Hibino et al. (2009) [188]	Y	Y	N	N	N	Y	Y	Y	Y	Y	Y	N	Y	Y

	Response to Quality assessment criteria													
Reference	1	2	3	4	5	6	7	8	9	10	11	12	13	14
Ekelin et al. (2008) [189]	Y	Y	Y	Y	N	Y	Y	N	Y	N	Y	N	Y	N
Hellmers et al. (2008) [190]	Y	Y	N	N	N	Y	Y	Y	Y	Y	Y	N	Y	N
Hildingsson et al. (2008) [191]	Y	Y	Y	Y	N	Y	Y	Y	Y	Y	Y	N	Y	Y
Habroe et al. (2007) [192]	Y	Y	Y	Y	N	Y	Y	Y	Y	Y	Y	N	Y	Y
Rudman et al. (2007) [193]	Y	Y	Y	Y	N	Y	Y	Y	Y	Y	Y	N	Y	N
Sekizuka et al. (2006) [194]	Y	Y	Y	Y	N	Y	Y	Y	Y	Y	Y	N	Y	N
Almedom et al. (2005) [195]	Y	Y	Y	Y	N	Y	Y	Y	Y	Y	Y	N	Y	N
Sjöström et al. (2004) [196]	Y	Y	Y	Y	N	Y	Y	Y	Y	Y	Y	N	Y	N
Engelhard et al. (2003) [197]	Y	Y	Y	Y	N	Y	Y	Y	Y	Y	Y	N	Y	Y
Abrahamsson & Ejlertsson (2002) [198]	Y	Y	Y	Y	N	Y	Y	Y	Y	Y	Y	N	Y	Y
Uren & Wastell (2002) [199]	Y	Y	Y	Y	N	Y	Y	Y	Y	Y	O-NA	N	O-NA	Y

Note. Y = Yes; *N* = No; O-NA = Other – Not Applicable; O-NR = Other – Not Reported.

1 = Research question or objective clearly stated?

2 = Study population clearly specified and defined?

3 = Participation rate of eligible persons at least 50%?

4 = Subjects recruited from same population with prespecified inclusion/exclusion criteria?

5 = Was sample size justification, power description, or variance and effect estimates provided?

6 = Were the exposure(s) of interest measured prior to the outcome(s) being measured?

7 = Was the timeframe sufficient so that one could reasonably expect to see an association between exposure and outcome if it existed?

8 = For exposures that can vary in amount or level, did the study examine different levels of the exposure as related to the outcome (e.g., categories of exposure, or exposure measured as continuous variable)?

9 = Were the exposure measures (independent variables) clearly defined, valid, reliable, and implemented consistently across all study participants?

10 = Was the exposure(s) assessed more than once over time?

11 = Were the outcome measures (dependent variables) clearly defined, valid, reliable, and implemented consistently across all study participants?

12 = Were the outcome assessors blinded to the exposure status of participants?

13 = Was loss to follow-up after baseline 20% or less?

14 = Were key potential confounding variables measured and adjusted statistically for their impact on the relationship between exposure(s) and outcome(s)?

2.2.7 Discussion

Our systematic review of the literature sought to critically analyse and summarise the state of knowledge on the measurement of SOC during pregnancy. Although the reviewed manuscripts were limited in study designs (i.e., either cross-sectional or prospective cohorts), we found substantial diversity in the outcome measures utilised (i.e., different SOC and PRO instruments), the settings where the responders were recruited (i.e., hospital, free-standing clinics, online platforms), the clinical scenarios involved during pregnancy (i.e. different trimesters, different clinical scenarios), and the study purpose (i.e., the effects of SOC on pregnancy-related outcomes versus SOC as a dependent variable to pregnancy-related covariate). Despite this heterogeneity, what is apparent from our review was that a high SOC was associated with improved or more optimum health outcome or an increased capacity/resiliency to cope with critical events during pregnancy. Conversely, a low SOC during pregnancy is associated with compromised health or obstetric outcomes (i.e., depression, anxiety, stress, complicated labour and delivery) which places (directly or indirectly) both mother and foetus at risk for a number of complications prenatally, during labour and in the post-partum period. However, these associations must be viewed with caution. In a number of the included studies [91,155-156, 159, 161-163, 167-169, 171, 173180, 183-186,189-190, 193-196], confounding factors were not addressed and threatens the validity of cause-and-effect inferences. Furthermore, as will be discussed in more detail below, some studies found no relationship between SOC and birth-related variables and certain outcomes.

2.2.7.1 Focus on Mental and Social Health Measures

In many of the studies reviewed, SOC was measured in relation to mental health (i.e., depression, anxiety, stress) and social health (i.e., social support, family, and couple relationships) functioning. This focus to date of the research undertaken on SOC in pregnancy is underscored by the findings that compromised mental and social health during pregnancy has consequences for both the mother and child. Depression has been recognised as a significant cause of disease burden in women of childbearing age worldwide. [200] With a prevalence ranging between 4% and 81% [201], antenatal depression results in higher incidence of preterm delivery (i.e., < 37 weeks), low birthweight (i.e., < 2500g), low Apgar scores (at 1 and 5 min), increased neonatal intensive care unit (NICU) admissions, operative delivery and preeclampsia, nonscheduled antenatal care visits. **[**204-207] Depression in the prenatal and postnatal period has been documented to be detrimental on the baby in terms of emotional, behavioural, and cognitive problems. [208] As in the non-pregnant population [209], we found that high levels of depression during pregnancy was associated with low SOC scores. [162, 165-167, 170-173, 175-176, 179, 188, 191, 193, 197] This inverse relationship with SOC was also found with levels of stress [175, 177, 179, 181, 187], levels of anxiety [166, 172, 184, 186, 189], measures of distress [166, 171, 174, 185, 187], mood disorder(s) [97]), worry [167, 191], and post-traumatic stress disorder [197]. Prenatal stress has been associated with preterm labour, preterm delivery, low birth weight, shortened gestational length, preeclampsia, and gestational diabetes. [210] Given that a strong SOC is characterised by a tendency to assess stressful events as less aggravating and perceive them as challenges [**207**], Linden et al. [168] found that high SOC was positively correlated with high or positive scores for well-being, self-efficacy and self-rated overall health and inversely

correlated with low diabetes distress and hypoglycemia fear among women with gestational diabetes.

Anxiety in pregnancy have been noted to have a negative impact on children's nervous system growth and development. [211] Based on data from the 1994 Canadian National Population Health Survey, Wolff and Ratner [212] analysed the effects of stress, social support, and recent traumatic life events on SOC. As predicted and confirmed with our findings, stress and recent traumatic events were found to be inversely related to SOC while social support was positively related. It has been proposed that women with low social support lack social stability and the ability for social participation and therefore insufficient emotional and instrumental support from their partner, family and/or friends. Lack of social support clearly has a detrimental impact on maternal psychological well-being, leading to depression, anxiety, and stress. [213-214]. A low score on the family SOC was associated with poor family life and marital functioning [169, 175, 177, 180] and lack of social support. [175, 177] Better perceived couple relationship quality 6 months after childbirth was statistically significantly associated higher SOC at gestational week 25. [163] SOC was positively correlated with crisis support (particularly to confiding in others and emotional support). [197] Low social support during early pregnancy was found to result in babies with markedly reduced birthweight. [215] Low birthweight in turn has been associated with an increased risk for a range of poor health outcomes in adult life that include cardiovascular diseases, type 2 diabetes, and osteoporosis. [216]

2.2.7.2 SOC in Relation to Birth-Related Variables and Birth Outcomes

A low SOC score was associated with greater use of epidural anaesthesia [97, 170], the use of instruments or assisted vaginal birth [170, 187] and Caesarean sections. [167, 187, 190] A low SOC was also associated with labour induction/augmentation and threatened premature birth and [174, 185, 187] a less positive experience with major

worries and depressive symptoms. [167, 170] Conversely, a high SOC during pregnancy was associated with less frequency of Caesarean births [170], more spontaneous birth [170, 187, 190], less or no use of epidural anaesthesia (EA) [97], high self-efficacy with childbirth [165] and greater birth satisfaction. [170] In those studies measuring changes in SOC scores, a decrease in SOC scores was associated with assisted vaginal birth [170] and the use of EA. [170] Hildingsson [167] found no differences in SOC scores in early pregnancy or two months postpartum with the use of epidural anaesthesia while Ferguson et al. [172] did not find that SOC was related for a desire to avoid epidural anaesthesia in labour. Jeschke et al. [182] found that although SOC was not recognised as an independent predictor for EA use, women with high SOC scores more often had the desire to deliver without EA.

Despite the relationship outlined above between SOC, childbirth and various birth outcomes, a number of the studies have also found no relationship with SOC scores during pregnancy and the postpartum period. No relationship was found between SOC and induction of labour [170] such as use of oxytocin augmentation [166, 168], the onset of labour [167] or duration of labour from onset to hospital admission or cervix dilation [97], the mode of birth [167] particularly spontaneous birth [170, 190] or normal birth in a primary care setting [172] or Caesarean births [166], the use of epidural anaesthesia [172, 182], birth outcomes such as newborn complications including stillbirths and neonatal deaths [166], infant Apgar score [97] and low birth weight [166], maternal complications such as use of forceps or vacuum extraction [166], hemorrhage [97, 166] and length of hospital stay. [97] Neerland et al. [161] found no convergent validity between SOC and the P-LAB instrument. The P-LAB was developed to assess a woman's confidence in her ability to achieve physiologic birth.

A closer examination of the individual studies may clarify the current state of knowledge on the relationship of SOC scores with birth-related variables (i.e., use of EA, mode of birth, induction, or augmentation) and birth outcomes (i.e., threatened premature birth, uncomplicated delivery, adverse birth outcomes and birth satisfaction). Our examination rests mainly on the study design, statistical analysis, sample size, and study strengths and limitations (see Table 2.5). Logistic regression analysis demonstrated that low SOC predicted threatened premature birth in both a cross-sectional [174] and prospective [175] study designs. This is supported by the logistic regression analysis of Oz et al. [187] that found that uncomplicated birth was predicted by a high SOC score in pregnant women. Engelhard et al. [197] showed that SOC was not a significant predictor for PTSD after pregnancy loss. However, despite the use of regression analysis, their findings are suspect given that the SOC scores were obtained in early pregnancy while the PTSD scores were obtained in the postpartum. Our review has demonstrated that measures of SOC are context dependent and have criterion-related validity. Therefore, studies examining the relationship (i.e., correlation) between SOC and a PRO measure (i.e., PTSD) must have temporal association as well.

The study by Staneva et al. [166] suffered from similar limitations. Despite finding a poor correlation between SOC scores and adverse birth outcomes, the SOC measures by Staneva et al. [166] were made at 12-26 weeks of gestation while the adverse event outcome index were measured 3-6 months postpartum. Furthermore, the adverse birth outcome index was calculated based on a number of late-trimester, birthing, or postpartum outcomes. With respect to a number of birth-related variables, the literature indicates that there is no association between the use of EA and SOC scores. The logistic regression analysis by Ferguson et al. [170] supporting an association is outweighed in another study

by Ferguson et al. [172] and by the studies of Hildingsson et al. [167] and Jeschke et al. [182]

In terms of the use of induction or augmentation, two studies indicated that there was no association to SOC. [167, 170] The weight of the evidence favours that birth satisfaction is not associated with SOC scores. Despite the findings by Hildingsson et al. [167] that a less positive birth experience was associated with lower levels of SOC scores, Ferguson et al. [170] found that SOC scores were not associated with birth satisfaction using odds ratio and logistic regression analysis. Finally, as it pertains to mode of birth (i.e., vaginal birth, Caesarean birth, planned birth), the overwhelming evidence refutes the relationship between SOC and mode of birth. [167, 170, 172, 190] Through *t*-test and ANOVA, Hildingsson et al. [167] found that mode of birth was not associated with SOC scores at any time point. Based on odds ratio analysis, Ferguson et al. [172] found that antenatal SOC scores were not associated with spontaneous vaginal birth. Using logistic regression analysis, Ferguson et al. [172] found that SOC scores were not associated with the pregnancy or anticipated labour choices of women such as planned birth type. Using Pearson's product moment correlation Hellmers and Schuecking [190] found that German women with a higher SOC tended more strongly towards spontaneous birth while the women with a lower SOC tended more strongly toward a Caesarean. This was not observed in their responders from the USA. Using logistic regression analysis, Ferguson et al. [170] found that assisted vaginal birth was associated with changes in women's SOC scores from the antenatal to the postnatal period. In addition, women with high SOC were less likely to experience Caesarean sections and more likely to experience assisted vaginal birth based on odds ratio analysis.

Overall, we also found contradictory findings on the relationship of a number of outcomes and SOC. How do we reconcile these finding? First, pregnancy has been

acknowledged as a period of rapid change, rendering a number of measures susceptible to significant fluctuations during the span of pregnancy. [187] Our disparate findings may reflect these fluctuations. Differences in the findings may also be attributed to differences in study designs (i.e., prospective versus retrospective cohort), differences in sample size, the timeframe of SOC measurements (i.e., SOC measures during early or late pregnancy or prenatal versus postnatal measures), and differences in country of study. For example, Hellmers et al. [190] found that German women with a higher SOC tended towards a spontaneous birth while a lower SOC score tended more towards a Caesarean birth. Among American women in the same study, the authors found that SOC scores did not affect the women's choice of spontaneous or Caesarean birth. The differences in country of study could also account for the wider social, cultural, economic, and environmental view of pregnancy such one's job status during pregnancy, back to work requirements, and access to affordable healthcare. [166] The disparate findings may also be attributed in how and for what purpose the outcome measures were used. For example, Bratt et al. [162] pointed out that a prenatal diagnosis of congenital heart disease is sometimes less precise regarding the most likely postnatal outcome because of the continued development of the heart during the rest of pregnancy. Such an uncertainty in the prenatal diagnosis and its long-term prognosis may be one cause of increased psychological distress compared to when the diagnosis is made after birth.

Ferguson et al. [170] did not distinguish the use of epidural anaesthesia for pain relief in labour as opposed to its use in facilitating assisted vaginal birth. Therefore, SOC measures may differ with intent or motivation. Staneva et al. [166] modified the SOC-13 with responses using a five-point as opposed to a seven-point Likert scale to facilitate participants' responses and to make it consistent with other measures. Finally, the differences in our findings may be attributed to the pregnant women's SOC level and the

role of SOC itself. Ferguson et al. [170] noted that women with high SOC may have increased comprehension, more effective use of existing and potential resources, and high motivation to manage their birth. Compared to women with low SOC, pregnant women with high SOC were older and of higher socio-economic status. [167] These women have an increased comprehension of their healthcare needs, are more capable of effectively using existing and potential resources and have higher motivation to manage their pregnancy and birth. As such they may be perceived and treated differently by health professionals. They may present in such a way that health professionals alter their own practice behaviours by decreasing unnecessary interventions in labour and providing the high SOC women with more choices. Oz et al. [187] pointed out that the decision to employ the use of epidural anaesthesia, induction or augmentation or the method of delivery rests mainly on a woman's willpower.

The idea of maternal factors (as opposed to non-maternal factors) may influence a woman's decision regarding their pregnancy and the care options they receive resonates with Hildingsson et al. [167] That is, a major life event such as pregnancy and birth required coping abilities and internal and external resources and therefore an adequate level of SOC. As previously discussed, one's ability to mobilise both internal and external resources is dependent on an individual's SOC. Hildingsson et al. [167] proposed that SOC is an internal manifestation that reflects maternal factors (i.e., attitudes, feelings, and experiences) that is not affected by external factors such as healthcare institutional policies and clinical guidelines that healthcare providers (and their patients) must follow for birth.

2.2.7.3 The Effects of Pregnancy-Related Complications on SOC

Although our findings have established a relationship between SOC and a number of PROs (i.e., depression, stress, anxiety, lack of social support) and to some extent covariates related to labour and birth outcomes, cause and effect inferences remains largely

unknown. For example, is a compromised health outcome the result of low SOC or conversely, a compromised health outcome results in low SOC? Although a number of factors must be satisfied to make cause and effect inferences (i.e., Hill's criteria [217] such as strength of association, consistency, temporality, and biological plausibility), insofar as the studies reviewed are concerned, a number of these studies have demonstrated a temporal association between SOC scores and a number of obstetric outcomes. A low or decreasing SOC was temporally associated with a diagnosis of congenital heart disease in the unborn foetus [162], lacking support from their partner during pregnancy [166, 167, 191], experiencing assisted vaginal birth and use of epidural anaesthesia [170], experiencing medical complications and hospitalisations [171], reporting pregnancy conditions [172], and exposure to domestic violence [176]. A high or increasing SOC score was temporally associated with birth satisfaction [158] and specifically, satisfaction with intrapartum care [193], reporting high levels of self-efficacy [97], achieving childbirth one year after use of ART [192] and mobilisation of crisis support [197]. Although not included in our systematic review as the SOC was measured in the post-partum period, Finnbogadottir et al. [218] found women who reported a history of violence had lower SOC scores.

2.2.7.4 SOC in Relation to Laboratory Findings

Health is a multifaceted concept that requires a conceptual model that relates both clinical and health-related quality of life measures. [219] Antonovsky hypothesised the SOC has a direct physiological consequence. [220] Our review found 5 studies that demonstrates a poor linkage (i.e., association or correlation) between measures of SOC during pregnancy with three laboratory measures: HbA1c [168], cortisol [180, 195] and sIgA. [185, 195] In the study by Linden et al. [168], the investigators found that although the correlation between HbA1c measures with SOC was statistically significant (i.e., $p <$

.01), the correlation was weak (r = -.23) placing into question the convergent validity between the two constructs. Swartz et al. [180] found no correlation between SOC scores measured in the 3rd trimester and salivary cortisol levels among mothers and fathers and their children measured at 6, 12- and 24-months post-partum as did Almedon et al. [195] between prenatal or postnatal salivary cortisol concentrations and total SOC scores. However, Almedon et al. [195] found that postnatal cortisol levels were significantly lower (p < .0171) in mothers with higher SOC scores, particularly in those with higher 'comprehensibility.' With respect to s-IgA levels and SOC scores during pregnancy, Sekikuza et al. [185] found that that low SOC (i.e., regression = -.157, p = .000) and low s-IgA (regression = -1.497, p = .028) threatened premature birth based on logistic regression analysis. However, although sIgA concentration was lower in women with low SOC scores when compared to women with high SOC scores but the differences were not statistically significant. In another study, Sekizuka et al. [194] found that the s-IgA levels were significantly lower in the low-SOC scoring group of women than in the high-SOC scoring group due to possible suppressed immunity in the low-SOC score group when compared to the high-SOC score group. We encourage continued efforts in demonstrating the relationship between SOC and objectively measured clinical variables such as cortisol, s-IgA and HbA1C. Thus far, the studies examined had study limitation and notable was the limited sample size [185, 194-195] and low response rate and possible selection bias [168, 180, 185, 194-195]. A higher-level research design with more detailed observations on the use of more physiological and biochemical factors is required to prove a causal relationship.

2.2.7.5 Lack of Pregnancy-specific PROs

We noted than less than 25% of the validated PROs utilised in conjunction with SOC instruments were specific to the prenatal period. Mogos et al. [221] similarly found a

limited number of PROs have been formally developed and validated in pregnant and postpartum populations. While the universal (generic) and condition specific PROs utilised in this review have a valid role in prenatal and postnatal research, they may not be sensitive enough to capture small but important effects that are unique from the prenatal and postnatal perspective. As Mogos et al. [221] discovered in their review, there were important validity, reliability and psychometric inadequacies in universal PROs that rendered their use in comparative effectiveness analysis with the pregnant and post-partum populations as inappropriate. Research into the development of valid PROs specific to the pregnant population and studies relating them to SOC should be further pursued.

2.2.7.6 Lack of Measures of Physical Health Domains

Our reviewed manuscripts revealed a deficit in research to examine the relationship between physical health measures and SOC during pregnancy. We found three studies relating a physical health measure to SOC. Ngai and Ngu [181] utilised the SF-12 that provides measures of both mental and physical health. The authors found that family SOC and social support had a direct effect on the mental health component of QoL, but not on its physical health component.

The use of the physical well-being index by Hildingsson et al. [191] found that dissatisfaction with partner support was associated with poor physical as well as poor emotional wellbeing. Staneva et al. [171] examined pregnancy-specific distress using the Revised Prenatal Distress Questionnaire (NuPDQ), a 17- item self-report scale measuring the extent to which women feel ‘bothered, upset, or worried at this point’ about pregnancy issues, including physical symptoms and bodily changes. The investigators found that lower levels of SOC predicted greater levels of distress and operating alongside physical health constructs. A recent review by Flensborg-Madsen et al. [220] found that SOC was only moderately-to-weakly correlated to various measures of physical health but strongly

correlated to measures of mental health. Eriksson and Mittelmark [222] acknowledged the findings by Flensborg-Madsen et al.[220] but argued that such fragmentation of the concept of SOC into physical and mental health components deviates significantly from Antonovsky's fundamental notion of an 'orientation to life.' Eriksson and Mittelmark [222] further argued that such fragmentation also reinforces the physical health versus mental health divide in modern health care. Alcantara et al. [83] found that physical health QoL domains have weaker correlations with SOC when compared to the mental health QoL domain measures. Furthermore, through random forest analysis [223], Alcantara et al. [83] demonstrated via variable importance plots that the mental health domains (i.e., general mental health, anxiety, depression) were the strongest predictors for SOC. However, the physical health domains of fatigue and sleep disturbance were also identified as strong predictors for SOC. Through partial dependence plots, Alcantara et al. [83] demonstrated that interaction may be taking place between physical, mental, and social health domains in predicting SOC scores. For example, despite a low physical health status, a high SOC score is predicted if a high mental health status exists. Additionally, a high physical health status does not necessarily predict a high SOC score in the presence of a low mental health status. As such, the correlation of mental health versus physical health in relation to SOC may not be so clear-cut. We encourage continued research to examine the interplay between physical, mental, and emotional health in relation to SOC in both the pregnant and non-pregnant populations.

2.2.7.7 Lack of Intervention Studies to Improve SOC

Despite our findings of measures of SOC during pregnancy concomitant with a number of pregnancy-related outcomes as measured with both universal and pregnancy-specific PROs, we found only two studies examining the effects of an intervention to enhance the SOC in the pregnant population. Muggleton et al. [154] examined whether changes in SOC

and its subdomains were associated with a pre-existing childbirth education program versus a new program based on the theory of salutogenesis (i.e., Salutary Childbirth Education) in a maternity service department at an Australian public hospital. Paired t-test in mean SOC scores from antenatal to postnatal measures demonstrated that no statistically significant differences were observed in those respondents under the old childbirth education program while in those in the new Salutary Childbirth Education program, the mean SOC score of the respondents increased from the antenatal to the postnatal period in a statistically significant manner. Habroe et al. [192] found that achieving childbirth after assisted reproductive technology (ART) was associated with higher SOC at 1-year follow-up for women (i.e., OR 1.81, 95% CI: 1.20 2.74) and for their male partners (i.e., OR 1.27, 95% CI: 0.88 1.86) with low SOC measures at baseline. However, among women with high SOC measures at baseline, their SOC did not change after ART. Healthcare approaches that enhance the SOC to implement primary, secondary and tertiary prevention during the antenatal and postnatal period would be invaluable to perinatal health and should be further investigated.

The existing studies thus far have demonstrated the clinical and research utility of various PROs and SOC measures. Further, they provide the foundation and direction to developing strategies and interventions to strengthen women's SOC during pregnancy. Staneva et al. [166] advised that interventions must take into account a wider social, cultural, economic, and environmental view of the preconception and perinatal period. Others have advised specific interventions that focused on anxiety more than depression as the target for interventions [162], the use of screening tools such as the EPDS [162], a focus on the protective effect of social support [165, 169, 177, 180-181, 188], increasing satisfaction with birth experience [170], promoting acceptance and the cultivation of self-care and self-compassion in pregnant women [171], promoting self-efficacy [97], assist

women to better handle fear and sadness during delivery and reinforce feelings of a positive character [191], and more visits in early pregnancy and parental education. [196]

We identified 3 systematic reviews in our search of the literature. Ferguson et al. [93] published their scoping review on salutogenesis and pregnancy to address the question of how a woman's SOC score affects her childbearing. Consistent with our findings, the authors found that a strong SOC was associated with positive outcomes for childbearing women, including increased emotional health, improved health behaviours, and increased normal birth choices and outcomes. Perez-Botella et al. [224] published their scoping reviews on salutogenesis and pregnancy to identify and address how salutogenesis has been defined and used in maternity care research undertaken with healthy women (i.e., outside of a pathogenic framework). The authors found that only 8 papers satisfied their inclusion criteria. Seven of these 8 papers [174, 179, 182, 184, 197, 189, 190] were included in our review. Perez-Botella et al. [224] lamented that most of these studies had an emphasis on pathology and the need for a more complete integration of salutogenesis into the empirical research on pregnancy care. This resonates with the scoping review of Downe et al. [225.] on what women want, need, and value in pregnancy. The focus on the identification and treatment of potential or actual pathology, without paying attention to the maintenance and promotion of positive health and wellbeing may be challenging but such an approach may only provide a small proportion of what women need and want. Perez-Botella et al. [**224**] proposed the use of more direct measures of positive health and wellbeing to influence change in maternity care research and delivery. Recently, Shorey and Ng [92] published their mixed studies review (i.e., including both qualitative and quantitative studies) on the use of the salutogenic theory across the perinatal period and is the most comprehensive review thus far. Based on their thematic analysis of their reviewed manuscripts, the authors found four themes emerging from their synthesis: (1) factors

affecting SOC, (2) influences of SOC, (3) ways to promote SOC among mothers, and (4) use of the salutogenic framework across perinatal healthcare.

In our review, maternal factors found to affect SOC scoring were age [165-166, 169], low level of education [165], single [165], multiparity [165], lack of social support [165-166, 195], having unplanned pregnancies [165], tobacco use [165], less positive attitudes towards being pregnant and major worries about giving birth [165, 167], less positive birth experience or prefer a Caesarean birth [167], high scores of self-efficacy [168], suffering from depression [165, 167-168] and success with ART. [192] Conversely, we found that high SOC scores resulted in higher perceived quality of couple relationship and better family functioning overall [164, 169, 177, 180], a more positive birth experience [167] with less complications [166] and less fear with childbirth [178], less likely to experience Caesarean sections and more likely to experience assisted vaginal birth [170, 190], have higher social support [170, 172], experience less depression [170, 172, 179, 197], have better coping with the stress and PTSD [197] along with lower postnatal cortisol levels. [195]

Low SOC scores during pregnancy were associated with high levels of parental stress [166-167], a threatened premature birth [174, 185], greater depression [175, 194], and nine times more likely to be exposed to domestic violence during pregnancy [176], have lower s-IgA [194] a greater need for professional support [196] and more likely to relapse back to smoking during pregnancy. [198]

In terms of ways to promote SOC among mothers, and use of the salutogenic framework across perinatal healthcare, Hildingsson et al. [191] noted that SOC seems to not be affected by events during labour and birth, which can be viewed as external circumstances and difficult for women to control and determine when the care provided during labour and birth is governed by policies and guidelines that women have to obey in

hospital. Perhaps providing a greater voice for women and part of the clinical decision-making during labour and birth may increase their SOC. Hildingsson et al. [191] found that SOC seems to be attributed to internal manifestations, which is mirrored mainly in women's characteristics, attitudes, feelings and experiences. As we previously noted, there is a lack of intervention studies and echo the sentiment of Perez Botella et al. [224] that there needs to be greater use of measures reflecting positive health and wellbeing to promote a salutogenic framework across perinatal healthcare.

The primary focus of our review of the literature was to examine quantitative measures of SOC during the prenatal period in conjunction with a number of PROs and their implications. What has become immediately apparent from our review is the universality and functionality of the SOC measure during pregnancy. Our review has found that SOC may be used as a diagnostic instrument (i.e., detect the presence or absence of a condition) as SOC has been found to be negatively correlated with PRO measures reflecting compromised health or functioning and positively correlated with PROs measuring optimum health or functioning. As a risk assessment tool, SOC has been found to be a predictor of certain outcomes such as depression [175, 194], domestic violence during pregnancy [176], wellbeing [196], uncomplicated delivery [187], PTSD after pregnancy loss [197], grief acuity [199], less use of EA and fear of childbirth. [178] High levels of SOC have also been found to have a moderator and protective role against postnatal depression and physical abnormalities caused by earthquake-related stress [188] and can modify the course of PTSD symptoms with pregnancy loss. [197] Although Oz et al. [187] and others [183-186, 189] argued that SOC reflects the lifetime experience of an individual and remains relatively stable, Staneva et al. [171] and others [170, 192, 226] proposed that SOC is modifiable through new patterns in one's life such as those resulting in life transformations during pregnancy. If indeed SOC is modifiable in the perinatal

period, we concur with Staneva et al. [171] that health promotion interventions must focus on strengthening SOC from a socio-ecological perspective that takes into account the impact of the social context on an individual's adaptation, resilience, and personal growth in the face of stressful life events. Indeed, a number of the manuscripts we reviewed addressed the socio-ecological interplay at the individual level and the relationship of a number of factors (i.e., patient outcomes and socio-demographic information). A number of authors have stressed the importance of the interpersonal and technical process of care provided to women throughout the perinatal period to enhance their SOC. Healthcare providers should be knowledgeable, emphatic and be able to develop strategies aimed at achieving this goal. [162-163, 168] Healthcare providers should also ensure that their patients are educated with sufficient information, participate in the decision-making process and provide them with access to emotional and instrumental support structures. [97, 162, 164, 165-166, 168-169, 171, 175-176, 177, 179-181, 187, 193, 195] The importance of community and societal factors have also been acknowledge but not addressed to the same extent. Staneva et al. [171] indicated that in addition to how well a pregnant woman feels supported, social factors such as their work environment and societal expectations surrounding pregnancy and motherhood are all crucial factors. As we previously mentioned, pregnancy care should also consider the wider social, cultural, economic, and environmental view of pregnancy. [166]

Despite the potential role (e.g., as an assessment tool) for SOC in the clinical management of women in the perinatal period; insofar as we are aware, its use in routine clinical care and its clinical utility remains to be fully characterised. Although Eriksson and Lindstrom [226] found the SOC-13 and SOC-29 scales to be reliable, valid and cross culturally applicable, their reliability and validity and responsiveness to change has yet to be fully established in pregnancy care. [227] To date, the Chinese version of the family

SOC-12 (i.e., F-SOC-12) utilised by Ngai and Ngu [169, 175, 177, 179, 181] remains as the SOC instrument to have demonstrable validity and reliability among pregnant women. Ferguson et al. [173] examined the reliability and validity of the SOC-13 among pregnant Australian women and found that its construct validity was difficult to establish. Exploratory factor analysis of the SOC-13 resulted in the removal of items 2, 3, 7 and 9 resulting in SOC-9. In terms of its reliability among pregnant responders, the F-SOC-12 [169] has an internal consistency of $\alpha = 0.83$ while the SOC-13 [1171, 196] has $\alpha = 0.80$ and $\alpha = 0.90$, respectively. Our findings on the correlational relationship of SOC with various PROs reflects the construct and criterion validity of the various SOC scales. Throughout this review, described changes in SOC scores paralleling changes in a number of PROs demonstrated the SOC instruments' ability to detect changes and its responsiveness in the expected outcomes. The SOC scales' diversity and universality in this regard may be advantageous in certain instances but it may also hamper the diagnostic precision of the various SOC scales. Furthermore, the directionality (i.e., cause and effect) of SOC and the various PROs remains unknown. Directionality would inform the prognostic significance of the SOC scales. The minimally clinically important difference (MCID), defined as the smallest change in a PRO scoring that a patient perceive as clinically significant, remains to be determined for the various SOC scales. Knowledge of the MCID would have aided greatly in the presentation and interpretation of the cross-sectional and longitudinal studies presented but more importantly, knowledge of the MCID would aid greatly in the overall interpretability and usefulness of the SOC scales in clinical decision-making during pregnancy care.

2.2.8 Study Limitations

There are limitations in our systematic review of the literature. All the studies reviewed were observational in nature, incorporating a prospective observational cohort or

a cross-sectional study design. Despite the heterogeneity in the studies reviewed, the lack of an intervention in the reviewed manuscripts with an experimental or quasi-experimental research design provides no specific analysis of the effectiveness of any treatment (i.e., nursing intervention) in altering the course of SOC within pregnant women. Although we documented the lack of an association between SOC and a number of pregnancy outcomes, we must acknowledge that there is the possibility of a selection bias (i.e., due to the observational nature of the studies reviewed) and also publication bias. We limited our search to manuscripts written in the English language and publications in the non-English language as it pertains to our subject matter remains unknown. Despite these limitations, this systematic review contributes to the current state of knowledge on measures of SOC during pregnancy as a framework for perinatal wellbeing. [228] This systematic review informs future research on SOC during the perinatal period on the need for higher level research designs using pregnancy specific PROs.

2.2.9 Conclusion

This review found that low SOC scores in the prenatal period are associated with compromised health outcomes in pregnant women; and that there is a knowledge deficit in characterising the relationship between physical health and SOC. Additionally, we found that cause and effect inferences between SOC and various health outcomes remains largely unknown. SOC as a modifiable risk factor in pregnancy could be improved by implementing a comprehensive care program that includes interventions that promote physical, mental and social wellbeing. Any such implementation should be the subject of future research.

2.3 The Chiropractic Care of Pregnant Women: A Scoping Review of the Literature

This chapter presents a systematic review which, upon completion, was submitted to *BMC Complementary Medicine and Therapies*, a peer-reviewed journal, for publication. The contribution of individual authors is outlined in the signed statement of contribution. All of the tables and figures included in this chapter were submitted for publication.

Joel Alcantara, DC, PhD (candidate),[1,2*] Ryan Whetten, MS (candidate),[3] Elizabeth Emmanuel, MN, PhD,[4] Sandra Grace, DO, DC, PhD,[5] Stephen P Myers, ND, BMed, PhD[5]

[1] Faculty of Health, Southern Cross University, Southern Cross Drive, Bilinga QLD Australia, 4225

[2] Research Director, the International Chiropractic Pediatric Association, 327 N Middletown Rd, Media, PA, 19063 USA

[3] Master of Science candidate, Department of Computer Science, Boise State University, 1910 W University Dr, Boise, ID 83725

[4] Senior Lecturer, Faculty of Health, Southern Cross University, Southern Cross Drive, Bilinga, QLD, Australia 4225

[5] Professor, Faculty of Health, Southern Cross University, Military Road, East Lismore NSW Australia 2480

*Corresponding author

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Abstract

Background: Of the various practitioner-based alternative therapies, chiropractic is highly utilised by pregnant women to address mainly pregnancy related pelvic girdle pain and low back pain. Despite its popularity among pregnant women, no consolidation of the peer-reviewed literature on chiropractic pregnancy care has been performed. To address this deficit, we performed a scoping review to inform chiropractors and other healthcare professionals involved in perinatal care.

Methods: The literature review was conducted from 1978 to 2022 using PubMed, AMED, EMBASE, CINAHL, MANTIS and Index to Chiropractic Literature. The search terms were chiropractic, chiropractic care, chiropractic manipulation, pregnancy or pregnant or prenatal or antenatal or perinatal or maternal and related words. Inclusion criteria for our review were manuscripts: (1) involving pregnancy care within the scope of practice of chiropractic (i.e., spinal manipulative therapy (SMT) and/or adjunctive therapies) and (2) published in a peer-reviewed journal. Exclusion criteria were: (1) abstracts from conference proceedings, (2) dissertations for a Master or PhD degree, (3) letters to the editor, (4) chapters in textbooks, and (5) non-English language manuscripts. Natural language processing and K-means cluster analysis was applied to the eligible manuscripts to identify themes and deficits of the existing literature.

Results: A total of 134 manuscripts from 745 titles met inclusion criteria for review consisting of three randomised controlled trials, 19 cohort studies, one case control, 53 case reports, 14 case series, one qualitative study, 34 commentaries, 8 systematic reviews, and one best practice recommendations document. Four clusters were identified with manuscripts describing care of pregnant women with complex MSK presentations (Cluster 1), the care of pregnant women with simple MSK presentations (Cluster 2), the use of the

Webster Technique (Cluster 3), and papers characterised by advocacy for the chiropractic care of pregnant women (Cluster 4).

Conclusions: Overall, there is a deficit in the literature on chiropractic pregnancy care. Studies characterising the practitioner and patient perspective are lacking. We encourage continued research efforts on chiropractic pregnancy care to inform prenatal research, practice, education, and policy.

2.3.1 Background

Utilisation studies continue to document the growing popularity of complementary and alternative medicine (CAM) in the general population. [42] For women in pregnancy and the postpartum period, Barnes et al. [229] identified two overarching motives for CAM use: 1) to protect themselves or their babies from adverse events, and 2) to facilitate the normal physiological processes of pregnancy, birth, and lactation. Bowman et al. [33] found similarly in that women used CAM to support their sense of self-determination, to pursue a natural and safe childbirth, and because they resonate with the philosophical underpinnings of the CAM therapies used.

Of the various practitioner-based CAM therapies, chiropractic is highly utilised [11, 230-233] and well established with chiropractors practicing in 100 countries worldwide. [11] Chiropractors have been caring for pregnant women since chiropractic's inception. [46] With a holistic and vitalistic approach to patient care [63], chiropractic supports a woman's need for a safe and natural childbirth [56, 113] and provide relief of their musculoskeletal (MSK) complaints (i.e., low back pain [LBP] and/or pelvic girdle pain [PGP]). [50, 234-235]

In the past 10 years, we noted from within chiropractic, a growing interest in pregnancy care among chiropractors based on the growing professional membership in the International Chiropractic Pediatric Association (ICPA) that advocate for and provide postgraduate training in chiropractic perinatal care [236], published textbooks on chiropractic prenatal care [237-238] and the overall popularity of CAM therapies during pregnancy. [33, 229] However, to date, no comprehensive assessment and consolidation of the peer-reviewed literature on the chiropractic care (i.e., the use of the spinal adjustments and adjunctive therapy) of pregnant women has been performed. To inform clinical practice and research, health care consumers and policy makers, we performed a scoping

review of the literature on the chiropractic care of pregnant women to determine the types and sources of literature, identify key themes and gaps/deficits in the existing literature.

2.3.2 Methods

We followed the Preferred Reporting Items for Systematic Reviews and Meta-Analyses for Scoping Reviews (PRISMA-ScR) guidelines [239] with the following steps: (1) formulate the research question, (2) identify and select the relevant literature, (3) charting or extracting relevant data, and (4) collating, summarising, and reporting the results.

2.3.2.1 STEP 1: Formulating the Research Question

Our scoping review was guided by the following questions:

1. What are the aims/purpose, types and sources of literature?
2. What is clinically relevant information (i.e., presenting complaints, management protocols) provided by the manuscripts?
3. What are the patterns or themes of the reviewed manuscripts?
4. What are the gaps/deficits in the existing literature?

2.3.2.2 STEP 2: Identifying and Selecting the Relevant Literature

Our literature search utilised PubMed, Allied and Complementary Medicine (AMED), Excerpta Medica Database (EMBASE), Cumulative Index to Nursing and Allied Health Literature (CINAHL), Manual, Alternative and Natural Therapy Index System (MANTIS), and Index to Chiropractic Literature. The search terms were ‘chiropractic or chiropractic care or chiropractic manipulation AND pregnancy or pregnant or prenatal or antenatal or perinatal or maternal’ utilising the ‘apply related words’ function from January 1, 1978, to July 13, 2023. Inclusion criteria for our review were manuscripts: (1) involving pregnancy care within the scope of practice of chiropractic (i.e., spinal

manipulative therapy (SMT) and/or adjunctive therapies) and (2) published in a peer-reviewed journal. Exclusion criteria were: (1) abstracts from conference proceedings, (2) dissertations for a Master or PhD degree, (3) letters to the Editor, (4) chapters in textbooks, and (5) non-English language manuscripts.

The principal author (JA) doubly screened the search results for their eligibility based on the inclusion and exclusion criteria. SPM, EE and SG independently examined the search results and confirmed their eligibility. Disagreements were resolved by discussion and consensus.

2.3.2.3 STEP 3: Charting or Extracting Relevant Data

The principal author (JA) extracted the following data from the relevant studies using an Excel spreadsheet: (1) study description (i.e., study design, year of publication, country of origin), (2) aim or study purpose, (3) clinical management information (i.e., diagnosis/assessment procedure(s), chiropractic technique and adjunctive therapies), and (4) summary of findings.

The extracted data was confirmed independently by the co-authors (EE, SG, and SPM) to minimise error. Disagreements were addressed by consensus among the authors.

2.3.2.4 STEP 4: Collating, Summarising, and Reporting the Results

To integrate disparate literature of varied designs/methodologies, aims, clinical scenarios etc., we utilised data-based convergent synthesis [240] where both qualitative and quantitative data are complementary and analysed together. In this way, a narrative synthesis of the literature, augmented with summary tables, defined themes of the literature to provide a framework/theory for future research [241] and identify gaps/deficits of the literature. The analysis involved a three-step process that involved (1) data transformation (text from various study designs were assigned a numerical value), (2)

integration (i.e., the process of integrating disparate study designs), and (3) the creation of patterns, themes, or trends from the text of the reviewed manuscripts. Data transformation utilised Natural Language Processing (NLP) [242] to quantify text from all the reviewed manuscripts to allow for statistical analysis. To quantify a value to text from the reviewed manuscripts and assign an importance of text in each manuscript relative to all other reviewed manuscripts, data transformation utilised the statistical measure called Term Frequency Inverse Document Frequency or Tf-idf. As an example, if a word occurred commonly in a document, it may be of importance. However, if the same word occurred commonly across the various manuscripts, it may not be as meaningful or important. The assignment of the importance of a text was performed by multiplying two measures: (1) the frequency a word appears in a document and known as term frequency, and (2) a measure of how common or rare a word is in a document and referred to as the inverse document frequency. The closer the inverse document frequency is to 0, the more common a word is. The inverse document frequency is calculated by taking the total number of documents, dividing it by the number of documents that contain a word, and calculating the logarithm. Multiplying the terms frequency and the inverse document frequency of the word results in the Tf-idf score of a word in a document. The higher the score, the more relevant that word is in that particular document. [243] More detail on the method of data transformation is provided in Appendix B.

Integration of the transformed text utilised the statistical technique of K-means cluster analysis [244] to identify similar groups or clusters of text. In this way, an exploratory analysis of the literature allowed for deeper and more useful insights into the text patterns, themes, and trends of the reviewed literature. Analysis of variance (ANOVA) determined statistical difference in ≥3 group means. The statistical software R was used for analysis

[245] with statistical significance was set at $p < .05$. Further details of this three-step process (i.e., NLP and K-means cluster analysis) is provided in Appendix B.

2.3.3 Results

2.3.3.1 Search Outcomes

A total of 744 titles were initially identified from the database search and one title from one of the reference articles. Duplicate titles (n=166) were removed resulting in 579 titles for screening. An additional 440 titles were eliminated based on the inclusion/exclusion criteria with 139 titles remaining for retrieval and further examination.

2.3.3.2 Study Characteristics

Of the 139 manuscripts reviewed, 134 met inclusion criteria: three were randomised controlled trials (RCTs) [246-248], seven prospective cohort studies [53-54, 113, 249-252], one case control [253], 12 cross-sectional studies [114, 254-264], 53 case reports [265-317], 14 case series [318-331], and one qualitative study. [332] An additional 43 manuscripts met our inclusion criteria consisting of 34 commentaries [46, 50, 333-364], eight systematic reviews (SRs) [49, 55-56, 99-102, 365], and one best practice recommendations consensus paper [366]. Five articles were excluded, with two involving post-partum care [367-368] and three involving non-chiropractic care [369-371] (see Figure 2.2). The extracted data based on study design are summarised in Table 2.7 to Table 2.10.

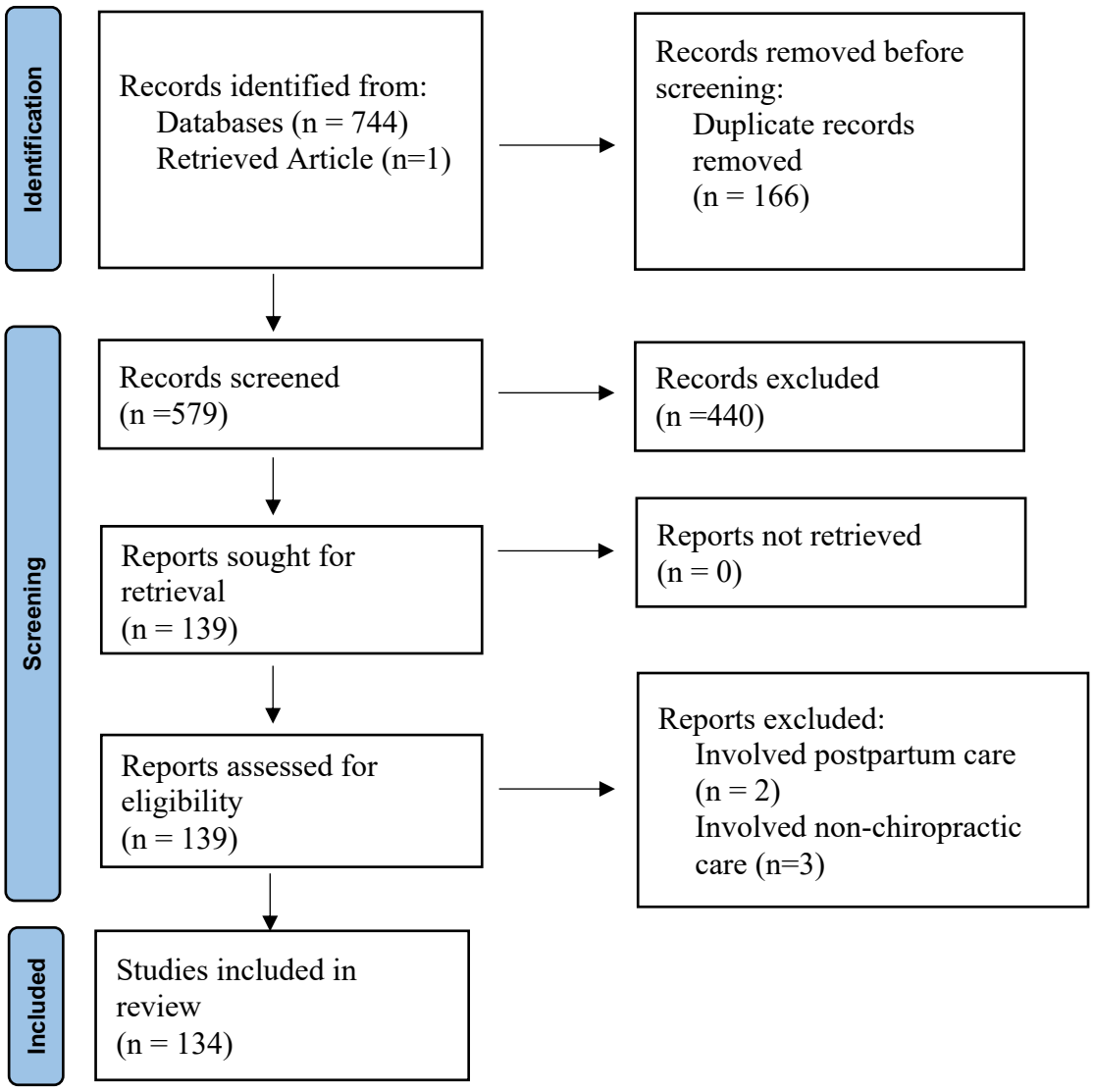

Figure 2.2. Flow Diagram of the Scoping Review of the Literature on the Chiropractic Care of Pregnant Women

Table 2.7. Findings of Clinical Trials, Cohort Studies, and Case Control Involving Chiropractic Care for Pregnant Women

Reference & country	Study aim(s) or purpose	Study design	Clinical presentation or study of Interest	Management protocol	Summary of findings
Peterson et al. [246] (2012) USA	A pilot study to comparative effectiveness study of three interventions (exercise, SMT, and NET) to mitigating pregnancy related LBP	RCT	57 pregnant women (mean age = 29.7 years, *SD* = 5.0) with a singleton foetus suffering from pregnancy-related LBP	Neuro-emotional technique, exercises, and HVLA SMT	No clinical or statistically significant differences between the three groups
George et al. [247] (2013) USA	To determine if the addition of manual therapy to standard obstetric care was superior in reducing pain, impairment, and disability in pregnant women	RCT	Pregnant women (n=169) 15-45 years old with a single foetus at 24-28 weeks of gestation were assessed for LBP and/or PGP	Manual therapy – chiropractic SMT with exercise and patient education Obstetrics Care – rest, aerobic exercise, heating pad application, use of acetaminophen or narcotics	Addition of manual therapy to obstetric care resulted in significant reductions in pain and disability
Gausel et al. [248] (2017) Norway	To determine the effectiveness of spinal manipulation (SM) and adjunctive therapies versus conventional medical care in pregnant women with dominating one-sided pelvic girdle pain (PGP).	RCT	48 women with dominating one-sided PGP randomised to chiropractic care versus conventional medical care	Chiropractic care – spinal manipulation, mobilisation, soft tissue treatment, exercises, and patient advice Conventional primary health care – not described	No statistically significant difference in measured outcomes (i.e., new occurrence of full time and/or graded sick leave due to PGP and/or LBP) between the two groups during and after pregnancy

Reference & country	Study aim(s) or purpose	Study design	Clinical presentation or study of Interest	Management protocol	Summary of findings
McCoy et al. [54] (2009) USA	To determine a number of outcomes (foetal correction, pain NRS, and SF-36) in pregnant women with a course of chiropractic care	Prospective cohort	25 pregnant women ranging from 23 to 39 WOG with an average age of 30.56 were followed prospectively for their response to care using clinical outcomes (pain NRS) and the SF-36	Diversified Technique and the Webster Technique	At time of reporting, the study was ongoing with no reported SF-36 outcomes; 8 of 25 pregnant women delivered with 5 delivering vaginally and 3 via Caesarean; of 4 foetal malpresentations, 2 turned to vertex, one was unable to turn, and one was not known; delivery of the foetuses were one vaginal birth, one unknown, and two Caesareans, with one an emergency Caesarean
Murphy et al. [249] (2009) USA	To determine the effectiveness of a diagnosis-based clinical decision rule as an approach to care for pregnancy-related lumbopelvic pain	Prospective cohort	115 pregnant women (mean age = 29.9, *SD* = 4.8; mean WOG = 25.2, *SD* = 7.4) suffering from LBP and/or PGP	Care provided by a chiropractor/physical therapist team following a diagnosis-based clinical decision rule based on a diagnostic process that considers differential diagnostic factors, pain-generating tissues, and perpetuating factors	At end of treatment (*n* = 83) and 11 months follow-up (*n* = 61), the mean patient-rated improvement was 61.5% and 83.2%; disability improved by 39% and 68%; change in pain NRS was 2.9 and 3.5 points; and the FABQ-Act was 0.54 and 2.6, respectively

Reference & country	Study aim(s) or purpose	Study design	Clinical presentation or study of Interest	Management protocol	Summary of findings
Alcantara et al. [53] (2012) USA	To determine the success of the Webster Technique in correcting foetal malposition/ malpresentation in women attending care in a PBRN	Prospective cohort	63 pregnant women with foetal malposition/ malpresentations, assessed at a mean 31.8 WOG: brow (n = 1), complete breech (n = 12), footling breech (n = 7), facial (n = 2), frank breech (n = 27), oblique (n = 6), posterior (n = 10), transverse lie (n = 16)	Webster Technique	70% (n = 44) success rate towards vertex position among 63 pregnancies with foetal malposition/ malpresentation.
Peterson & Peterson [250] (2012) USA	To determine if manual muscle testing (MMT) could predict foetal sex in-utero beyond chance	Prospective cohort	27 women who did not already know the sex of their baby	Manual muscle testing (MMT)	The use of MMT was found to be incapable of predicting foetal sex in-utero beyond chance
Peterson et al. [251] (2014) Switzerland	To examine the effectiveness of chiropractic care in women with pregnancy-related LBP and/or PGP	Prospective cohort	115 women with LBP and/or PGP were followed longitudinally over a 1-year period commensurate with chiropractic care	Nonstandardised chiropractic care	After one week of care, 52% indicated their pain as 'improved'; after one month, 70%; at 3 months, 85%; at 6 months 90%; and one year, 85%. There was significant reduction in pain NRS and Oswestry Disability Index scores with a course of care.

Reference & country	Study aim(s) or purpose	Study design	Clinical presentation or study of Interest	Management protocol	Summary of findings
Haavik et al. [252] (2016) New Zealand	To examine changes in levator hiatal area following a single session of HVLA SMT in pregnant and non-pregnant women	Prospective cohort	11 pregnant and 15 non-pregnant women were assessed for their hiatal areas and anterior-posterior and lateral diameters at rest, on maximum pelvic floor muscles contraction, and during maximum Valsalva, before and following chiropractic SMT using 3-/4-dimensional (3D/4D) transperineal ultrasonography	Chiropractic SMT – HVLA SMT	Levator hiatal area at rest increased significantly after spinal manipulation in the pregnant cohort but not in the control group
Alcantara et al. [113] (2018) USA	To measure the quality of life (using PROMIS-29) and visit-specific patient satisfaction (using VSQ-9) of pregnant women in a PBRN	Prospective cohort	343 pregnant women (average age = 30.96) with non-described clinical presentations were assessed for their QoL and patient satisfaction	Chiropractic care – various chiropractic techniques with/without the use of adjunctive therapies within a practice-based research network	In addition to high patient satisfaction, significant improvements were observed in fatigue, pain interference, pain intensity, and sleep disturbance, while significant increase in satisfaction with social roles. was observed; anxiety and depression did not change

Reference & country	Study aim(s) or purpose	Study design	Clinical presentation or study of Interest	Management protocol	Summary of findings
Phillips et al. [253] (1995) USA	To determine if obstetric interventions during labour and delivery were affected with the addition of chiropractic care to standard obstetric care	Case control	35 pregnant women between 18 and 35 years of age receiving chiropractic care were matched with 35 non-chiropractic women to determine differences in obstetrics intervention	Diversified, Thompson, Logan, and/or Webster Techniques and Upledger craniosacral therapy; adjunctive therapies consisted of general prenatal health education including nutritional advice, exercise recommendations, and birth education	No statistically significant differences were identified in the level of intervention of labour (i.e., synthetic oxytocin [Pitocin] induction or stimulation) was not affected with the addition of chiropractic care to usual obstetrics care
Laufer [254] (1987) Canada	Retrospective file review to characterise (i.e., age, occupation, number of children, and major complaints) women presenting for chiropractic pregnancy care	Cross-sectional retro-spective survey	To characterise 126 pregnant women presenting for chiropractic care	Non-intervention study	The average age was 29.8 years; most were career-oriented and presented commonly with LBP
Diakow [255] (1991) Canada	To determine the association of LBP in pregnancy and delivery and whether SMT affected the outcome of low back pain during labour	Cross-sectional survey	170 women were interviewed about their pregnancies (n = 400) with respect to their complaints and its severity	Non-intervention study	There was a significant association between LBP during pregnancy and during labour

Reference & country	Study aim(s) or purpose	Study design	Clinical presentation or study of Interest	Management protocol	Summary of findings
Andrew & Pedersen [256] (2003) United Kingdom	To investigate the use of chiropractic care and to provide useful information on the management of women with SPD	Cross-sectional survey	Retrospective survey of 16 women experiencing SPD in the perinatal period along with 7 chiropractors providing care for SPD	Non-intervention study	Response to care resulted in 10 women with moderate recovery, 4 women with complete recovery, and 2 women with slight improvement 7 chiropractors indicated using spinal adjustments for care, 6 used Sacro Occipital technique (SOT) blocks, 5 with exercises, 2 with cryotherapy, 3 with soft-tissue work
Rubin [257] (2007) USA	To illustrate the use of triage skills in a single-practitioner chiropractic practice	Cross-sectional retro-spective survey	Pregnant women were triaged as P1/red/emergency (needs immediate referral), P2/yellow/cautionary (warrants additional attention and follow-up), or P3/ green (limited concern)	Non-intervention study	7 of 8 (87.5%) new pregnant women were assessed at the P3 level of triage with limited concern. One (12.5%) was assessed at P2 level (12.5%) due to significant vomiting and LBP and groin pain in third trimester
Aas-Jakobsen et al. [258] (2010) Norway	Retrospective file review of 100 consecutive pregnant women attending care at a chiropractic clinic in a one-year period to characterise their age and presenting complaint	Cross-sectional survey	The mean age of the presenting women was 32.5 years (range 25-42) with MSK complaints	Non-intervention study	Approximately 90% suffered from pelvic pain as the motivator for care. Six out of 10 had LBP, and 6 out of 10 had specific thoracic pain. 3 out 10 had neck pain, 29% had symphysis pubis pain, 15% experienced headaches, and 2% migraines. Overall, 82% experienced a combination of pain sites.

Reference & country	Study aim(s) or purpose	Study design	Clinical presentation or study of Interest	Management protocol	Summary of findings
Alcantara et al. [114] (2012) USA	To characterise (i.e., age, WOG, presenting complaints) the chiropractic care of pregnant patients attending care in a PBRN	Cross-sectional survey	126 pregnant patients provided sociodemographics (age, gender, level of education), WOG, presenting complaints triaged as primary (1^0), secondary (2^0), and tertiary (3^0) and perceived effectiveness of care	Non-intervention study	Their average age was 30.56 years and presented at a mean of 29.42 WOG. Approximately 25% presented for 'wellness care.' Presenting complaints were mostly MSK pain. The majority (98%) reported a high perceived effectiveness of the care with specific outcomes categorised as 'decreased pain,' 'improved function' and 'other.'
Pistolese [259] (2002) USA	To survey chiropractor members of the International Chiropractic Association on their use of the Webster Technique and its outcome(s)	Cross-sectional survey	Surveys were sent to 1047 members of the ICPA. Of 187 responders, 112 surveys comprised the data	Webster Technique	Of 112 surveys, 102 (92%) chiropractors indicated success with the correction of a breech foetal presentation, while 10 (9%) indicated the foetus positioning as remaining unaffected with the Webster Technique
Stuber [260] (2007) Canada	To explore the experience of chiropractors and pregnant women having chiropractic care for LBP	Cross-sectional survey	18 chiropractors were surveyed on their perceived safety of chiropractic care for pregnant women, their care protocols, and referral patterns with other healthcare professionals	Non-intervention study	The majority indicated that SMT was appropriate for LBP, mid-back pain, neck pain, headaches, and benign vertigo, Common adjunctive therapies include soft-tissue therapy and exercise for women with multiple pregnancies, gestational diabetes, hypertension, pre-eclampsia, ectopic pregnancy, and blood clotting disorders.

Reference & country	Study aim(s) or purpose	Study design	Clinical presentation or study of Interest	Management protocol	Summary of findings
Yuen et al. [261] (2013) Canada	To determine the most common therapeutic interventions provided by Greater Toronto Area chiropractors to pregnant women	Cross-sectional survey	143 chiropractors (39% female, 61% male) from 630 successfully delivered invitations comprised the study (24% response rate)	Non-intervention study	Majority of respondents (90%) reported using Diversified Technique, soft tissue therapy (62%), and Activator Methods (42%). Most common referral was to a massage therapist (90%). Most indicated recommending stretching exercises (92%), multivitamins (84%), or folic acid (81%).
Weis et al. [262] (2019) Canada	To determine a cohort of Ontario chiropractors' knowledge on current guidelines for exercise during pregnancy.	Cross-sectional survey	86 chiropractors (41 female, 45 male) out of 456 invited comprised the study population; the majority (30%) were 30-40 years of age or 41-50 years of age, with the majority (53.5%) with practice experience of 0-15 years	Non-intervention study	The mean knowledge score was 0.52 (out of 10) with great variability among the respondents to a 10-item questionnaire.
Kawchuck et al. [263] (2020) Canada	To assess chiropractors' compliance with specific health- and pregnancy-related conditions as well as claims of immunity during the COVID-19 pandemic in British Columbia, Canada	Cross-sectional	Approximately 750 websites and 650 social media pages of approximately 1250 CCBC registrants were reviewed with a customised internet search tool resulting in 250 potentially inappropriate communications	Non-intervention study	The internet search tool identified 636 potential cases involving pregnancy-related conditions from 1350 websites. Further evaluation classified 83 cases as inappropriate.

Reference & country	Study aim(s) or purpose	Study design	Clinical presentation or study of Interest	Management protocol	Summary of findings
Edwards et al. [264] (2023) USA	To determine foetal adverse events via foetal heart rate (FHR) monitoring in women receiving concurrent care with chiropractic and nurse-midwifery	Cross-sectional	The files of pregnant women receiving concurrent care of chiropractic and nurse-midwifery were reviewed to examine the results of their FHR to determine possible adverse event following chiropractic visits resulting in SMT	The patients received care using the Webster Technique and Diversified Technique, characterised as HVLA SMT and combination of techniques	All FHR data were within normal limits, reflecting an indirect measure of safety to the unborn foetus and pregnant women following care with SMT.
Sadr et al. [332] (2012) Canada	To explore the experience of chiropractors and pregnant women having chiropractic care for LBP	Qualitative study	Pregnant patients in their second or third trimester, with LBP during pregnancy, and their treating chiropractors in separate interviews	Semistructured interviews	From both sets of interviews, 5 themes emerged: clinical presentations, the care provided and its effectiveness, chiropractor-patient communication, safety considerations, and self-care.

Note. CCBC = College of Chiropractors of British Columbia; COVID = corona virus disease; HVLA = high velocity, low amplitude NET = Neuro Emotional Technique; LBP = low back pain; PGP = pelvic girdle pain; MSK = musculoskeletal; PRO = patient-reported outcome; PBRN = practice-based research network PROMIS = Patient-Reported Outcomes Measurement Information System; RCT = randomised controlled trial; SD = standard deviation; SF-36 = Short Form 36; SMT = spinal manipulative therapy; SOT = Sacro Occipital Technique; SPD = symphysis pubis dysfunction; VSQ = visit-specific questionnaire; ICPA = International Chiropractic Pediatric Association; 1^0 = primary; 2^0 = secondary; 3^0 = tertiary; WOG = weeks of gestation.

Table 2.8i8. Summary Findings of Case Reports and Case Series Involving the Chiropractic Care of Pregnant Women

Reference & country	Study aim(s) or purpose	Clinical presentation or study of interest	Management protocol	Summary of findings
Fallon [265] (1996) USA	To describe the care of a 23-year-old at 10 WOG	The woman was referred by her obstetrician with complaints of right-sided mid-back pain radiating from the spine to the sternum	The patient received chiropractic HVLA SMT directed at the T6 vertebral level; the patient received care similarly on subsequent visits	The patient attended a total of 5 visits and was then released from care.
Ducar et al. [266] (2005) USA	To describe the care of a 32-year-old woman at 20 WOG	The woman presented with groin pain, pain with forward bending, and a positive long dorsal ligament test. She had a Quebec Task and Force Disability Scale questionnaire score of 122 and rated her pain as an 8/10 on a visual analog scale.	Active Release Technique, home relaxation exercises, patient education, and ergonomic training were provided over approximately 3 weeks (3 treatments)	The woman's Quebec disability score decreased to 62 from 122 and her pain NRS from 8/10 to 0/10.
Skaggs et al. [267] (2006) USA	To describe the care of a 22-year-old at 16 WOG	The woman presented with LBP, bilateral anterolateral thigh paresthesia, and groin pain of one month duration	Treatment was provided at 6 visits over a 6-week period where the patient underwent manual intervention, and exercise prescription. Active Release Technique (ART) was performed to the SIJ, quadratus lumborum muscles and iliopsoas muscles.	After 6 visits, the patient reported complete resolution of LBP and left lower extremity symptoms and a 90% improvement in the right thigh symptoms. At her one-year follow-up, the woman reported no further complications and the absence of pain.

Reference & country	Study aim(s) or purpose	Clinical presentation or study of interest	Management protocol	Summary of findings
Kruse et al. [268] (2007) USA	To describe the chiropractic treatment of a 26-year-old woman in her second trimester of pregnancy	The woman suffered from severe LBP that radiated to her hips bilaterally and to her right leg. She reported tingling down her right lower leg to the dorsum of her foot.	Treatment consisted of manual traction in the side-lying position using Cox flexion-distraction decompression modified for pregnancy	Relief was noted after the first visit, and complete resolution of her complaints after 8 visits.
Alcantara & Hamel [269] (2008) USA	To describe the chiropractic care of a 29-year-old woman	The woman presented with LBP	The patient was cared for with the Webster Technique, employing a drop-piece mechanism for the sacral adjustment	The patient's LBP resolved along with a successful vaginal birth at 40 WOG.
Thomas [270] (2008) USA	To describe the care of a 28-year-old at 37 WOG	The woman presented with a breeched foetus as determined via Leopold's maneuver by her midwife	Webster Technique	After 3 visits, the foetus assumed a breech to vertex position based on Leopold's maneuver as performed by her midwife.
Alcantara & Cossette [271] (2009) USA	To describe the care of a 24-year-old female at 32 WOG	The woman presented with long-standing medically diagnosed migraine headaches	Chiropractic care involved SMT and adjunctive therapies and the use of the Webster Technique	The results of care were symptom improvement and independence from medication.

Reference & country	Study aim(s) or purpose	Clinical presentation or study of interest	Management protocol	Summary of findings
Alcantara et al. [272] (2009) USA	To report on the successful collaboration of chiropractors and midwives in the care of a 26-yr-old in home-birth delivery with 3 midwives and her chiropractor	The woman experienced difficulty with her labour	With lack of cervical dilation, descent and diminished uterine contractions, along with decreased foetal heart tones at 23 hours of labour, the chiropractor applied the Webster Technique resulting in stronger and more frequent contractions with stabilised foetal heart tones. At 28 hours, the foetus was determined to be asynclitic. At 34 hours of labour, the attending chiropractor performed the psoas release followed by complete cervical dilation.	The labour progressed rapidly after the psoas release and a healthy baby girl was born.
Drobbin & Welsh [273] (2009) USA	To describe the care of a 41-year-old at 36 WOG	The woman presented with ultrasound-confirmed breech foetus with recommended Caesarean	Webster Technique	After 5 visits, the foetus turned from a longitudinal foetal lie to a longitudinal foetal lie and vertex presentation.
Hwang [274] (2009) USA	To describe the care of a 28-year-old at 32 WOG	The woman presented with sharp, stabbing pain starting at the left sacroiliac joint and radiating into her posterior left thigh	Chiropractic SMT using drop table	The patient experienced 50% relief from the frequency and intensity of pain within two weeks of care; a 90% improvement in function and decrease in pain by the 6th week.

Reference & country	Study aim(s) or purpose	Clinical presentation or study of interest	Management protocol	Summary of findings
Stone-McCoy & Sliwka [275] (2010) USA	To describe the care of a 37-year -old woman at 35 WOG	The woman presented with ultrasound-confirmed frank breech foetus	The woman received care with the Webster Technique, effleurage, and home exercises	After 5 Webster Technique adjustments, the foetus turned from a breech position to a vertex, head-down position.
Dashtkian & Whittle-Davis [276] (2011) USA	To describe the care of a 25-year-old woman who sought chiropractic care at 31 WOG	The woman sought care to avoid a Cesarean section due to breech presentation as confirmed by her Ob/Gyn	Webster Technique	The woman's baby shifted from the breech position to transverse after the first visit. After the second visit, the foetus shifted from transverse to vertex. The patient continued care thereafter due to pregnancy-related low back pain.
Abbot [277] (2012) USA	To describe the care of a 30-year-old woman at 34 WOG	The woman presented with a breech foetus as confirmed by ultrasound; previous pregnancy was Caesarean section	Webster Technique was applied using an Activator Adjusting Instrument. Trigger point therapy was also performed according to Webster protocol.	After 3 visits, the foetus moved from a breech position to a normal vertex (head-down) position.
Ferguson & Kulesza [278] (2012) USA	To describe the care of a 35-yr-old at 30 WOG	Doula confirmed transverse breech	Webster Technique	After 4 visits and receiving care with the Webster/drop table, the foetus turned to vertex.
Heagy & Wrubel [279] (2012) USA	To describe the care of a 28-year-old with twin pregnancies presenting at 30 WOG	The woman presented with a breech presentation as determined by her obstetrician	Gonstead and Webster Technique	The woman attended 5 visits over 3 weeks. Her obstetrician confirmed that the involved twin was in cephalic lie.

Reference & country	Study aim(s) or purpose	Clinical presentation or study of interest	Management protocol	Summary of findings
Morton [280] (2012) USA	To describe the care of a 31-year-old woman at 16 WOG; the woman had a history of Systemic Lupus Erythematosus	Presented to a chiropractor for treatment of occipital headache; immediately after receiving treatment, the subject noted severe right-sided anterior neck pain, and rapidly developed ipsilateral Horner's syndrome. Magnetic resonance imaging (MRI) revealed extensive dissection of the right internal carotid artery. The subject was treated with intravenous heparin and subsequently low-molecular weight heparin.	Not described	Four days after the onset of neurological symptoms, intrauterine foetal demise was noted. The patient was subsequently anticoagulated with warfarin for 6 months. Follow-up MRI 6 months later revealed a focal false aneurysm of the right internal carotid artery. The Horner's syndrome persists one year after the initial presentation.
Peterson [281] (2012) USA	To describe the care of a 32-year-old woman at 24 WOG	The woman presented with persistent heartburn that was treated with Zantac® and Tums®, daily	Neuro Emotional Technique (NET)	At her final evaluation, the woman was symptom-free and free of medications to control her heartburn; the heartburn did not return for the remainder of her pregnancy.
Herring & Mullin [282] (2012) USA	To present the care of 38-year-old multigravid woman and review the atypical presentation of deep vein thrombosis (DVT) in pregnancy	The woman complained of radicular leg pain imitating sciatic neuropathy	No treatment provided; the patient was immediately referred to a local vascular diagnostic centre to rule out thrombosis. A diagnosis of thrombus of the right lower extremity, including possible acute deep vein thrombosis from the common femoral vein into the calf veins was made.	The patient was immediately admitted into the hospital for emergency intervention. The patient went on to have a successful delivery without complications at 40 WOG.

Reference & country	Study aim(s) or purpose	Clinical presentation or study of interest	Management protocol	Summary of findings
Stone-McCoy et al. [283] (2012) USA	To describe the care of a 33-year-old expectant mother at 8 months gestation	The woman presented with a breech presentation as noted by her midwife	Webster Technique	The woman's progress was monitored by her midwife; the foetus was no longer breech after 9 visits and the mother delivered a healthy baby.
Rocker [284] (2013) USA	To describe the care of a 23-year-old primigravida	The woman presented with a breech presentation and sacroiliac pain	Webster Technique	The woman attended a total of 7 visits over a 3 1/2-week period. The patient's sacroiliac pain NRS reduced from 8/10 to 3/10. However, her breech presentation remained unchanged. At 37 WOG, her midwife detected vaginal bleeding and reduced fundal height, resulting in hospitalisation and a diagnosis of oligohydramnios. The woman delivered by emergency Cesarean.
Clark & Alcantara [285] (2013) USA	To describe the chiropractic care of a 24-year-old at 37 WOG	The woman presented with a chief complaint of LBP and left leg pain and the desire for a natural childbirth; the breech foetus was diagnosed at 36 WOG via ultrasound imaging	Chiropractic care administered over 2 visits utilised the Webster Technique, resulting in the baby assuming the vertex position as imaged by ultrasound	The woman continued care with the Webster Technique to address pelvic bowl dysfunctions over a total of 9 visits with positive outcomes.
Afshar [286] (2014) USA	To describe the care of a 28-year-old female presented at 36 WOG	The woman presented with a transverse position foetus as confirmed with ultrasound by her Ob/Gyn	Webster Technique	After one session with the Webster Technique, the foetus was confirmed to have moved from transverse position to vertex position via ultrasound.

Reference & country	Study aim(s) or purpose	Clinical presentation or study of interest	Management protocol	Summary of findings
Edwards & Alcantara [287] (2014) USA	To describe the care of a 32-year-old at 32WOG	The patient presented with ultrasound imaging-confirmed breech foetal positioning and placenta previa	The patient was cared for with a combination of Diversified and Webster Techniques	Comparative ultrasound imaging confirmed the breeched foetus assumed a vertex position with the placenta migrating to more than 3 cm away from the os of the cervix.
Drobbin & La Rosa [288] (2015) USA	To describe the care of a 31-year-old at 30 WOG	The woman presented with a transverse breech foetus as determined by her obstetrician	Webster Technique	The patient's care consisted of a total of 24 visits. After 7 visits over 3 weeks, the woman's midwife confirmed a vertex presentation. The woman went on to have a natural home birth.
Edwards & Alcantara [289] (2015) USA	To describe the chiropractic care of a 30-year-old at 34 WOG	The woman presented with her baby in a transverse lie malpresentation	The patient was cared for over a 6-week period. She received care using Diversified and Thompson Techniques along with Webster Technique.	The woman's baby converted to the vertex position and delivered naturally.
Edwards & Alcantara [290] (2015) USA	To describe the care of a 28-year-old woman at 14 WOG	The woman presented with migraine headaches, hypothyroidism, and tachycardia along with a desire to have a natural childbirth	The patient was cared for with the Gonstead Technique, Thompson Drop, and Webster Technique	She attended care for a total of 33 visits over a 7-month period. The result was a successful trial of labour at 40 weeks plus 4 days and delivery of a healthy baby girl.
Edwards & Alcantara [291] (2015) USA	To describe the chiropractic care of a 28-year-old at 33 WOG	The woman presented with complaints of tingling and numbness in the second-through-fourth fingers on her right hand, LBP, and swelling in her right leg and a history of endometriosis, ovarian cysts, and two miscarriages	The patient was scheduled twice a week for 9 visits. Care consisted of HVLA SMT to sites of subluxations	The patient's presenting complaints resolved with a trial of care.

Reference & country	Study aim(s) or purpose	Clinical presentation or study of interest	Management protocol	Summary of findings
Bernard & Tuchin [292] (2016) Australia	To describe chiropractic care of a pregnant 35-year-old at 32 WOG	The woman suffered from severe pregnancy-related lumbopelvic pain and leg pain	The woman received spinal manipulation, soft tissue therapy, exercises, and ergonomic advice in 13 visits over 6 weeks	The woman's LBP reduced from 7 to 2 on a 0-10 numeric pain scale rating. Functional activities were reported such as walking, sitting, and traveling comfortably in a car had improved.
Edwards & Alcantara [293] (2015) USA	To describe the care of a 24-yr-old woman at 26 WOG	The woman presented with severe neck pain extending to both shoulders, migraine headaches, and diplopia	The patient was cared for with multiple techniques: Ortho-Bionomy, flexion-extension distraction, Thompson and Diversified dDrop Table Techniques, Gonstead and Logan basic Techniques	The woman attended a total of 14 visits in 5 weeks and was scheduled for a Caesarean-section delivery at 37 weeks. Three days after her final visit, the patient's water broke, and she successfully delivered vaginally at 30 WOG.
Cherry & Wilson [294] (2016) USA	A 27-year-old female at 35 WOG	The woman presented with a breech foetal position and problems with pelvic alignment	Webster and Logan Techniques	After 3 visits, the woman's baby reverted to a vertex as confirmed via US by her obstetrician.
Spear & Alcantara [295] (2016) USA	To describe the care of a 37-year-old woman at 35 WOG	The woman presented with right hip and pelvic pain with ultrasound imagining-determined frank breech pregnancy	The patient received care with the Webster Technique	Over 3 visits spanning 5 days, the foetus reverted to vertex and the woman gave birth vaginally.
Spear & Alcantara [296] (2016) USA	To describe the chiropractic care of a 28-year- at 29 WOG	The woman presented with complaints of chronic migraines, neck and LBP, along with ultrasound-confirmed placenta previa	The patient was cared for with Diversified and Drop Table Technique	Following a total of 6 visits over a 6-week period, the patient's presenting complaints resolved and had a successful VBAC.
Drobbin & McClain [297] (2017) USA	A 35-year-old at 34 WOG	The woman presented with a frank breech as determined via ultrasound imaging by her obstetrician	The Webster and Diversified Techniques	The patient underwent 4 adjustments before reporting vertex positioning of the foetus as confirmed by her obstetrician via ultrasound.

Reference & country	Study aim(s) or purpose	Clinical presentation or study of interest	Management protocol	Summary of findings
Edwards & Alcantara [298] (2017) USA	To describe the care of a 28-year-old at 21 WOG	The woman presented with pregnancy-related MSK complaints (LBP) and a history of shoulder pain and neck pain secondary to scoliosis	The patient received care using a combination of Gonstead, Diversified, and Webster Techniques utilising drop table to correct the sacral malposition	Each visit resulted in a reduction of her pain NRS by 2 points relative to her baseline rating. After completing 13 visits over 6 weeks of care, her pain NRS reduced from 6/10 to 2/10. Her PROMIS-29 quality of life measures improved in the prenatal period but not in the post-partum period compared to baseline measures.
Edwards & Alcantara [299] (2017) USA	To describe the care of a 32-year-old woman	The woman presented with triplets and complaints of LBP, lower extremity swelling, and acid reflux	The patient was cared for with Logan Basic, Diversified Technique, and Webster Technique	The patient was able to carry her pregnancy into her 3rd trimester with the babies born by Caesarean.
Falk & Stinson [300] (2017) USA	A 26-year-old female in her 27 WOG with her second child	The woman presented with LBP and ultrasound confirmed breech foetus	Webster Technique	After 29 visits, the foetus moved from a breech position to a normal vertex position as confirmed by ultrasound at 39 weeks WOG. The woman had a natural vaginal birth with no complications.
Rashid et al. [301] (2017) New Zealand	To the care of a 29-year-old at 32 WOG	The woman was medically diagnosed with placental insufficiency and foetal growth restriction	The woman attended care over a 3-week period, using Thompson Terminal Point Technique in combination with Diversified SMT	Immediately following the initial visit there were improvements in placental resistance, with normalised FGR evident on Doppler ultrasound at 36 WOG.
Shtulman & Alcantara [302] (2017) USA	A 38-year-old in her 30th WOG	The patient presented with twins in a footling breech presentation	Webster Technique and Activator Instrument	The attended care over a 2-week period consisting of 5 patient visits. Both foetuses innately turned to vertex, facilitating a successful vaginal birth.

Reference & country	Study aim(s) or purpose	Clinical presentation or study of interest	Management protocol	Summary of findings
Stone-McCoy & Speller [303] (2017) USA	To review the care of a 39-year-old woman	The woman was seeking a vaginal birth after three Caesarean births (VBAC)	The woman received care using the Webster and Diversified Techniques	A total of 14 visits over an 8-week period was scheduled prior to the patient giving birth. The patient made significant improvement and was able to have a vaginal birth (VBAC).
Vanderslice & Beachum [304] (2017) USA	To describe the chiropractic care of 28-year-old female	The woman was under wellness care with her second pregnancy	The patient was cared for with Diversified Technique and recommended to use, a pelvic compression belt	The woman attended a total of 32 visits prior to the conception of her second child. Her second birth experience was both shorter and easier compared to her first birth.
Drobbin & Zink [305] (2018) USA	A 33-year-old nulliparous female at 29 WOG	The woman presented with a frank breech foetus as confirmed by ultrasound by her obstetrician	Webster and Diversified Techniques	The patient attended 9 visits before her obstetrician confirmed vertex positioning of her baby. The patient went on to have a successful, natural, vaginal birth with no reported complications.
Spear & Alcantara [306] (2018) USA	A 34-year-old woman at 16 WOG	The woman presented with twin girls and a chief complaint of left sacroiliac, left posterior hip, and left buttock pain of 3 weeks duration. The woman also indicated a desire to have a natural childbirth since giving a Caesarean birth 2 years prior	Network Spinal Analysis	The woman attended 18 visits over a period of 19 weeks. The woman's presenting complaints abated and at almost 36 WOG, she successfully delivered via VBAC.
Porter & Alcantara [307] (2019) USA	To discuss the chiropractic care of a 24-year-old 10 WOG	The woman presented with complaints of LBP, upper back pain and disturbed sleep	The patient was cared for with the Webster Technique and Thompson Technique	The woman attended 16 visits over 3 months. The woman was able to return to work without pain and elected to continue her care throughout her pregnancy.

Reference & country	Study aim(s) or purpose	Clinical presentation or study of interest	Management protocol	Summary of findings
Shulman et al. [308] (2019) USA	To describe the chiropractic care of a 28-year-old at 20 WOG	The woman presented with symphysis pubic dysfunction	The patient received care consisting of the Activator Protocol to address subluxations at the coccyx and right inferior pubic bone, and toggle recoil to address a C1 subluxation and drop table (Webster Technique) to address a right sacral posteriority	The patient attended 35 visits over a period of 8 months with positive outcomes.
Snyder & Alcantara [309] (2019) USA	To describe the care of a 28-year-old at 31 WOG	The woman presented with pain localised to the L5/S1 level and right sacroiliac joint	The woman received care with the Webster Technique scheduled at once week for 3 weeks	The woman's LBP resolved with improved ROM.
Stone-McCoy & McNeill [310] (2019) USA	To describe the care of a 28-year-old woman at 39 WOG	The woman presented with a transverse lie foetus	Webster and Thompson Techniques	The patient experienced a natural VBAC with no complications. Ultrasound imaging confirmed the foetus moved from a transverse lie to a vertex position.
Urban & Alcantara [311] (2019) USA	To describe the care of a 24-year-old woman in her 12 WOG	The woman had complaints of LBP concomitant with placenta previa	Diversified and Webster Technique were utilised to address vertebral subluxations over a 4-week period	After one week of care, her LBP had decreased significantly. By the end of the fourth week, the woman reported complete resolution of both LBP and placenta previa, as confirmed by ultrasound.
Marjerrison & Alcantara [312] (2019) USA	To describe the care of a 36-year-old at 33 WOG	The woman had presented with hip pain and LBP along with escalating pubic pain following a fall	The woman was cared for with Diversified Technique and Drop Table in conjunction with the Webster Technique	The woman attended a total of 10 visits over a 4-week period. She experienced relief with care and delivered a healthy baby.

Reference & country	Study aim(s) or purpose	Clinical presentation or study of interest	Management protocol	Summary of findings
Stone-McCoy & White [313] (2020) USA	A 33-year-old expectant mother presented for care at 8 months pregnant.	The woman presented with a breech foetus	Webster Technique	After 9 sessions, the baby was determined to be in the vertex position. The position change was determined by the midwife after the 9th visit and the woman had a normal, vaginal delivery of her child.
Poirier & Loranger [314] (2022) USA	A 30-year-old woman presented for care at 39 weeks pregnant	The woman presented with a frank breech presentation	Webster Technique	Following the second visit, the woman noted movement with her baby with correction to vertex position as noted by ultrasound imaging by her obstetrician.
Swenson & Acevedo [315] (2022) USA	A 40-year-old woman presented for care at 33 weeks gestation.	The woman presented for care with the desire to have a natural childbirth	Webster Technique and Diversified Technique	The woman attended a total of 10 visits resulting in a natural childbirth after 2 Caesarean births.
Rabe & Emary [316] (2023) USA	A 29-year-old pregnant woman presented for care at 5 months pregnant.	The woman presented with a chief complaint of bilateral neck and shoulder pain accompanied by right upper limb paresthesia and intermittent hand weakness and diagnosed with thoracic outlet syndrome (TOS)	Based on a review of the literature, a trial of conservative care (physical therapy/chiropractic, orthopaedic braces, and taping) was recommended for the duration of her pregnancy and for 6 months after	The case report was meant to showcase evidence-based practice and the use of the research literature to inform clinical care. No outcomes were described for the patient.

Reference & country	Study aim(s) or purpose	Clinical presentation or study of interest	Management protocol	Summary of findings
Schwab et al. [317] (2023) USA	A pregnant woman at 26.4 weeks gestation.	The woman had a chief complaint of severe pelvic pain and crepitus in the pubic symphysis region	The Webster Technique and the use of the Activator Instrument along with Diversified Technique and left psoas muscle release was performed on the patient	Immediately following the pubic bone adjustment, the patient reported immediate relief in her pubic pain. Following the psoas release, the patient reported that standing was much easier and less painful to perform.
Guadagnino [318] (1999) USA	A retrospective file review of 12 pregnant women aged 14 to 34 years presenting for care over a 2-yr period	All complained of low back pain attributed to their pregnancy	Each patient was treated with SMT at a treatment frequency of 2-3 times per week until their delivery. Based upon their examination, a technique (Diversified, SOT, or Gonstead knee chest) was designated as the care approach. Prior to manipulation/mobilisation, each patient received manual axial distraction and soft tissue trigger point therapy. Six patients also received “hot packs” to their low back pain area.	The overall group mean pain NRS score decreased from 7.58 at initial presentation to 3.71 immediately after care, 4.83 the following day and 4.25 under maintenance care.

Reference & country	Study aim(s) or purpose	Clinical presentation or study of interest	Management protocol	Summary of findings
Kunau [319] (1999) USA	A case series of 14 pregnant women presenting with a variety of presenting complaints, cared for with chiropractic	The pregnant women had an average age of 31.3 years (*SD* = 7.70) and presented at a mean of 17.2 WOG (*SD* = 12.8). The women presented with a variety of complaints consisting mostly of breech foetuses, pain complaints involving the spine and pelvis and extremities, as well headaches, sexual abuse, and meralgia paresthetica.	The women received care with the Webster Technique to address their breech presentations and the remainder received Diversified Technique and adjunctive therapies as appropriate	This case series showcased the unique circumstances of each pregnant woman and the adaptation of chiropractic care provided with respect to the myriad of presenting complaints.
Lisi [320] (2006) USA	A retrospective file review to examine the response to care in 17 pregnant women	The files of 17 pregnant women presenting with LBP were reviewed with respect to their pain NRS ratings	Active care consisted of reassurance and education, advice on body mechanics, and exercise instruction. Passive treatments were myofascial release, manual joint mobilisation, and HVLA SMT	The overall group mean pain NRS score decreased from 5.9 (range 2-10) at initial presentation to 1.5 (range 0-5) at termination of care. 16 of 17 (94.1%) cases demonstrated clinically important improvement. The average time to initial clinically important pain relief was 4.5 days (range 0-13) after initial presentation, and the average number of visits undergone up to that point was 1.8 (range 1-5). No adverse effects were reported in any of the 17 cases.
Andrews et al. [321] (2008) United Kingdom	To assess the usefulness of a validated survey instrument (Measure Your Own Medical Outcome Profile [MYMOP2]) and a non-validated survey instrument (Chiropractor's Assessment and Treatment Tool [CATT)	A retrospective file review of three women's experiences with their chiropractic care with clinical presentations of pregnancy related PGP	Sacro-Occipital technique (SOT)	This pilot study demonstrated that the MYMOP2 and CATT demonstrated a consistency of response for recording and evaluating both women's experiences and chiropractors' findings.

Reference & country	Study aim(s) or purpose	Clinical presentation or study of interest	Management protocol	Summary of findings
Phillips [322] (2010) USA	To examine benefits of a combination of techniques in pregnant women with musculoskeletal and radicular pain	3 of the 4 women had a mean age of 34.33 years ((*SD* = 2.52) with all women presenting at a mean of 30.25 WOG (*SD* = 5.06). All women presented with LBP with one also presented with neck stiffness, bilateral hip pain, thyroiditis, and headaches.	The women were cared for with a combination of techniques consisting of SMT, Craniosacral Therapy (CST), and Dynamic Body Balancing Techniques (DBB)	The women responded well to treatment with respect to their MSK and radicular complaints.
Rubin [323] (2012) USA	To describe the chiropractic care of three pregnant women	The only information provided were the women presented with breech foetuses	The women were cared for with the Webster Technique utilising Activator Methods to address the sacral subluxation	With subject A, the baby turned after the 2nd session with Webster. Subject B responded successfully in 3 visits. Subject C required 4 sessions for correction of the breech foetus.
Kadin [324] (2010) USA	A 49-year-old and a 28-year-old with twin pregnancies	Both women had twin breech foetuses	Webster Technique, Diversified, and Thompson Techniques	Patient 1: both baby A and baby B assumed the vertex position as confirmed by ultrasound after 14 sessions over a 7 week period. Patient 2: both babies were vertex after the 10th session over a 7-week period and confirmed by ultrasound. Both pregnancies remained vertex throughout their respective terms. Both women also stated improved function and decreased pain throughout the remainder of their pregnancies.

Reference & country	Study aim(s) or purpose	Clinical presentation or study of interest	Management protocol	Summary of findings
Van Loon [325] (2010) USA	To describe the response to care in 3 pregnant women	Three women presented with rib pain. The women presented at 33, 34 and 24 WOG. Age of the women was not provided	The women received care described as Diversified Technique with soft tissue therapy, and the use of an external support involving an Ace wrap applied to the lower rib cage	The use of the Ace wrap in conjunction with chiropractic care was an inexpensive solution to women presenting with rib pain.
Alcantara et al. [326] (2011) USA	To describe the results with the Webster Technique in 5 women with breech presentations	4 of the women presented at a mean WOG of 36.6 weeks (*SD* = 2.43). 2 women were described as 21 years of age; 3 women were described as presenting with breech foetuses, one as transverse breech, and another as oblique right transverse breech.	Webster Technique	All women responded favourably with correction of their breech presentations.
Howell [327] (2012) USA	To review the chiropractic and rehabilitative care of 2 pregnant women with symphysis pubis dysfunction (SPD)	Patient 1 was a 35-year-old and at 30 WOG with severe left-sided SPD and low back pain. Patient 2 was a 33-year-old female also 30 WOG presenting with right-sided SPD and sacroiliac pain.	Care included soft tissue therapy, pregnancy support belt, side-lying mobilisations, pelvic SOT blocks, and instrument-assisted pubic symphysis adjustments. Home advice included ice, staying active, moving as a unit, stretching, use of a pillow between the knees while sleeping, regular breaks from sitting, and pelvic floor (Kegel) exercises.	Both patients reported some relief with treatment and home care. Post-partum, rehabilitation exercises were prescribed to restore muscular endurance, control, and pelvic stability. On long-term follow-up, the 35-year-old reported no pubic symphysis pain, but some low back pain secondary to a subsequent knee injury. The 33-year-old reported being mostly pain-free with a rare exacerbation of her pubic symphysis.

Reference & country	Study aim(s) or purpose	Clinical presentation or study of interest	Management protocol	Summary of findings
Alcantara & Ohm [328] (2013) USA	To assess the quality of life of 6 pregnant women (average age = 33.3) presenting at an average parity of 0.33 (range 0-1) and at a mean of 20 WOG	The women indicated suffering from neck pain (*n* = 1), leg pain (*n* = 1), low back pain (*n* = 2), low back pain and upper extremity/shoulder pain (*n* = 1), and wellness care (*n* = 3)	Chiropractic care – nondescript	In 4 of the 6 women, improvements in various domains of quality of life. Interestingly, pain interference was observed as the most common improvement in a majority of the patients, along with fear and anxiety. 2 patients demonstrated a decrement in a majority of QoL domains.
Draper et al. [329] (2019) USA	To describe the response to chiropractic care in 2 women suffering from LBP	2 pregnant women presented for care with two different clinical and varying presentations of pregnancy-related LBP	Chiropractic SMT and a taping protocol	In both cases, the addition of taping applied to the lumbosacral and/or abdominal area decreased the pain NRS from 9-10 (out of 10) to 4 or less.
Mulcahy & Mayo [330] (2019) USA	To describe the care of a 40-year-old woman at 36 WOG and a 30-year-old woman at 30 WOG	Both women were diagnosed with OB-confirmed breech foetus	Both women received care with the Webster technique over a period of 3 weeks and the other with 6 visits	Ultrasound confirmation at an OB's office confirmed vertex foetal position for both women.
Shelly & Blum [331] (2023) USA	Retrospective case series study involved 103 pregnant women age range 21-32 years who were seen at a chiropractic clinic from 1979-1983	Patients were evaluated via SOT diagnostic protocol, which included the SOT arm fossa test, increased unilateral or bilateral iliopsoas tension, palpation for pelvic torsion, leg length differentials, and Moiré contour photography	Sacro Occipital Technique	Prior to delivery, 83 of 98 women demonstrating a positive Arm Fossa Test (AFT) were negative following SOT Category II blocking. A negative AFT testing was associated with reduction or elimination of pelvic or inguinal pain, improvement of muscle strength, and ability to rise from seated position as well as lift or carry objects, and improved sleeping and restfulness.

Note. ActRelTec = active release technique; CATT = Chiropractor's Assessment and Treatment Tool; CST = Craniosacral Therapy; DBB = Dynamic Body Balancing Techniques; DVT = deep vein thrombosis; HVLA = high velocity, low amplitude; LBP = low back pain; MRI =

magnetic resonance imaging; MSK = musculoskeletal; MYMOP2 = Measure Your Own Medical Outcome Profile; NET = neuro emotional technique; NRS = numeric rating scale; OB = obstetrician; Ob/Gyn = obstetrician/gynaecologist; PROMIS = Patient-Reported Outcomes Measurement Information System; QoL = quality of life; ROM = range of motion; SD = standard deviation; SOT = Sacro Occipital Technique; SMT = spinal manipulative therapy; SIJ = sacro-iliac joint; USA = United States of America; VBAC = vaginal birth after Caesarean; WOG = weeks of gestation.

Table 2.9. Summary Findings of the Commentaries

Reference & country	Study aim(s) or purpose	Commentaries
Wiles [333] (1980) Canada	To review the neurological and pathophysiological aspects of pregnancy and the role of chiropractic	Chiropractors should be aware that due to the close relationship of efferent and afferent fibres serving pelvic organs, vessels, and glans may result in a number of reflexes (i.e., viscero-somatic reflexes) resulting in diverse and unpredictable effects that challenge the chiropractic examination and diagnosis. The intent of chiropractic care is to decrease extraneous MSK stress and to assist the body to cope with unavailable weight bearing stress. The chiropractor should be aware of contraindication to chiropractic care such as excessive vaginal bleeding (at any time during pregnancy), premature labour, placenta previa, placenta abruptio, ectopic pregnancy, and ruptured amniotic membranes without labour.
Gibbons et al. [46] (1982) USA	A historical account on the practice of obstetrics by chiropractors	Reports that the developer of chiropractic, Daniel David Palmer, may have been the first accoucheur and that chiropractors should be able to provide primary pregnancy care. Between 1930-1960 several schools (i.e., Carver College, Logan College, Western States College, and National College) taught obstetrics. By 1952, California, Oklahoma and Oregon allowed obstetrics as a chiropractic specialty but eventually lost these rights through adverse malpractice cases and negative rulings by the State Attorney General in those states. In 1980, Wiles [109] commented that chiropractic moved away from the practice of obstetrics for political reasons rather than a reflection of chiropractic's limitations.
Fligg [334] (1986) USA	A commentary to review the important treatment considerations associated with biomechanical changes in pregnancy	In the first trimester, the main consideration is a history of miscarriage or spotting. By the fifth month of gestation, alternative patient positioning must be considered such as the knee chest and seated adjusting procedures. The psoas and piriformis deserve attention with stretching. For adjustments to the SIJ in a side posture position, the chiropractor should be cognisant of the foetus' position; use less hip flexion; position the women further away from the chiropractor to allow for more abdominal support.

Reference & country	Study aim(s) or purpose	Commentaries
Penna [335] (1989) USA	The author outlines the maternal changes that occur during pregnancy to educate patients and their medical providers on the safety and appropriateness of chiropractic care	Cardiovascular changes include maternal blood volume, heart rate, stroke volume and cardiac output. Exercise can cause increase in cardiac output, heart rate and oxygen consumption and cause murmurs and accentuates heart sounds. Biomechanical changes occur as a result of weight gain and enlarged uterus that shifts the center of gravity with progressive lumbar lordosis. The result is MSK pain (LBP/PGP) along with tension headaches and a waddling gait attributed to relaxin and other hormones. The use of electrical stimulation and ultrasound may cause uterine contraction and contraindicated. If there's spotting, its recommended to use non-force techniques such as SOT blocking. Avoid torquing the lumbopelvic and incorporate trigger point therapy, exercise and stretching. By the 3rd trimester, care should be provided to address MSK pain with appropriate modification of technique.
Esch & Zachman [336] (1991) USA	To provide a commentary on spinal adjusting procedures for pregnant women	Prior to significant weight gain, the aim of care for the pregnant woman is postural training, abdominal strengthening, and low back stabilisation. With a growing foetus, there should be accommodation of the woman's abdomen with the use of pillows or a drop piece. Spinal adjustments should apply less force using low force techniques such as the Logan Technique. Recommendations were made to address pubic symphysis dysfunction and sacral dysfunction as well as the use of spinal adjustments during labour and the use of trigger point therapy directed to the psoas muscles.
Troyanovich [337] (1993) USA	To identify the most common postural displacements of pregnancy and provide a rational approach to strengthening the postural muscles	Postural alterations in pregnancy are due to weight gain, increase in blood volume and maternal storage of fat and protein. Structural alterations include forward flexion of the pelvis on the heads of the femur and increase in the sacral base angle and hyperlordosis of the lumbar spine. The author recommends "mirror image" exercises for anterior translation and flexion of the skull relative to the thorax and the use of pelvic rock exercise, partial stomach crunches and squats to strengthen the quadriceps muscles.
Burton [338] (1997) USA	Advocacy for the addition of the chiropractor in prenatal care	The chiropractor should assess the spine and provide advice on lifestyle changes along with the use laboratory analysis (i.e., blood typing) during the antenatal period. Following conception, the chiropractor can provide relief of LBP, monitor the woman and order routine laboratory tests and provide advice on exercise and nutrition.
Thompson [339] (1997) USA	An outline of the benefits of chiropractic care during pregnancy	In addition to alleviating pregnancy related LBP, the chiropractor can provide advice on the use of exercise, nutrition and perform standard pre-conception work-up (i.e., ergonomic and posture advice).

Reference & country	Study aim(s) or purpose	Commentaries
Cohen [340] (1997) USA	A review of the changes that occur during pregnancy and the protocol to address common presenting complaints	Structural changes include increased sacral base angle, hypermobility of the sacro-iliac joint (SIJ), sacrococcygeal and pubic joints, hyper pronation of the feet, shift in weight-bearing toward the heel, altered gait, muscle weakness and compromised coordination and compensatory changes in the thoracic spina and head and neck. Care approaches should address the compensatory tightening of the gluteus muscles due to relaxation of the ligaments supporting the SIJs. Posterior weight bearing results in antero-superior (AS) ilium subluxation. The thoracic spine is stressed, and a thoracic release technique involving low forces should be applied.
Bartol [341] (1997) USA	To review the factors that must be considered in SMT during pregnancy	The author advised that the chiropractor should ensure mobility of the SIJ in pregnant women in preparation for labour and delivery. Spinal adjustments should be "'light' in force with modifications of the side-posture patient position with less flexion at the hip, positioning the chiropractor away from the patient and placing a small pillow between the abdomens to support the weight of the foetus. An alternative to mobilising the SIJs is to position the patient in a side posture position and circumduction of the hips by adduction, extension, and flexion at the hip joint. The author also advised on how to correct an anterior listhesis, rotation of the fifth lumbar vertebrae, osteitis pubis and other spinal adjusting techniques.
Carlidge [342] (1997) USA	To provide a perspective of a nurse-trained chiropractor on the McTimoney-Corley technique for pregnancy care	Pregnancy care should maintain balance and structure during pregnancy. For example, the author advised to keep the pelvis balanced during delivery and provided general advice about lifting and holding the baby. The effects of relaxin were acknowledged and may affect skeletal structures with long term effects due to biomechanical compensations. The author promoted that McTimoney chiropractic provides a gentle approach to pregnancy care.
Krantz [343] (2016) USA	Commentary to address the when, why, and safety of chiropractic pregnancy care	The author advocated that chiropractic care should begin prior to conception and continue to the postpartum period to allow for free nerve flow. In the 1st trimester – headaches and ligament pain are common. In the 2nd trimester, LBP begins which continues in the 3rd trimester along with sciatica and numbness of the hands and arms. The author recommended that a drop piece be used to accommodate the growing foetus and for patient comfort and Webster Technique applied to address breech presentations. Postpartum care was recommended to facilitate the spine and pelvis to return to its normal state.

Reference & country	Study aim(s) or purpose	Commentaries
Ohm [344] (2001) USA	Advocacy for collaboration between chiropractors and midwives	The author argued for collaboration between chiropractors and midwives. Both professions trust the inner wisdom of the body, support and commitment for noninvasive procedures and offer personal individualised care. The use of the Webster Technique by chiropractors provides a reason for midwives towards collaboration as the technique optimises for natural delivery.
Andrew [345] (2002) United Kingdom	Advocacy from midwife-chiropractor for chiropractic in pregnancy directed to midwives	The author advocated on the benefits of chiropractic care during pregnancy based on the author's clinical experience. For prolonged/delayed labour, SMT to the pelvis facilitates birth along with cranial work to ease the baby's distress. Addressing pelvic dysfunction and restoration of pelvic alignment has an effect on foetal positioning with the Webster technique along with addressing LBP/PGP. The use of pillows and table drop piece should be applied to accommodate the growing foetus and ensure the woman's comfort. Use of gentle SMT and exercise /stretching were advised along with patient education on posture and activities of daily living as well as ergonomic advice at work and home. The author noted that chiropractors should be aware of possible contraindications on the use of SMT during pregnancy.
Phillips [346] (2003) USA	Advocacy for the care of pregnant women	The author commented on technique adaptations to the care of pregnant women that included the use of proper tables to accommodate the growing foetus, the limitations of the use of electrical modalities, care approaches to the pelvic bowl and the lower extremities and the use of proper body mechanics when performing activities of daily living during pregnancy.
DiMarco [347] (2003) USA	To educate chiropractors and other healthcare professionals with clinical knowledge to treat LBP of pregnant and postpartum patient with a review of the biomechanics and structural components involved in the development of postural changes and LBP and the clinically relevant anatomy, and neuromusculoskeletal disorders encountered during pregnancy	According to the author, changes in hormonal (i.e., progesterone, estrogen, and relaxin) concentrations results in compromised structural integrity and alteration in posture (i.e., increased lumbar lordosis) and gait patterns. Changes in load distribution places excessive pressure on spinal structures. The pelvic girdle undergoes metamorphosis during the gravid state as the pubic symphysis relaxes and widens. Spinal adjustments should not compromise the health of the foetus and the patient's comfort. Prone patient positioning should be considered for the patient's comfort and the left lateral decubitus and seated position are recommended when applying SMT. Gentle non-force techniques are best. The author provided a list of contraindications to SMT.

Reference & country	Study aim(s) or purpose	Commentaries
Ohm [348] (2004) USA	Advocacy for collaboration between chiropractors and midwives based on shared clinical and philosophical framework for pregnancy care	Collaboration for both professions based on a trust of the inner wisdom of the body, support and commitment for noninvasive procedures and personalised patient-centred care.
Ohm [349] (2005) USA	An article to warn about the neuro toxicity of mercury for both mother and child	The author indicated the presence of mercury in a number of vaccines and can cause potential harm for both mother and foetus. For example, thimerosal as a preservative in vaccine, mercury in the influenza vaccine and in RhoGAM.
Ursprung et al. [350] (2006) USA	To discuss the biological effects of low-dose ionising radiation and the use of plain film radiography in pregnancy	According to the author, foetal radiation effects depend on dose and foetal gestational age. During the preimplantation age, radiation is an all-or-nothing response and with kill the foetus or not. After 9 days of gestation, the foetus responds to radiation much like the adult human. Radiation during organogenesis results in growth retardation with doses ranging from 100 mSv (10 rad [0.1 Gy]) to 200 mSv (20 rad [0.2 Gy]) at 8 weeks gestation resulting in congenital anomalies. A minimum dose of 10 mSv (1 rad [0.01 Gy]) to the foetus during the last trimester of pregnancy increases the risk of childhood leukemia by 40% and dose of 10 mSv (1 rad [0.01 Gy]) at any stage of pregnancy increases the risk of childhood leukemia by a multiple of 1.5.
Shaw [351] (2007) USA	To advocate for pregnancy care to avoid or relieve LBP and prepare a woman's back and pelvis for the stresses of labour and delivery	The author commented that a gentle, noninvasive option for relief of pregnancy-related back and neck pain include chiropractic care by balancing the hips and pelvis. The care provided may involve gentle procedures such as gentle stretching and the use of the Activator instrument and the use of proper chiropractic tables such as a high-lo table to accommodate the protruding abdomen later in the woman's pregnancy.
Zerdecki & Passmore [352] (2008) USA	To review the chiropractic approach to pregnant women	The authors reviewed the sources of LBP as a result of hormonal changes on the biomechanics of the spine during pregnancy, the effects of lumbar disc herniations, and the effects of an anterior pelvic rotation. In addition, the authors discussed peripheral nerve entrapments, headaches, transient osteoporosis and pubic pain. The association between pain and depression and pregnancy were also discussed as well as the appropriate treatments and contraindications to chiropractic SMT.

Reference & country	Study aim(s) or purpose	Commentaries
Andrews [353] (2010) USA	To describe non-optimal foetal positioning in the chiropractic context	A woman presenting with non-optimal foetal positioning may show signs of pelvic asymmetry, muscular imbalances, postural influences, delayed or disrupted neuromuscular control/functioning or inhibition. The author noted that form closure and force closure ensure the stability of the pelvis and functional movement and that dysfunction in either of these mechanisms can result in pain and/or dysfunction and consequently have an effect on the available space in the pelvis for the foetus to engage and negotiate during birth. The author advocated that chiropractic care ensures proper posture and re-positioning of the pelvis would restore or retain a change towards proper biomechanics of the body during pregnancy.
Browning et al. [354] (2010) United Kingdom	To explore the current evidence supporting chiropractic care for LBP and PGP with recommendations for diagnosis and clinical management	The author outlines the reliable clinical tests used by chiropractors for monitoring pregnant women and the number of chiropractic techniques available to them to address pregnant women suffering from LBP and/or PGP.
Marriott [355] (2010) USA	To provide an overview of the classifications, diagnosis, and management of diabetes and gestational diabetes mellitus, and discuss adverse pregnancy outcomes associated with gestational diabetes mellitus along with post-partum recommendations	Diagnosis of diabetes is based on fasting plasma glucose (FPG) or with an oral glucose tolerance test (OGTT) after consuming 75 grams of carbohydrate. Additional tests include impaired fasting glucose (IFG) and impaired glucose tolerance (IGT). Management of diabetes involves glycemic control resulting in significantly decreased rates of microvascular and neuropathic complications. Weight control, nutritional therapy i.e., carbohydrate-controlled meal plan), physical activity and patient self- monitoring of blood glucose (SMBG) or interstitial glucose and HgA1c and drug therapy. During pregnancy, normoglycemia is maintained by compensatory increase in insulin secretion and a progressive increase in insulin resistance and development of gestation diabetes mellitus (GDM). Adverse outcomes with GDM during early pregnancy include early miscarriage and foetal malformations and macrosomia (i.e., a large foetus for their gestational age or an infant with a birth weight that is greater than the 90th percentile for gestational age and sex). Macrosomia can lead to prolonged labour, labour enhanced with oxytocin, Caesarean delivery, post-partum haemorrhage, infection, third- and fourth-degree lacerations, thromboembolic events, and anaesthetic accidents.

Reference & country	Study aim(s) or purpose	Commentaries
Riva et al. [356] (2011) USA	Commentary to advocate for collaborative efforts between chiropractors and pharmacists	Due to concerns for potential for risk with medication use, the United States Food and Drug Administration (FDA) assigned pregnancy categories and used by pharmacists and medical physicians in clinical situations. As part of this new classification system, an alternative therapeutic section will be included with summaries of the evidence discussed supporting it. As a clinical example for the need for collaboration if alternative therapies are used, the authors related the story of a family physician referring a patient with pregnancy-related LBP to a chiropractor. The use of Biofreeze was deemed contraindicated by the community pharmacist due to the presence of menthol 3.5% and camphor 0.2%. Both menthol and camphor are rated in the Pregnancy Risk Factor C Category.
Gordon et al. [357] (2012) USA	Commentary on the role of the chiropractor in patient care such as the use of specific history and examination procedures for the appropriate co-management and referral of a pregnant woman with pre-eclampsia	The diagnosis of pre-eclampsia is typically made at 20 WOG in the presence of hypertension (i.e., blood pressure >140/90 mmHG) and proteinuria, with or without oedema. The severe form often features haemolysis, elevated liver enzymes, and low platelet count (i.e., HELLP syndrome). Comorbidities include hyper-reflexia, clonus, visual disturbances, epigastric pain, and headaches. Complications include eclampsia (i.e., pre-eclampsia plus seizures), rapid weight gain, disseminated intravascular coagulation, nausea, vomiting, headaches, visual disturbance, hyper-reflexia, clonus, convulsions, cerebral ischemia, right upper quadrant pain or epigastric pain, and HELLP syndrome. The role of the chiropractor includes screening for pre-eclampsia, blood pressure monitoring and neurological examination, use of low force techniques and observe contraindications to SMT, lifestyle and dietary counselling to lower BMI.
Ohm & Alcantara [358] (2012) USA	To clarify the philosophical, theoretical, and clinical framework of the Webster Technique	The authors address the inaccuracy of the statement that the Webster Technique was a breech turning technique based. Scope of practice and malpractice issues necessitated this clarification with the Webster Technique defined as a specific chiropractic analysis and the use of various chiropractic techniques to address pelvic bowl dysfunction and restoration of neurobiomechanical function in the sacral/pelvic region resulting in the resolution of foetal malposition/malpresentation and decrease in LBP and PGP.

Reference & country	Study aim(s) or purpose	Commentaries
Oswald et al. [50] (2013) USA	Advocacy for massage therapy and chiropractic care as highly safe and effective evidence-based options for pregnant women suffering from mechanical low back and pelvic pain	The authors outline the biomechanical and postural changes during pregnancy: in the second and third trimesters, the centres of mass shift anteriorly resulting in an increase in lumbar lordosis. This in turn causes overactivity of the low back and pelvic muscles, and hypermobility of the thoracic joints, typically at the T6 to T8 levels of the spine, lumbar spine, and pelvis. This, coupled with the expanding pelvis, leads to increased activity in the paraspinal musculature, as well as in the rectus femoris, external oblique, psoas major, and adductor longus muscles bilaterally. Along with SMT, chiropractors can also prescribe exercise and stretches.
Alcantara et al. [359] (2013) USA	A response to a case report of a pregnant woman with systemic lupus erythematosus (SLE) suffering from vertebra-basilar artery insufficiency (VBAI) temporally associated with chiropractic care	To counter claims that the woman's VBAI was attributed to the chiropractic care she received, the authors opined that the woman's pre-existing conditions of pregnancy, migraine headaches and SLE were possible risk factors for stroke. The authors also countered that a recent population-based case-control and case-crossover study findings that an increased risk for VBAI with chiropractic care may be inaccurate as patients with headaches and neck pain presenting for chiropractic care may be presenting for care with complaints associated with undetected VBA dissection.
Pettigrew [360] (2014) USA	Advocacy for chiropractic pregnancy care with a focus on alleviating back pain, sciatica, and symphysis pubic dysfunction	The author outlined that distortion of the shape, position and function of the birth canal, foetal malposition and uncoordinated or inefficient nervous system input to the uterus and perineum all increase the difficulty of birth leading to birth trauma for the woman and her baby. The Webster Technique was recommended to address the above-described distortions.
Bernard-Giglio [361] (2016) Australia	Advocacy for chiropractic care to address pregnancy-related lumbo-pelvic pain	The authors cited recent studies by George et al. [23]and Peterson et al. [22] on the effectiveness of chiropractic for pregnancy-related lumbo-pelvic pain.
Curnow & Geraghty [362] (2019) Australia	A commentary on the benefits of chiropractic care during pregnancy for both the pregnant woman and their child	The authors commented on the role of chiropractic care in relieving back pain, facilitating the correction of breech presentations, and treatment of colic, breastfeeding and constipation in the neonate.
Conner et al. [363] (2021) USA	Advocacy for chiropractic care due to its safe and drugless approach and a review of commonly treated conditions with SMT and adjunctive therapies	Common conditions amenable to chiropractic care include LBP with or without radiculopathy, PGP, headaches. The authors further discussed the safety of chiropractic care and the use of the Webster Technique.

Reference & country	Study aim(s) or purpose	Commentaries
Bhopal & Bhopal [364] (2022) USA	To present SOT in its foundational context and provide clinical relevance for its specific use during pregnancy	According to the authors, pregnant women present as a Category II, defined as presenting with instability of the articulations of the pelvis, hypertonicity of the pelvic stabilising muscles with increased global postural tone in the lumbar, thoracic, and cervical regions. Pregnant women often present with low back pain that can be attributed to gluteus medius weakness, changes in iliopsoas tonicity, lumbar facet dysfunction, and/or piriformis syndrome. The authors provide a means of evaluation for the above clinical presentations along with treatment considerations (i.e., corrective pelvic blocking).

Note. AS = antero-superior; BMI = body mass index; FPG = fasting plasma glucose; FDA = Food and Drug Administration; GDM = gestational diabetes mellitus; Gy (gray) = unit of radiation dose = 1 joule/kilogram = 100 rad; HbA1c = haemoglobin A1C test to measure the amount of glucose (sugar) attached to haemoglobin; HELLP = haemolysis, elevated liver, low platelet count; IFG = impaired fasting glucose; IGT = impaired glucose tolerance; LBP = low back pain; mmHg = millimetres mercury; MSK = MKS = musculoskeletal; OGTT = oral glucose tolerance test after consuming 75 grams of carbohydrate; PGP = pelvic girdle pain; RhoGAM = Rho(D) immune globulin human; SOT = Sacro Occipital Technique; SIJ = sacro-iliac joint; SMBG = self- monitoring of blood glucose; SMT = spinal manipulative therapy; USA = United States of America; VBAI = vertebra basial artery insufficiency.

Table 2.10. Summary Findings of the Systematic Reviews

Reference & country	Study aim(s) or purpose	Inclusion/exclusion criteria	Databases	Commentary
Borggren [99] (2007) USA	To review the literature on chiropractic care of pregnant women	Inclusion criteria not indicated but used search terms: pregnancy and chiropractic	PubMed (1987-2006)	A narrative review. Whether this article is a systematic review is questionable. The authors failed to follow a protocol for performing systematic reviews. The author's use of references to support statements on chiropractic care for LBP, safety of chiropractic care, and chiropractic care in the postpartum. Many of the cited references were not indexed or published in peer-reviewed journals.
Stuber & Smith [100] (2008) Canada	To review the literature on chiropractic care, including spinal manipulation, for pregnancy-related LBP	Inclusion criteria: (1) manuscripts in English (2) involved the care of pregnant with lower back pain (3) cared for by a chiropractor (4) published in peer-reviewed journals	PubMed, CINAHL, ICL (First journal publication to October 2011}	The authors found 6 studies meeting their inclusion criteria. The use of the Downs and Black [372] methodological quality assessment produced scores ranging from 5 to 14 (maximum score = 27). All of the included studies reported positive results with chiropractic care for pregnancy-related LBP. Outcome measures between the studies were inconsistent, as were descriptions of patients, treatments, and treatment schedules.
Khorsan et al. [101] (2009) USA	To examine/evaluate the evidence on the effects of SMT on back pain and other related symptoms during pregnancy	Inclusion criteria: (1) publication in English, (2) use of chiropractic and osteopathic SMT during pregnancy/ childbirth	PubMed (1966-September 2008), MANTIS (1966-September 2008), CINAHL (1982-September 2008), ICL (inception -September 2008), Google Scholar	A total of 32 manuscripts were reviewed. Overall, the studies varied in treatment protocols and outcome measures. The authors concluded that the use of SMT during pregnancy to reduce back pain and other related symptoms was supported by limited evidence and described as emergent.

Reference & country	Study aim(s) or purpose	Inclusion/exclusion criteria	Databases	Commentary
Stuber et al. [56] (2012) Canada	To critically review reported cases on adverse events associated with SMT during pregnancy and 6 weeks postpartum	Inclusion criteria: (1) manuscripts in English/French, (2) involved pregnant/ postpartum women and (3) received SMT with documented associated adverse events with the SMT	PubMed, CINAHL, ICL (journal inception to October 2011)	Five articles reported on adverse events in 7 subjects; remaining two were systematic reviews. Two articles described adverse events from 2 postpartum women while three articles reported on 5 pregnant women. Injury severity ranged from minor injury to more severe injuries such as fracture, stroke, and epidural hematoma.
Alcantara et al. [102] (2015) USA	To examine use of validated patient-reported outcome (PRO) measures in chiropractic care of pregnant women	Inclusion criteria: (1) publication of primary investigation, (2) reports involved chiropractic care of pregnant women, and (3) use of a validated outcome measure	PubMed, CINAHL, Medline, ICL, and MANTIS (1966-2014). Hand-search also performed of specific chiropractic journals (2009-2014)	Eight articles met the authors' inclusion criteria that identified the use of PROs. Despite heterogeneity and inconsistency issues on the use of PROs, some measure of effectiveness was noted by the authors.
Weis et al. [49] (2020) Canada	To assess the effectiveness of common care approaches employed by chiropractors for pregnancy-related low back (PRLBP) and pelvic girdle pain (PRPGP)	Inclusion criteria: (1) publication in English, (2) involve pregnant women suffering from lumbar spine or pelvic girdle pain, (3) chiropractic care (SMT and/or adjunctive therapies) were provided	PubMed, CINAHL, ICL, Cochrane Database, MEDLINE (journal inception to November 2016)	Based on 18 systematic reviews, 30 RCTs, and 2 cohort studies, the authors concluded that the care of women with PRLBP had moderately favourable evidence for electrotherapy and osteopathic manipulative therapy (OMT). There was favourable strength of evidence for chiropractic care, exercise, and support devices. There was inconclusive/unclear strength for SMT. Inconclusive, unclear strength evidence for SMT, OMT and support devices for PRLBP or PRPGP.

Reference & country	Study aim(s) or purpose	Inclusion/exclusion criteria	Databases	Commentary
Weber-Hellstenius [365] (2020) Sweden	A scoping review of the potential risk(s) in women, particularly during the perinatal period	Exclusion criteria: (1) non-English manuscripts, (2) case reports, (3) commentaries, (4) pilot studies, and (5) letters to the editor. Search terms: pregnancy, stroke migraine, stroke race, women, obesity, and manual therapy in various combinations.	PubMed, Research Gate (1995-2020)	According to the author, the perinatal period is associated with a 9-15-fold elevated risk for stroke. Conditions such eclampsia and preeclampsia confer the strongest risk factors (i.e., 12-fold increase) for stroke as well as a diagnosis of an infection, obesity, hypertension, and gestational diabetes mellitus and a history of migraine headaches, while decreased mobility (i.e., due to PGP and LBP) increases the risk for clotting, compounding a pregnant woman's other risk factors for stroke. The application of significantly high rotatory forces to the upper cervical spine and its effects on the vertebral artery and the possible risk for stroke remains to be fully elucidated. Regardless, the author cautions that an increased risk for stroke is a contraindication for high force manipulation of the upper cervical spine.
Weiss et al. [55] (2021) Canada	To update the literature on adverse events associated with care in pregnant and postpartum women	Inclusion criteria: (1) manuscripts documenting adverse events/iatrogenic injuries, (2) involved pregnant/ postpartum, (3) intervention performed by chiropractors, osteopaths and physiotherapists	PubMed, CINAHL, Index to Chiropractic Literature, Cochrane Database of Systematic Reviews/ Cochrane Central Register of Controlled Trials, and Medline (October 2011-November 2018)	Eight systematic reviews, 7 RCTs, 5 cohort studies and one case report met the authors' inclusion criteria. The updated systematic review [14] found a case report involving a serious adverse event following SMT in the cervical spine and a number of minor and transient adverse events in the low back.

Note. CINAHL = Cumulative Index to Nursing and Allied Health Literature; ICL = Index to Chiropractic Literature; MANTIS = Manual, Alternative and Natural Therapy Index System; OMT = osteopathic manipulative therapy; PRLBP = pregnancy-related low back pain; PRPGP = pregnancy related pelvic girdle pain; PRO = patient-reported outcome; RCT = randomised controlled trial; SMT = spinal manipulative therapy; USA = United States of America.

2.3.4 Cluster Analysis

In Figure 2.3, the K means cluster analysis determined a K value of four centroids or clusters, plotted in Figure 2.4 and summarised in Table 2.11. In Figure 2.4, the data from the top two principal components (i.e., PCA1 versus PCA2) are plotted in two dimensions to visually identify clusters of closely related data points. As observed in Figure 2.4, clusters are identified based on their "closeness" to each other. In Figure 2.4, four clusters (see accompanying figure legend) are identifiable based on their proximity to each other.

Despite overlapping distributions, each manuscript was assigned to a cluster based on their closest distance from a defined cluster center. The commentaries by Conner et al. [363] and Bhopal and Bhopal [364], the best practice recommendations by Weis et al. [366], the case reports by Poirier and Loranger [314], Swenson and Acevedo [315], Rabe and Emary [316] and Schwab et al. [317] and the case series by Shelley and Blum [331] were not initially included in the NLP analysis but ultimately assigned to a cluster based on thematic analysis. Cluster 1 involved manuscripts with complex MSK presentations; cluster 2 with simple MSK presentations; cluster 3 focused on the use of the Webster Technique and cluster 4 were papers characterised by advocacy for chiropractic.

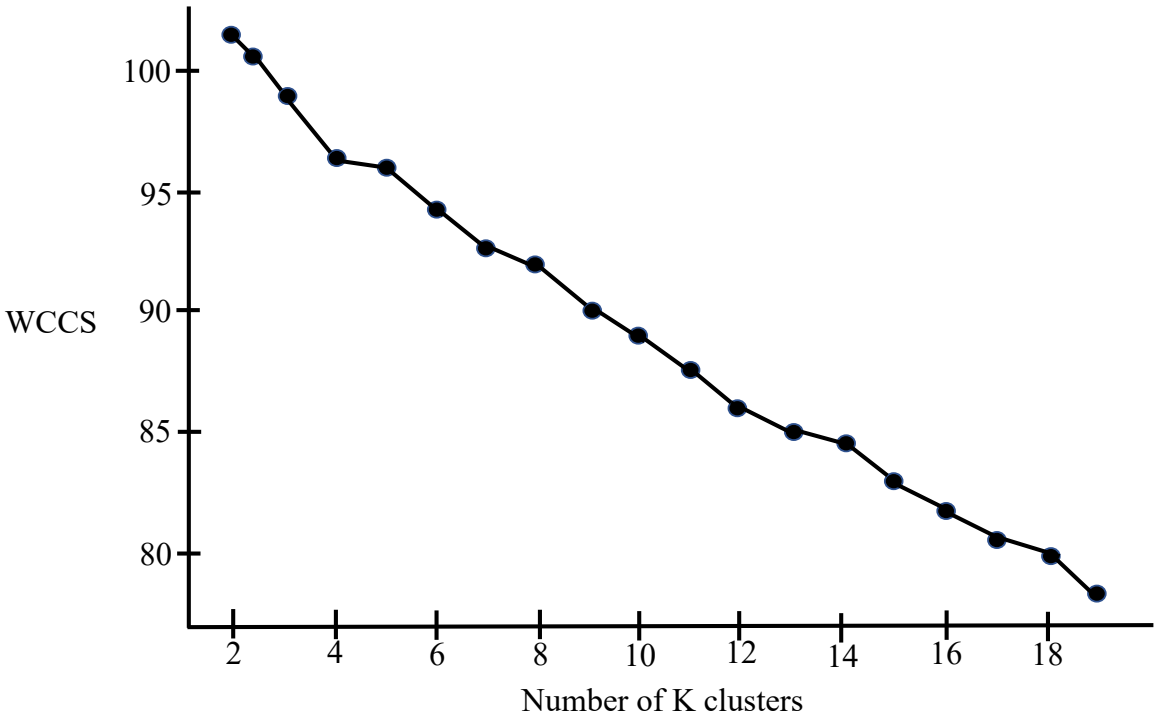

Figure 2.3. Determination of K Clusters Based on Within-Cluster Sum of Squares (WCSS)

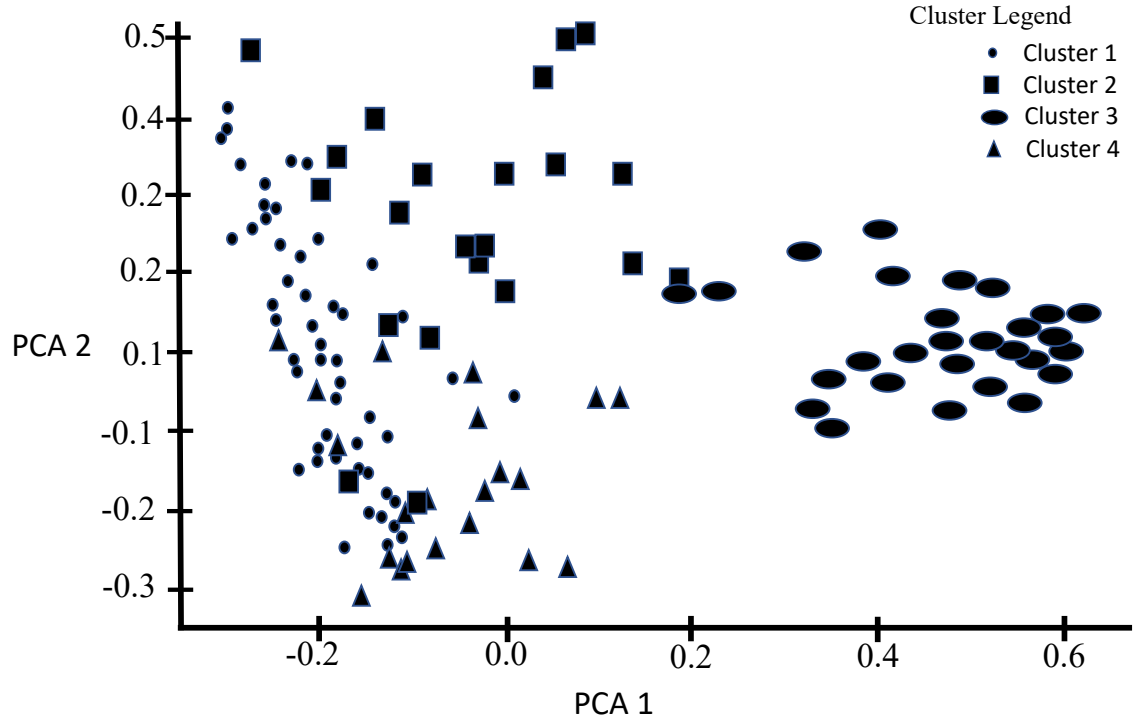

Figure 2.4. Scatter Plot for Principal Component Analysis (PCA)

Cluster Visualisation

Table 2.11. Summary of Findings of K-Means Cluster Analysis

	References			
Study Design	Cluster 1	Cluster 2	Cluster 3	Cluster 4
Case Reports	269, 271-272, 278, 285, 287, 289-291, 293, 296, 298-299, 301, 303-304, 306-309, 311-312	266, 267-268, 274, 292, 313, 316, 317	270, 273, 275-278, 279, 283-284, 286, 288, 294-295, 297, 302, 305, 310, 314, 315	265, 280-282, 300
Case Series	319, 322	318, 320-321, 327, 329	323-324, 328, 330	325-326, 331
Case Control				253
Cross sectional cohort	114	255-256, 258, 260, 264	259	254, 257, 261-263
Prospective cohort	54	113, 249, 251-252	53	250
RCTs		246-248		
Qualitative study		332		
Commentaries	360, 362	354, 361, 363	358	46, 50, 333-353, 355-357, 359, 364
SRs		49, 55-56, 100-102		99, 365
Best practice recommendations		366		
Key terms	Pain, pregnancy, treatment, back, study, pregnant patient, woman, care, exercise, low, chiropractor, pelvic, group, LBP	Care, pain, pregnancy, complaint, pregnant, week, patient, Webster, case, PROMIS, technique, visit, back, headache, migraine	Breech, Webster Technique, presentation, Cesarean. foetus, position, subluxation, vertex, section, birth, vaginal, care, pregnancy, adjustment	Pregnancy, pain, back, labour, pregnant, care, chiropractor, may, woman, baby, doctor, position, technique, adjustment, pelvic

Note. LBP = low back pain; PROMIS = Patient-Reported Outcomes Measurement Information System.

Cluster 1 manuscripts were characterised overall by women presenting with various pregnancy related MSK conditions and comorbidities that elevated the complexity of their care and possibly necessitated referral to a medical specialist. The case series by Kunau [319] exemplified the breadth and depth of care provided by a chiropractor that involved mandatory reporting, foetal heart rate monitoring, women presenting with nausea, vomiting and amenorrhea, trauma from a fall, spotting, poor digestion, weakness and dizziness, an enlarged heart, high cholesterol, kidney infection, hypoglycemia and hypothyroidism, breech foetuses, and headaches. Phillips [322] similarly reported women with MSK pain with accompanying neurological symptoms, thyroiditis, headaches and restless leg syndrome. McCoy et al. [54] similarly described comorbidities of foetal mispositioning, migraine headaches, and asthma.

The case reports documented comorbidities of migraine headaches [271, 290, 293, 296], foetal malposition/malpresentation [270, 273, 275-279, 283-289, 294-295, 297, 300, 302, 305, 307, 310, 319, 323-324, 326], constipation and acid reflux [269], lower extremity swelling and acid reflux [299], diplopia with pseudotumor of the cerebrum [293], a history of Harrington rod surgery [298], hypothyroidism, and tachycardia, visual field disturbances and neurological deficits in the face and upper extremities [290], placenta previa [287, 296, 311], peripheral neuropathy, lower extremity swelling and notable history of endometriosis, ovarian cysts, and two miscarriages [291], the desire for a natural childbirth after Caesarean (VBAC) [269, 290, 303], a history of trauma (i.e., a fall) [312], sleep disturbance [307], placental insufficiency and foetal growth restriction [301], prolonged and complicated labour [272], and twin [306] and triplet [299] pregnancies.

Cluster 2 were manuscripts that described pregnant women with pregnancy related MSK complaints along with manuscripts addressing safety and the use of validated

patient-reported outcomes (PROs). The manuscripts documented a significant association between LBP during pregnancy and labour [255], that pregnant women present commonly with pelvic pain [258], and that chiropractic care alleviates symphysis pubic dysfunction (SPD) [256, 317, 320], LBP and/or PGP [246-247, 249, 251] but not one-sided PGP [248]. In a qualitative study, Sadr et al. [332] found pregnant women's experiences revolved around their presenting complaints, provided care and self-care options, their safety and effectiveness and the importance of chiropractor-patient communication. The case reports and case series documented various MSK complaints that included LBP with/without radiculopathy and/or PGP [268, 274, 292, 318, 320, 321, 327, 328, 329], groin pain [266, 317], bilateral anterolateral thigh paresthesia and groin pain [267], SPD [327], leg pain [328], neck pain [328], upper extremity/shoulder pain [328] and thoracic outlet syndrome. [316] Of the six SRs [49, 55-56, 100-102] in this cluster, four systematically reviewed chiropractic care for pregnancy-related LBP and/or PGP. [49, 100-102] The remaining SRs [55-56] reviewed the safety of chiropractic SMT and adjunctive therapies. Despite indicated contraindications to SMT (i.e., a history of a trauma, placenta previa, spotting/bleeding) [318, 352], there are cases refuting these contraindications with safe and/or beneficial outcomes. [287, 296, 311, 312, 319] In a retrospective file review of the foetal heart rate (FHR) monitoring of pregnant women following SMT, Edwards et al. [264] found normal FHR findings and interpreted this to be an indirect measure of safety of SMT for the unborn child and the pregnant women. In an update to the SR by Alcantara et al. [102] on the use of validated PROs, subsequent manuscripts include the use of the PROMIS-29 and RAND VSQ9 [113], the Quebec Task Force Disability Scale [266], the Roland Morris Disability [246], Oswestry Disability Index [248] and EQ-5D Health questionnaires [248], and pain rating [246, 248, 266, 292, 329]. The best practice

recommendations by Weiss et al. [366] addressed the care of pregnant women with LBP and/or PGP.

The manuscripts in Cluster 3 focused primarily the use of the Webster Technique to facilitate correction of foetal malposition/malpresentation. Early empirical observations inappropriately referred to the technique as a 'breech turning' technique. [358] Intentional breech turning is outside the scope of chiropractic. [373] The Webster Technique involves a specific chiropractic analysis and the correction of sacral subluxation to restore neuro-biomechanical integrity in the lumbosacral/pelvic region. [358] An optimal environment for the foetus facilitates auto-correction to the vertex position and the alleviation of MSK pain complaints [358]. Among 41 women cared for with the Websters Technique, the mean age was 30.83 years (n = 35, SD = 6.32). For 34 women with known gestational age, they presented for care at a mean gestation age of 33.69 weeks (SD = 3.12). Thirty-eight pregnancies resulted in correction to vertex position except in two cases [284, 319] resulting in a Caesarean birth as did two other cases [277, 323]. Four case reports noted vaginal birth after Caesarean (VBAC). [277, 303, 306, 315] In 39 pregnancies, the mean number of visits to determine outcome (i.e., foetus in vertex position) was 5.44 visits (SD = 5.03) with duration of care spanning a period of 1 day to several weeks. Foetal position was determined by ultrasound imaging (n = 26), palpation (n = 3), both ultrasound and palpation (n = 1), at birth (n = 2) with 8 not indicated. Twenty-three pregnancies were indicated as resulting in a natural childbirth, and 13 not indicated. The foetal presentations addressed were complete breech (n = 30) [270, 273, 276-278, 279, 283-285, 287, 294, 300, 313, 319, 323, 324, 326, 330] with three of these pregnancies involving twins [279, 324], frank breech (n = 5) [275, 295, 297, 305, 314], footling breech twins [302], and seven transverse breech [286, 288-289, 310, 319, 326] pregnancies.

The manuscripts in Cluster 4 were characterised as advocating for chiropractic care during pregnancy [99, 331, 344, 345, 348, 356, 363], promote the collaborative care with other health care professionals [56, 331, 344, 345, 348, 356, 363] or address and provide instructions on management issues (i.e., pre-eclampsia, stroke following SMT, gestational diabetes, radiology during pregnancy) germane in pregnancy care. [46, 250, 253-254, 257, 261-263, 265, 280-282, 325, 333-334, 336-337, 341-343, 349, 350, 353, 355, 357, 359, 364, 365] Ohm [344, 348] called for greater collaboration between chiropractors and midwives as both professions acknowledge and trust in the body's inner wisdom, offer profound support and commitment to noninvasive birthing procedures, and offer individualised care.

2.3.5 Discussion

This scoping systematic review on the chiropractic care of pregnant women provides a comprehensive systematic evaluation of the literature. Despite the heterogeneity of the reviewed studies, our use of NLP [242] and K-Means Cluster analysis [244, 374] was a novel approach to data-based convergent synthesis to identify the nature and extent of the literature on the chiropractic care of pregnant women. [375]

In recent times, there have been an acknowledgement that practice patterns and patient care are affected by practitioner demographics [376]. Although six survey studies [256, 259-263] involved chiropractors as responders, the reviewed literature provided data for age in only two studies [114, 262] while three studies [114, 261-262] described gender, three studies provided practice experience [114, 261-262], and three studies provided postgraduate training. [114, 261-262]

Patient characteristics have also been shown to be an important determinant of patient preferences regarding many aspects of their health care. [377] Excluding case reports and case series, patient characteristics such as age [53-54, 113-114, 246-248, 251-

255, 260], educational status [113, 246, 248], ethnicity [246, 250, 252], gestation age (i.e., WoG) [53, 114, 246-248, 249-253, 258], patient satisfaction [113], quality of life [113] and motivation for care beyond MSK complaints (i.e., wellness care, foetal malposition) [53-54, 113-114] were minimally documented.

In addition to the Webster Technique, we found Sacro Occipital Technique or SOT [114, 261, 319, 331, 364], Activator Methods [54, 257], Applied Kinesiology [261], Neuro-Emotional Technique [246], Logan Technique [253, 261], Thompson Technique [253], Upledger craniosacral therapy [253] and Gonstead Technique [261] applied to pregnant women. Our review confirmed the popularity of use of Diversified Technique [54, 235, 246-248, 249, 252, 255, 256, 260, 261], characterised as an HVLA thrust SMT, for pregnant women. Adjunctive therapies such as exercise and soft-tissue therapy [248, 256, 260-261, 337] and the use of nutritional supplementation and diet [338, 346, 355, 357] have also been documented. Despite the reported high success rate (i.e., 91%) of the Webster Technique to correct breech presentations by Pistolese [259], the study was fraught with confounders and bias (i.e., concurrent care with moxibustion, slant/tilt board) as Alcantara et al. [53] acknowledged in their study on the effectiveness of the Webster Technique.

There is minimal literature documenting the collaborative efforts of chiropractors with massage therapists [260-261] or the receipt of referrals from midwives and obstetricians. [113, 258, 260] Through pregnancy care, chiropractors have an opportunity to demonstrate their ability and willingness to advance collaborative efforts with other healthcare providers. Alcantara et al. [113] found that among pregnant women, a high proportion of primary providers (i.e., obstetricians, midwives) were aware of the women's chiropractic care with some making the referral to their chiropractor.

Despite three SRs [55-56, 365] and a cross-sectional study [260] on the safety of chiropractic perinatal care, the literature is arguably lacking. The study by Stuber [260] involved a small sample size (n = 18) with minimal clinical experience in pregnancy care among the respondents. The scoping review by Weber-Hellstenius [365] examined the potential stroke risk(s) in women, particularly during pregnancy and the postpartum period while the SRs by Weis et al. [55] and Stuber et al. [56] examined the documentation of adverse events associated with SMT in the perinatal period, such studies have limitations. Edwards et al. [264] provides the first attempt to address the safety of SMT for the unborn foetus. As in medicine [378], the reporting of adverse events by chiropractors has many challenges and often unreported. To date, no prospective surveillance of adverse events has been performed to assess the prevalence and incidence of adverse events associated with chiropractic pregnancy care. We also encourage further investigations into the relative and absolute contraindications associated with pregnancy care given that existing contraindications were provided without clinical justification. [260, 333, 345, 347, 352, 359]

Finally, the best practice recommendations by Weis et al [366] acknowledged the required meta-competencies for successful practice such as taking a history, performing an examination (including the use of imaging studies), implementation of care (including risks), and collaboration with other providers as necessary. However, no substantive recommendations were provided by the authors beyond 'modifications or alternate chiropractic procedures should be considered' in the care approach. Specific to pregnancy care, patient positioning to avoid 'torquing' the lumbopelvic and ensure patient comfort with a pregnancy pillow or a table with a drop piece is important. In terms of modification of technique, the use of HVLA thrust SMT should give due consideration to the amount and depth of force applies. Alternative technique procedures should implement non-force

techniques (i.e., SOT, Activator Methods and Thomson Technique). Chiropractors versed in pregnancy care would argue that the Webster Technique in pregnancy care is invaluable and our findings reflect this. The application of this technique was not discussed appropriately.

Overall, we found major gaps and deficits in the literature on the chiropractic care of pregnant women. To date, there exists no comprehensive examination or characterisation of chiropractors (i.e., age, gender, years in practice, postgraduate training, clinical experience) involved in pregnancy care, their practices (i.e., practice environment, fee structures and reimbursement modes), their management protocols, referral patterns and collaborative efforts with other practitioners along with patient characteristics (age, pregnancy covariates). There is a need for more appropriately designed prospective cohorts and clinical trials are warranted, along with context-specific qualitative research to better understand the experiences of pregnant women under chiropractic care and the perspectives of their chiropractors.

As new studies continue to be published, and the evidence base is constantly evolving, conducting a new systematic review allows for an updated synthesis of the latest evidence. Furthermore, conducting another systematic review with a different perspective or approach to analysis as in this scoping review provided an alternative synthesis of the evidence, offering a broader range of insights and perspectives on chiropractic pregnancy care. Although eight systematic reviews have been published in the literature pertaining to chiropractic pregnancy care, our scoping review provided a high-level overview of evidence in the field. Two of the systematic reviews on pregnancy chiropractic care examined reported cases of adverse events following SMT and other manual treatments [55, 56] while another examined potential stroke risks in pregnant women. [365]. Three systematic reviews examined chiropractic pregnancy care for LBP and/or PGP. [49, 100-

101] Alcantara et al. [102] examined the use of validated outcome measures in pregnancy chiropractic care. Borggren [99] briefly reviewed the clinical studies on chiropractic care and safety of chiropractic pregnancy care. Our scoping review identified and examined the types of research conducted, delineated the available evidence on pregnancy chiropractic care, and identified knowledge gaps on the chiropractic care of pregnant women. [379] Our scoping review focused on aspects of pregnancy chiropractic care that have not been addressed in previous systematic reviews.

Although the quantitative review draws on the same quantitative studies included in this scoping review; in the totality of the reviews included for analysis, the scoping review and quantitative reviews served different purposes and provided different perspectives and different synthesis of the evidence.

2.3.6 Strengths and Limitations

Our study found a diverse body of literature on chiropractic pregnancy care and applied NLP and K-Means Cluster Analysis for data-based convergent synthesis of the literature. Time will dictate the veracity of our analytical approach given that no established protocol exists for scoping reviews. [380] Although our search methods were rigorous and comprehensive, we may have missed relevant studies (i.e., selection bias) as our search was limited to literature published in English. Restricting our review to English-only publications were for pragmatic reasons and the lack of professional language translators may have resulted in publication bias. [381] This excluded English records during our literature search since the database retrieved only those records that explicitly have defined English as a ‘value’ in their language data ‘field’ and not those English records that are missing such value for the field. [382] As Juni et al. [383] reported, including non-English studies influenced effect estimates in more than half of their meta-analyses. Egger et al. [384] found that authors were more likely to report their findings in

English language journals when their results were statistically significant and increasingly less likely to publish in non-English language journals.

The lack of quality appraisal of the reviewed studies and the inclusion of lower quality studies implies systematic bias in our scoping review. However, the focus of our review was to obtain a comprehensive examination of the literature to identify patterns or themes rather than address a specific clinical question based on literature with identified levels of evidence concomitant with their methodological quality. [379]

2.3.7 Conclusion

Our scoping review appraised the current state of knowledge on the chiropractic care of pregnant women. Our findings reaffirms that chiropractic care for pregnant women has a focus on pregnancy related MSK complaints and comorbidities of pregnancy, the use of the Webster Technique, and the need for collaboration with other health care professionals.

2.4. Chiropractic Care During Pregnancy: A Quantitative Systematic Review and Narrative Synthesis of the Literature

This chapter presents a systematic review which, upon completion, was submitted to *Complementary Therapies in Medicine*, a peer-reviewed journal, for publication. The contribution of individual authors is outlined in the signed statement of contribution. All of the tables and figures included in this chapter were submitted for publication.

Joel Alcantara,[1*] Stephen P Myers,[2] Elizabeth Emmanuel,[1] Sandra Grace[2]

[1]Facuty of Health, Southern Cross University, Gold Coast Campus, Terminal Drive, Bilinga, QLD, Australia, 4225

[2]Facuty of Health, Southern Cross University, Lismore Campus, Military Rd, Lismore, NSW, Australia, 2480

*Corresponding Author

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Declarations

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Declaration of Interest: None

Abstract

Objectives: To perform a systematic review (SR) of the literature on chiropractic prenatal care.

Design: A SR following the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA).

Methods: A literature review was conducted from 1978 to 2023 using PubMed, Allied and Complementary Medicine (AMED), Excerpta Medica Database (EMBASE), Cumulative Index to Nursing and Allied Health Literature (CINAHL), Manual, Alternative and Natural Therapy Index System (MANTIS), and Index to Chiropractic Literature. The search terms were pregnancy, pregnant, prenatal, antenatal, perinatal, maternal, postnatal, postpartum, birth, mother, maternal, chiropractic, chiropractic care, chiropractic manipulation and related words. Eligible studies for review were manuscripts: (1) involving chiropractic pregnancy care, (2) published in an English peer-reviewed journal, and (3) reporting quantitative outcomes.

Results: A total of 32 manuscripts from 745 titles met inclusion criteria for review consisting of three randomised controlled trials, seven prospective and 12 cross-sectional cohort studies, one case control study, eight SRs and one best practice recommendations document. The majority of the studies focused on alleviating low back and/or pelvic girdle pain. The literature was lacking in characterising practitioners and their pregnant patients, the clinical protocols employed and collaborative efforts in pregnancy care.

Conclusions: We found a limited and heterogenous number of manuscripts with low to high methodological quality with the majority addressing low back and pelvic girdle pain in pregnant women. We recommend continued research efforts to document the safety and effectiveness of chiropractic care for this special patient population.

2.4.1 Introduction

Unique morbidities occur in pregnant women as a result of numerous biochemical, physiological and anatomical changes. Examples include hyperemesis gravidarum [385], gestational diabetes [386], pre-eclampsia [387], and depression and anxiety. [388] Due to a growing abdomen, a pregnant woman's center of gravity shifts forward with concomitant lumbar hyperlordosis, pelvic tilt and altered balance and gait that may lead to musculoskeletal (MSK) injuries such as from a fall or pregnancy related low back pain (LBP). [137, 389] These morbidities can negatively impact a woman's perinatal health [390] and quality of life [88] and are important determinants of healthcare utilisation. [391] Medical pluralism, defined as the use of both conventional and complementary, alternative and integrative medicine (CAIM), is common among pregnant women. [30] Pregnant women perceive CAIM therapies to be safe, expand their care options and allow for more control during their pregnancy. [32]

Of the practitioner based CAIM therapies, chiropractic has made the largest inroads into private and public health care financing systems in the United States and is one of the largest constituents of the global CAIM workforce with over one hundred thousand chiropractors practicing in over 100 countries. [2, 392] Chiropractors predominantly address MSK conditions in the general population [11]. Given the high prevalence of LBP and pelvic girdle pain (PGP) [393] in pregnancy, its estimated that 5%-11% of pregnant women attend chiropractic care (i.e., spinal adjustments and adjunctive therapies) for these complaints. [366] This estimate may be higher when one considers chiropractic for wellness care (i.e., health promotion and disease prevention strategies to increase overall functioning and adaptability) [115, 394], which resonate with pregnant women who prefer a holistic approach to patient care. [32]

In 2009, Khorsan et al. [101] published the first systematic review on the effectiveness of chiropractic and osteopathic SMT and/or mobilization on LBP and/or PGP and other related symptoms during pregnancy and labour. The investigators described the evidence as emergent and since their publication, an additional 7 systematic reviews have been published on pregnancy chiropractic care. Stuber et al. [56] and Weis et al. [55] reviewed the literature for reported cases of iatrogenic injuries following SMT applied by a healthcare practitioner during pregnancy and the postpartum period Hellstenius [365] addressed the issue of safety in pregnancy chiropractic care with a narrative review of the literature on the potential stroke risks for pregnant women. Stuber and Smith [100] and Weis et al. [49] independently reviewed the literature to examine the effectiveness of SMT and adjunctive therapies for pregnancy-related LBP and/or PGP. Alcantara et al. [102] reviewed the literature on the use of validated outcome measures in chiropractic pregnancy care. Borggren [99] provided a narrative review of the literature on the safety and effectiveness of chiropractic in relieving LBP during pregnancy. The last systematic review addressing chiropractic pregnancy care was by Weis et al. in 2021. [55] As the evidence base is continually evolving with new publications, a new systematic review allows for an updated synthesis of the latest evidence. To date, no systematic review of the literature has been performed to highlight the quantitative measures in the literature on the chiropractic care of pregnant women beyond randomized clinical trials (RCTs) and cohort studies involving LBP and/or PGP. Conducting such a systematic review with updated and inclusive studies beyond LBP and/or PGP can address a research gap and provide a wider view and perspective of the research evidence on pregnancy chiropractic care to inform clinicians, researchers, clinical educators, and healthcare policy on chiropractic prenatal care. Towards such efforts, a systematic review of the literature that provide quantitative measures in chiropractic pregnancy care was performed.

2.4.2 Methods

2.4.2.1 Search Strategy

This SR covered the period from January 1978 – July 13, 2023, and utilised PubMed, Allied and Complementary Medicine (AMED), Excerpta Medica Database (EMBASE), Cumulative Index to Nursing and Allied Health Literature (CINAHL), Manual, Alternative and Natural Therapy Index System (MANTIS), and Index to Chiropractic Literature (ICL). The search terms were 'pregnancy' or 'pregnant' or 'prenatal' or 'antenatal' or 'perinatal' or 'maternal' or 'postnatal' or 'postpartum' or 'birth' or 'mother' or 'maternal' AND 'chiropractic' or 'chiropractic care' or 'chiropractic manipulation' along with the expander function of 'apply related words'.

2.4.2.2 Study Selection and Eligibility

Inclusion criteria for review were manuscripts: (1) involving chiropractic pregnancy care (i.e., spinal manipulative therapy (SMT) and/or adjunctive therapy), (2) published in a peer-reviewed English-language journal, and (3) containing quantitatively measured outcome(s). Although primary studies comprise the majority of systematic reviews, secondary studies such as narrative reviews or systematic reviews are included in this review to identify and summarize existing narrative or systematic reviews in this field, allow for the differentiation and justification for an updated or alternative synthesis of the present systematic review. Manuscripts were excluded if they were: (1) abstracts from conference proceedings, (2) dissertations for a master's or doctorate degree, (3) letters to the editor, (4) textbooks or textbook chapters, (4) commentaries, (5) case reports/series, and (6) qualitative studies. Case reports/series and commentaries were excluded due to their high potential for bias. [395] Titles and abstracts were screened independently by each co-author (JA, SPM, EE and SG). Disagreements were resolved by group discussion

and consensus. The reviewed manuscripts were also searched for additional references by JA and independently confirmed by SPM. Our reporting followed the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA). [396].

2.4.2.3 Data Extraction, Analysis, and Synthesis

A table was created by JA to record the following extracted variables: author(s), year and country of publication, study aim/purpose, study design, presenting complaints, weeks of gestation (WOG) or trimester of pregnancy, number of pregnant responders, chiropractic intervention, statistical analysis and findings, patient-reported outcomes (PROs), inclusion and exclusion criteria, the database(s) consulted and summary of findings. The extracted variables were cross-checked by the co-authors (SPM, EE, SG) to provide a comprehensive analysis of chiropractic pregnancy care.

2.4.2.4 Quality Appraisal

Quality appraisal was performed independently by JA, SPM, EE, SG utilising the Joanna Briggs Institute Critical Appraisal Tools (JBI CATs) for various research designs to assess their trustworthiness, relevance, and overall methodological quality. [397] The best practice recommendations document was assessed with the AGREE II instrument by JA and SPM, independently. [398] The quality assessments were discussed as a group by the co-authors and differences in assessment were resolved by consensus.

2.4.3 Results

2.4.3.1 Search Outcomes

A total of 745 titles were initially screened resulting in the removal of 166 duplicate titles. An additional 445 (from the end) titles were eliminated based on the inclusion/exclusion criteria with 134 manuscripts remaining. Further application of the

inclusion/exclusion criteria eliminated 53 case reports, 14 case series, one qualitative study and 34 commentaries with 32 manuscripts remaining for review (Figure 2.5).

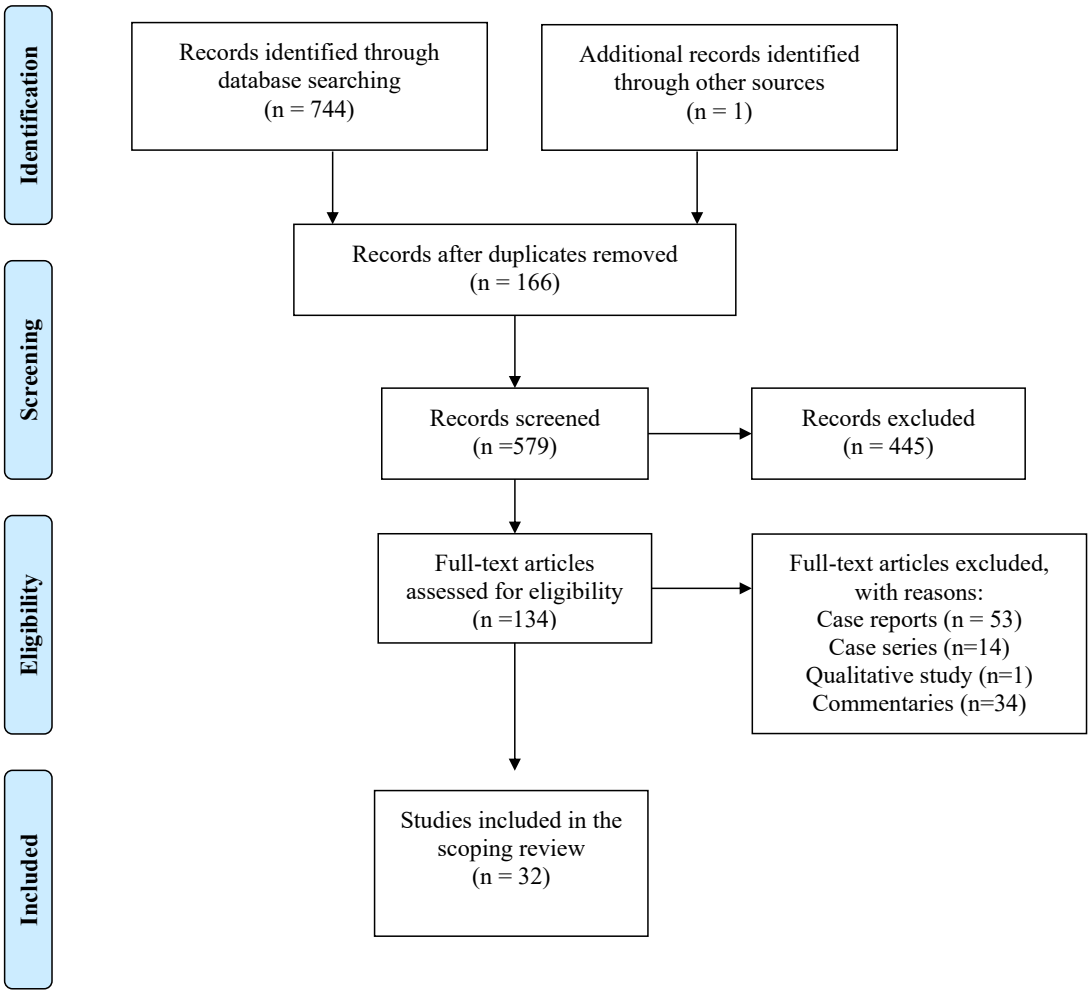


Figure 2.5. Flow Diagram of the Systematic Review of the Quantitative Literature on the Chiropractic Care of Pregnant Women

2.4.3.2 Study Characteristics

The 32 manuscripts consisted of three randomised controlled trials (RCTs) [246-248], seven prospective cohort studies [53-54, 113, 249-252], one case control study [253], 12 cross-sectional studies [114, 254-264], eight SRs [49, 55-56, 99-102, 365] and one best practice recommendations document. [366] The extracted variables are summarised in Tables 2.12-2.14. The results of the quality appraisal are discussed in section 2.4.3.10.

Table 2.12. Summary Findings of Clinical Trials, Cohort Studies, and Case Control Involving Chiropractic Care for Pregnant Women

Reference & country	Study aim(s) or purpose	Study design	Study responders	Patient-reported outcomes (PROs) and other outcome measures	Summary of findings
Gausel et al. [248] (2017) Norway	To assess the effectiveness of chiropractic SMT with mobilisation, soft tissue work, exercise, and advice versus conventional medical care in pregnant women with dominating one-sided pelvic girdle pain	RCT	Subjects (n = 56) randomised to individualised chiropractic care (n = 28) or conventional medical care (n = 28)	Sociodemographic information, sick leave, previous illnesses, treatments, current symptoms, pain location and duration; Norwegian version of the Oswestry Disability Index Questionnaire, EQ-5D Health Questionnaire, retrospective reporting of pelvic pain with pain NRS	No statistically significant difference in measured outcomes between the two groups during and after pregnancy
George et al. [247] (2013) USA	To assess if the addition of manual therapy provided by a chiropractor (i.e., SMT, exercise, and education) to standard obstetric care in reducing pain, impairment, and disability in pregnancy	RCT	Pregnant women (n = 169) randomised to MOM group (n = 87) and obstetrics care only (STOB) (n = 82)	Current Pain NRS, The Quebec Taskforce Disability Questionnaire	Addition of chiropractic care to obstetric care resulted in significant mean reductions in pain disability from baseline to follow-up compared to those receiving standard obstetric care only
Peterson et al. [246] (2012) USA	To compare the effectiveness of three interventions (exercise, SMT, and NET) to address pregnancy-related low back pain	RCT	Pregnant women (n = 57) randomised to the following care: Exercise (n = 22), SMT (n = 20), and NET (n = 15)	Roland Morris Disability Questionnaire, pain NRS	No clinical or statistically significant differences between groups based on outcome measure

Reference & country	Study aim(s) or purpose	Study design	Study responders	Patient-reported outcomes (PROs) and other outcome measures	Summary of findings
Alcantara et al. [113] (2018) USA	To quantify the quality of life and visit-specific patient satisfaction of pregnant women using the PROMIS-29 and RAND VSQ9, respectively, in a PBRN	Prospective cohort	A cohort of 343 pregnant women followed longitudinally	PROMIS-29, RAND VSQ9	Baseline and follow-up measures demonstrated improvements in QoL and high patient satisfaction. Significant reductions observed in fatigue, pain interference and pain ratings, sleep disturbance, and significant increase in satisfaction with social roles. Mental health domains (i.e., anxiety and depression) had no significant change.
Haavik et al. [252] (2016) New Zealand	To investigate the effects of a single session of SMT on pelvic floor muscle function in pregnant and non-pregnant women	Prospective cohort	2nd trimester of pregnancy (n = 11) and nulliparous women (n = 15) as control group	No PROs, but use of transperineal ultrasonography to measure levator hiatal muscle contraction	Levator hiatal area at rest increased significantly after spinal manipulation in pregnant women and none in control group
Peterson et al. [251] (2014) Switzerland	To examine the effectiveness of chiropractic care in alleviating low back pain and/or pelvic pain in a cohort of pregnant women	Prospective cohort	Pregnant women at baseline (N = 143), at follow-up (n = 115)	Pain NRS, Oswestry Disability Index, Patient's Global Impression of Change	Percentage of women reporting as 'improved' with care at: 1 week (52%), 1 month (70%), 3 months (85%), 6 months (90%), and 1 year (85%). Significant reductions in pain NRS and Oswestry Disability Index scores during course of care.
Alcantara et al. [53] (2012) USA	To examine the results of the Webster Technique in women with foetal malposition/ malpresentation attending care in a PBRN	Prospective cohort	Pregnant women (n = 81) with foetal malpresentation	Improved foetal presentation following course of chiropractic care	63 women followed up; 70% (n = 44) indicated correction to vertex position from a foetal malpresentation

Reference & country	Study aim(s) or purpose	Study design	Study responders	Patient-reported outcomes (PROs) and other outcome measures	Summary of findings
Peterson et al. [250] (2012) USA	To evaluate whether manual muscle testing (MMT) could predict foetal sex in-utero	Prospective cohort	27 sequential pregnant women	Foetal sex of male or female as confirmed by ultrasound following MMT	MMT predicted foetal sex in 13 of 27 women. The positive likelihood ratio was 0.92, the sensitivity was 0.40, specificity was 0.54, positive predictive value was 0.46, and negative predictive value was 0.44. MMT was found to be no better than chance at predicting foetal sex in-utero.
Murphy et al. [249] (2009) USA	To examine the outcomes in women with pregnancy-related lumbopelvic pain treated according to a diagnosis-based clinical decision rule provided by chiropractors and physiotherapists	Prospective cohort	At baseline (n = 115), end of treatment (n = 83) and 11 months since last treatment (n = 61)	Bournemouth Disability Questionnaire, pain NRS, Verbal self-rating of outcome, percentage of improvement (0% = no improvement; 100% = complete resolution), Activity subscale of Fear Avoidance Beliefs Questionnaire	At end of treatment (n = 83) and 11 months follow-up (n = 61) (respectively): mean patient-rated improvement was 61.5% and 83.2%; disability improved by 39% and 68%; change in pain NRS was 2.9 and 3.5 points; FABQ-Act was 0.54 and 2.6.
McCoy et al. [54] (2009) USA	To determine the outcomes of chiropractic care in pregnant women	Prospective cohort	A cohort of 25 pregnant women	SF-36, Paraspinal Surface Electromyography, Paraspinal Thermography	The study was incomplete and no primary outcome measures were reported
Phillips et al. [253] (1995) USA	To determine whether the addition of chiropractic care to standard obstetric care results in fewer obstetric interventions during labour and delivery	Case control	Pregnant women (n = 35) receiving chiropractic care compared to a matching comparison group (n = 35)	Outcome measure: intervention of labour (i.e., pitocin induction or stimulation)	No statistically significant differences were identified in the level of intervention of labour (i.e., pitocin induction or stimulation) between the chiropractic and matched comparison groups.

Reference & country	Study aim(s) or purpose	Study design	Study responders	Patient-reported outcomes (PROs) and other outcome measures	Summary of findings
Edwards et al. [264] (2023) USA	To retrospectively assess the foetal heart rate (FHR) monitor of pregnant women concurrent with chiropractic SMT	Cross-sectional	The files of 33 pregnant women were reviewed	FHR	33 women eventually were monitored for FHR in the third trimester (MWG = 35.75, *SD* = 3.37). A mean FHR of 140.30 bpm (*SD* = 8.48) was found in the 33 women. All FHR data were within normal limits.
Kawchuck et al. [263] (2020) Canada	To describe the findings of chiropractors' compliance related to specific health conditions, claims of immunity during the COVID-19 pandemic, and pregnancy-related conditions in British Columbia, Canada	Cross-sectional	Registrants (*N* = 1250) of College of Chiropractors of British Columbia, Canada	Outcomes: potential violations of regulations	For pregnancy-related conditions, the internet search tool identified 636 potential cases from approximately 1350 registrants. Further evaluation classified 83 cases as inappropriate. All chiropractors complied following contact by the College.
Weis et al. [262] (2019) Canada	To determine a cohort of Ontario chiropractors' knowledge on current guidelines for exercise during pregnancy	Cross-sectional survey	*n* = 86 from 500 randomly selected chiropractors completed survey	Survey on demographic and practice characteristics in pregnancy care, particularly with providing advice on exercise regimen	The mean knowledge score was 0.52 with great variability among the respondents.
Yuen et al. [261] (2013) Canada	To determine the most common therapeutic interventions provided by Greater Toronto Area chiropractors to pregnant women	Cross-sectional survey	*n* = 174 from 755 potential responders	Survey on sociodemographic information, chiropractic techniques, and adjunctive therapies	Majority of respondents (90%) reported using Diversified Technique, soft tissue therapy (62%), and Activator Methods (42%). Most common adjunctive therapy was massage therapy (90%). Most (92%) indicated recommending stretching exercises along with multivitamins (84%) or folic acid (81%).

Reference & country	Study aim(s) or purpose	Study design	Study responders	Patient-reported outcomes (PROs) and other outcome measures	Summary of findings
Alcantara et al. [114] (2012) USA	To characterise the chiropractic care of pregnant patients attending care in a PBRN	Cross-sectional survey	126 pregnant women	Survey demographics (i.e., age, gender, level of education), weeks of gestation, presenting complaints, perceived effectiveness of care, and specific effects of care	Mean age of women at 30.56 years, presented for care at mean 29.42 weeks gestation. Approximately 25% of women indicated presenting for 'wellness care' with 241 presenting with musculoskeletal complaints. Majority (97%+) reported high perceived effectiveness of care described as decreased pain, improved function, and 'other.'
Aas-Jakobsen et al. [258] (2010) Norway	Retrospective file review to characterise pregnant women attending care at a chiropractic clinic in a one-year period.	Cross-sectional survey	100 files of new pregnant patients	Examined age, pregnancy status, previous care, referral source for care, presenting complaints, and duration of complaint(s) of pregnant women	Mean patient age = 32.5 years, weeks of gestation = 26.5. Percentage of women in their first, second, and third pregnancy were: 47%, 49% and 4%, respectively. Referral patterns: from other health professionals (71%), friends/family (44%). Pelvic pain (90%) was main reason for clinical presentation.
Stuber [260] (2007) Canada	To assess chiropractor attitudes on patient safety, treatments employed, and referral source to care for pregnant women	Cross-sectional survey	Convenience sample (n = 18) chiropractors	12-item survey examining sociodemographics, years in practice, alma mater, treatment rates and modalities, experience with pregnancy care, common complaints, appropriateness of SMT referral patterns	Majority of responders (n = 14) indicated 0-5 pregnant patients per month while 4 indicated 6-10 pregnant patients per month. Most (94%) indicated SMT, soft-tissue therapy, and exercise as the most common treatment applied; and SMT was appropriate for a number of conditions during pregnancy and that SMT was 'somewhat safe.'

Reference & country	Study aim(s) or purpose	Study design	Study responders	Patient-reported outcomes (PROs) and other outcome measures	Summary of findings
Rubin [257] (2007) USA	To illustrate the use of triage skills in a single practitioner chiropractic practice	Cross-sectional survey	New pregnant patients (n = 8), plus unknown number of existing pregnant patients	Triage based on presenting complaints	Most common complaints found to be back pain, headaches, shoulder and middle back pain, rib pain, and sinus problems. Office visits of existing pregnant patients showed 85% (n = 118) complaints were non-triage while 15% (n = 21) involved some level of triage. None of the pregnancy visits required emergency care.
Andrew et al. [256] (2003) United Kingdom	To determine the chiropractor and pregnant patient perspective in the care of SPD in the perinatal period	Cross-sectional survey	Survey of 16 pregnant women and 7 chiropractors completing their respective surveys	Pregnant women identified reasons for chiropractic care; chiropractors recorded women's pain complaints, characteristics of visits, and treatments options	Majority reported pubic pain (94%) and low back (50%), with 81% describing the pain as deep bruising aggravated by changing positions (81%), with rest (56%) as palliative. The majority (62.5%) indicated as having moderate recovery. The chiropractors were experienced in caring for patients with SPD using SMT, exercise, and SOT blocks.
Pistolese [259] (2002) USA	To survey chiropractor members of the International Chiropractic Association on their use of the Webster Technique and its outcome(s)	Cross-sectional survey	Professional members of the International Chiropractic Organization (n = 112)	Practice characteristics, knowledge, application, and clinical outcomes with the Webster Technique	n = 112 indicated using the Webster technique with 102 (92%), reporting resolution of a breech presentation, while 10 responders (9%) indicating breech as unresolved.
Diakow [255] (1991) Canada	To determine the association of LBP in pregnancy and delivery and whether SMT affected the outcome of low back pain during labour	Cross-sectional survey	400 pregnancies were reported based on retrospective interviews of 170 women at 5 chiropractic clinics	Questions around low back pain during pregnancy (e.g., severity, location, and associated aggravating/exacerbating factors)	χ^2 test found statistically significant (p < .01) association between low back in pregnancy and low back pain in labour. Women receiving SMT during pregnancy reported experiencing improved lower back pain during labour.

Reference & country	Study aim(s) or purpose	Study design	Study responders	Patient-reported outcomes (PROs) and other outcome measures	Summary of findings
Laufer [254] (1987) Canada	Retrospective file review to characterise (i.e., age, occupation, number of children and major complaints) women presenting for chiropractic pregnancy care	Cross-sectional survey	Pregnant women (*n* = 126)	File review for age, occupation, pregnancy status, and major presenting complaints	Average age women 29.8 years. Majority working in public service (33%), business community (20%), or 'homemakers' (19%). For majority (69%), current pregnancy was their first pregnancy. Most frequent complaint was lower back pain (61.5%), thoracic pain (6.9%), while 10.4% presented for a check-up.

Note. EQ-5D = EuroQoL Group 5 Dimensions of Health; FHR = foetal heart rate; NET = Neuro Emotional Technique; PRO = patient-reported outcome; PBRN = practice-based research network; PROMIS = Patient-Reported Outcomes Measurement Information System; RCT = randomised controlled trial; SD = standard deviation; SMT = spinal manipulative therapy; SPD = symphysis pubis dysfunction; VSQ = visit-specific questionnaire.

Table 2.13. Summary Findings of Systematic Reviews Involving Chiropractic Care for Pregnant Women

Reference & country	Study aim(s) or purpose	Inclusion / exclusion criteria	Database & year of publication	Summary of findings
Weiss et al. [55] (2021) Canada	To update a critical review of the literature on adverse events associated with chiropractic care in pregnant and postpartum women	Inclusion criteria: (1) documented adverse events/iatrogenic injuries, (2) involved pregnant/ postpartum (up to 6 weeks postbirth), (3) intervention performed by chiropractors, osteopaths and physiotherapists	PubMed, CINAHL, Index to Chiropractic Literature, Cochrane Database of Systematic Reviews/Cochrane Central Register of Controlled Trials, and Medline (October 2011–November 2018)	8 systematic reviews, 7 RCTs, 5 cohort studies, and 1 case report. Overall, only new document found—a case report demonstrating a serious adverse event following SMT in the cervical spine and minor and transient adverse events in the low back.
Weber-Hellstenius [365] (2020) Sweden	To address potential stroke risks in women, particularly during pregnancy and postpartum	Exclusion criteria: (1) non-English manuscripts, (2) case reports, (3) commentaries, (4) pilot studies, and (5) letters to the editor; used the search terms: pregnancy, stroke migraine, stroke race, women, obesity, and manual therapy in various Boolean combinations	PubMed, ResearchGate (1995-2020)	Third trimester pregnancy and 6 weeks postpartum were found to elevate risk 9- to 15-fold for stroke. Eclampsia and preeclampsia showed strongest risk factors accounting for 25-57% of strokes. Obesity elevated this risk 12-fold. Women diagnosed with infection at time of delivery have a 2.4- to 10.5-fold increase in risk of having a stroke regardless of their hypertensive status.

Reference & country	Study aim(s) or purpose	Inclusion / exclusion criteria	Database & year of publication	Summary of findings
Weis et al. [49] (2020) Canada	To assess effectiveness of common care approaches employed by chiropractors for pregnancy-related low back (PRLBP) and pelvic girdle pain (PRPGP)	Inclusion criteria: (1) publication in English, (2) pregnant women suffering from lumbar spine or pelvic girdle pain, (3) received chiropractic care (SMT and/or adjunctive therapies)	PubMed, CINAHL, ICL, Cochrane Database, MEDLINE (journal inception to November 2016)	Based on 18 systematic reviews, 30 RCTs and 2 cohort studies, care of PRLBP had moderately favourable evidence for electrotherapy and osteopathic manipulative therapy (OMT); favourable strength of evidence for chiropractic care, exercise, and support devices. Inconclusive, unclear strength evidence for SMT, OMT, and support devices for PRLBP or PRPGP.
Alcantara et al. [102] (2015) USA	To examine use of validated outcome measures in chiropractic care of pregnant women	Inclusion criteria: (1) publication of primary investigation, (2) reports involving chiropractic care of pregnant women, and (3) use of a validated outcome measure	PubMed, CINAHL, Medline, ICL, and MANTIS (1966-2014); hand-search also performed of specific chiropractic journals (2009-2014)	8 articles met inclusion criteria identifying 7 validated PROs. Despite heterogeneity and inconsistency issues, some measure of effectiveness was noted in pregnant women.
Stuber et al. [56] (2012) Canada	Systematic review of literature on adverse events associated with SMT during pregnancy and 6 weeks postpartum	Inclusion criteria: (1) manuscripts in English/French, (2)involving pregnant/postpartum women receiving SMT, (3) with documented associated adverse events with SMT	PubMed, CINAHL, ICL (journal inception to October 2011)	Two manuscripts described adverse events associated with SMT in 2 postpartum patients. Three manuscripts described a total of 5 patients experiencing an adverse event with SMT during pregnancy. Adverse events ranged from minor to more severe injuries including fracture, stroke, and epidural hematoma.

Reference & country	Study aim(s) or purpose	Inclusion / exclusion criteria	Database & year of publication	Summary of findings
Khorsan et al. [101] (2009) USA	To examine effects of SMT on back pain and other related symptoms during pregnancy	Inclusion criteria: (1) publication in English, (2) use of chiropractic and osteopathic SMT during pregnancy/childbirth	PubMed (1966-September 2008), MANTIS (1966-September 2008), CINAHL (1982-September 2008), ICL (inception -September 2008), Google Scholar	32 manuscripts reviewed (1 = RCT, 2 = systematic reviews, 1 = cohort study, 2 = case-control studies, 1 = non-randomised static-group comparison study, 4 = narrative reviews, 6 = case series, 9 = descriptive surveys). Overall, studies varied in treatment protocols and outcome measures. Investigators concluded the use of SMT during pregnancy to reduce back pain and other related symptoms was supported by limited evidence and described as emergent.
Stuber & Smith [100] (2008) Canada	To review the literature on chiropractic care for PRLBP	Inclusion criteria: (1) manuscripts in English, (2) on pregnant women with LBP, (3) cared for by chiropractor, (4) outcomes measures applied	MEDLINE, CINAHL, AMED, ICL (January 1982- July 2007)	6 studies involved (1 = quasi-experimental design, 4 = case series, 1 = cross-sectional case series). Downs and Black [372] quality scores ranged from 5-14 of total of 27. All studies reported positive results with chiropractic care of LBP during pregnancy. Outcome measures were inconsistent, as were descriptions of patients, treatments, and treatment schedules.
Borggren [99] (2007) USA	To review the literature on chiropractic care of pregnant women	Inclusion criteria not indicated but used search terms: pregnancy and chiropractic	PubMed (1987-2006)	A commentary using 33 references to support statements on chiropractic care for LBP, safety of chiropractic care, and chiropractic care in postpartum. Limitations: many of cited references were from journals not indexed or not peer-reviewed.

Note. Yr = year; MANTIS = Manual, Alternative and Natural Therapy Index System; CINAHL = Cumulative Index to Nursing and Allied Health Literature; AMED = Allied and Complementary Medicine Database; ICL = Index to Chiropractic Literature.

Table 2.14. Summary Findings of Studies Examining the Effects or Possible Effectiveness of the Chiropractic Care of Pregnant Women

Reference & country	Study design	Clinical condition	Setting	Gestational age or trimester of pregnancy	Intervention	Statistical analysis	Evidentiary support for chiropractic
Gausel et al. [248] (2017) Norway	RCT	Dominating one-sided pelvic girdle pain (PGP)	Two clinics involving 5 chiropractors	Week 18 to 6 weeks postpartum	Control group received conventional medical care; intervention group received HVLA-type SMT (except one receiving mobilisation). All received soft tissue treatment and advice with 17 receiving instructions for home exercises.	Descriptive statistics (means, *SD*s), χ^2 tests. Relative risks with 95% CI; Multiple linear regression analysis (significance at $p < .05$)	No
George et al. [247] (2013) USA	RCT	Low back pain, pelvic pain, or both	Women's Health Center and two private clinics	Weeks 24-28	Control group received standard obstetric care (i.e., STOB); intervention group received obstetrics care and chiropractic care (i.e., MOM)	Power analysis, χ^2 tests, *t*-test, mixed models repeated measures of analysis (significance at $p < .05$)	Yes
Peterson et al. [246] (2012) USA	RCT	Low back pain of unknown origin that began during pregnancy	Single practitioner clinic	All trimesters	Use of exercise booklet versus HVLA-type, versus NET	Linear regression, differences in the proportion of responders indicating improvement or no improvement between groups (significance at $p < .05$)	Yes

Reference & country	Study design	Clinical condition	Setting	Gestational age or trimester of pregnancy	Intervention	Statistical analysis	Evidentiary support for chiropractic
Alcantara et al. [113] (2018) USA	Prospective cohort	Quality of life and patient satisfaction	Multiple practices participating in a practice-based research network	Mean of 25.67 weeks (median = 28 weeks; range = 0-42 weeks)	Pregnant women attending care received unspecified chiropractic SMT and/or adjunctive therapies	Descriptive statistics, generalised linear model, mixed model using logit link function (significance set at $p < .05$)	Yes
Haavik et al. [252] (2016) New Zealand	Prospective cohort	Pelvic floor muscle function	Not described	Mean of 22.1 weeks (range:16-25 weeks)	Intervention group received HVLA-type SMT (i.e., Diversified Technique); control group received passive and active movements of the head, spine, and body	Three-way repeated-measures ANOVA among outcome variables with post hoc paired *t*-tests (significance set at $p < .05$)	Yes
Peterson et al. [251] (2014) Switzerland	Prospective cohort	Low back pain or pelvic pain	Two chiropractic clinics	At baseline, the majority were in their 3rd trimester ($n = 48$; 53.1%), followed by 2nd trimester ($n = 48$; 41.6%), and 1st trimester ($n = 6$; 5.3%)	Individualised chiropractic care at the discretion of the chiropractor	Descriptive statistics, paired and unpaired *t*-test, ANOVA, logistic regression analysis (significance set at $p < .05$)	Yes
Alcantara et al. [53] (2012) USA	Prospective cohort	Foetal malposition or malpresentation	Practice-based research network	Mean of 36.1 weeks (median = 37 weeks, mode = 38 weeks)	Care received was unspecified chiropractic SMT and/or adjunctive therapies	Descriptive statistics	Yes

Reference & country	Study design	Clinical condition	Setting	Gestational age or trimester of pregnancy	Intervention	Statistical analysis	Evidentiary support for chiropractic
Murphy et al. [249] (2009) USA	Prospective cohort	Lumbar pain (LP) or posterior pelvic pain (PPP)	A multi-disciplinary clinic	Mean of 25.2 weeks (*SD* = 7.4, Median = 26, *n* = 110)	Unspecified provided by chiropractic and physical therapy	Descriptive statistics, general linear modelling, χ^2 test (significance set at $p < .05$)	Yes
McCoy et al. [54] (2009) USA	Prospective cohort	Quality of life	Chiropractic clinic with one chiropractor	Not indicated	Diversified Technique and Webster technique	Descriptive statistics	None provided
Phillips & Meyer [253] (1995) USA	Case control	Alteration of need for obstetrical intervention during labour and delivery	Chiropractic college teaching clinic	20-44 weeks	Diversified, Thompson, Logan, and/or Webster Technique in addition to Upledger craniosacral therapy as well as nutritional advice, exercise patient education	χ^2 test	No

Reference & country	Study design	Clinical condition	Setting	Gestational age or trimester of pregnancy	Intervention	Statistical analysis	Evidentiary support for chiropractic
Edwards et al [264] (2023) USA	Cross-sectional cohort	Possible adverse event(s) in foetus due to chiropractic SMT	Chiropractic clinic with single chiropractic provider	6 women (mean weeks gestation = 12.4, *SD* = 0.58) had FHR records in the first trimester; 14 women in the second trimester (mean weeks gestation = 22.03, *SD* = 3.59). A total of 33 women FHR data the third trimester (mean weeks gestation = 35.75, *SD* = 3.37)	Chiropractic SMT	Descriptive statistics	Yes
Alcantara et al. [114] (2012) USA	Cross-sectional cohort	The majority (89.9%) of pregnant women had a primary complaint of sacro-spinal pain	Multiple practices in a practice-based research network	They presented for chiropractic care at an average of 29.42 weeks of gestation (median = 32.00 weeks, mode = 37.00 weeks)	Most common techniques applied by participating chiropractors were Diversified (*n* = 43; 30.9%), Thompson Technique (*n* = 35; 25.2%), Webster Technique (*n* = 27; 19.4%), Gonstead Technique (*n* = 13; 9.4%), and Other (*n* = 21; 15.1%)	Descriptive statistics	Yes

Reference & country	Study design	Clinical condition	Setting	Gestational age or trimester of pregnancy	Intervention	Statistical analysis	Evidentiary support for chiropractic
Aas-Jakobsen & Miller [258] (2010) Norway	Cross-sectional cohort	About 90% of 100 pregnant women presented with pelvic pain; 60% had back pain and 60% with specific thoracic pain; 30% had neck pain, 29% had symphysis pubis pain, 15% experienced headaches, and 2% migraines. Overall, 82% experienced a combination of pain sites.	Chiropractic clinic with single chiropractor provider	The average gestational age was 26.5 weeks (mode = 26 weeks)	Not specified or described	Descriptive statistics	Yes
Andrew & Pedersen [256] (2003) United Kingdom	Cross-sectional cohort	Symphysis pubis dysfunction in pregnant and postpartum women	Chiropractic clinic with single chiropractor provider	Not indicated	Not specified or described	Descriptive statistics	Yes
Pistolese [259] (2002) USA & Canada	Cross-sectional cohort	Breech foetus.	Individual chiropractic practices	Not indicated	Webster Technique	Descriptive statistics	Yes

Reference & country	Study design	Clinical condition	Setting	Gestational age or trimester of pregnancy	Intervention	Statistical analysis	Evidentiary support for chiropractic
Diakow [255] (1991) Canada	Cross-sectional cohort	Low back pain	Chiropractic clinic of 5 chiropractors	Not indicated	Nonspecific SMT	χ^2 test (significance set at $p < .01$)	Yes

Note. ANOVA = analysis of variance; CI = confidence interval; FHR = foetal heartrate; HVLA = high velocity, low amplitude; MOM = multimodal musculoskeletal and obstetric treatment; NET = Neuro-Emotional Technique; RCT = randomised controlled trial; SD = standard deviation; SMT = spinal manipulative therapy; STOB = standard obstetric treatment; Yr = year.

2.4.3.3 Year of Study

The majority (*n* = 19; 59.4%) of studies were published between 2011-2023 [49, 53, 55-56, 102, 113-114, 246-248, 250-252, 261-264, 365-366], 10 (31.3%) were published between 2000-2010 [54, 99-101, 245, 256-259] and three (9.4%) before 2000. [253-255]

2.4.3.4 Countries

The majority (*n* = 15; 46.9%) of the studies were conducted in the United States [53-54, 99, 101-102, 113-114, 246-247, 249-250, 253, 257, 259, 264], followed by Canada (*n* = 11; 34.4%) [49, 55-56, 100, 254-255, 260-263, 366], Norway (*n* = 2; 6.3%) [244, 254] and one each (3.1%) from New Zealand [248], Switzerland [247], Sweden [362], and United Kingdom [252] (Tables 2.12-2.13).

2.4.3.5 Sample and Size

In the studies involving pregnant women responders [53-55, 113-114, 246-248, 251-252, 249-250, 253-254, 256-258] the mean sample size was 94.59 (*SD* = 84.56, range: 8–343) while studies with chiropractor responders had a mean sample size of 348.00 (*SD* = 562.93, range:18–1350). [252, 260-263] The retrospective file review by Edwards et al. [264] involved 33 pregnant women. The best practice recommendations by Weis et al. [366] involved 70 chiropractors as panellists. The large standard deviation reflects a large variation in sample size.

2.4.3.6 Patient Characteristics

Twelve studies [53-54, 113-114, 246-249, 251-252, 254, 258] involved a total of 1405 pregnant women with an average age of 30.56 years. Phillips et al. [253] reported pregnant responders (*n* = 63) between 18-35-years of age (*n* = 53; 84.1%) and >35 years of age (*n* = 10; 15.9%). The retrospective study by Diakow et al. [255] 170 women with their

age ranging from 18-67 years of age. Edwards et al. [264] reviewed the file of 33 pregnant women with an average age of 30.65 years (*SD* = 5.22). Three studies [250, 257, 260] did not provide the age of their subjects.

In terms of gestational age, 11 studies [53, 113-114, 246-248, 249-250, 251-252, 258] indicated a mean of 25.86 WOG from 1177 women. Phillips et al. [253] reported 52 women were between 37-44 WOG, one was between 20-26 WOG and 10 of unknown gestational age. Edwards et al. [264] reviewed the foetal heart rate (FHR) monitoring of women at various stages of pregnancy. Data from the first trimester involved 6 women with a mean WOG of 12.4 (*SD* = 0.58). Fourteen women were in their second trimester with a mean WOG of 22.03 (*SD* = 3.59). In the third trimester, a total of 33 women had a mean of WOG of 35.75 (*SD* = 3.37). Five studies [54, 254-257] provided no gestational status of their pregnant subjects.

Reported educational levels of pregnant women in these studies indicated high educational levels with one cohort [248] having a mean education of 14.75 years (*SD* = 5.05; *n* = 52) while two studies [113, 246] reported that 47% (*n* = 27) and 73% (*n* = 229) (respectively) of their responders attained a 4-year baccalaureate degree or higher.

Four studies described varying ethnicities among their subjects. George et al [247] described White (*n* = 69), African American (*n* = 86), and other (*n* = 14) as ethnicities while Peterson et al. [246] described their subjects as White (*n* = 44; 77.2%) Black (*n* = 2; 3.5%), Asian (*n* = 2; 3.5%), and Hispanic (*n* = 9; 15.8%) [32]. Haavik et al. [252] described their subjects as mostly of European descent and Indian, Samoan, and of Asian ethnicity, while Peterson and Peterson. [250] described the ethnicities of their subjects as one Asian and 28 White pregnant women.

2.4.3.7 Experimental versus nonexperimental study designs

While three studies [246-248] were experimental in research design, the majority (n = 19) of the reviewed manuscripts were observational studies. [53-54, 113-114, 249-264] Among the intervention studies (see Table 2.14), the majority (i.e., n = 13, 40.6%) [53, 113-114, 246-247, 249, 251-252, 254-256, 258-259, 264] provided evidence of benefit with chiropractic care while three studies (9.4%) demonstrated no benefit in alleviating sacroiliac joint pain [248], predict foetal gender [250] or affect labour intervention. [253] In addition to alleviating LBP and/or PGP. [114, 246-247, 249, 251, 255-256, 258] The studies also demonstrated that a course of chiropractic care improved quality of life [113], increased levator hiatal area [252], facilitate correction of foetal malposition/malpresentation [53, 259], possible safety of chiropractic care to the unborn foetus and pregnant woman [264], chiropractors' regulatory compliance with website claims on chiropractic pregnancy care [263], chiropractors' knowledge of exercise for pregnant women [262], chiropractors' interventions for pregnant women [260-261], and their ability to triage pregnant women. [257]

Five manuscripts [49, 100, 257, 264, 366] addressed the safety of chiropractic for pregnant women and reported a lack of harm. Four SRs [49, 99-101] addressed chiropractic care in alleviating LBP and/or PGP while Alcantara et al. [102] highlighted the heterogeneity and the lack of pregnancy-specific validated PROs in research and clinical care.

The best practice recommendations by Weis et al. [366] highlighted the meta-competencies (i.e., informed consent and risk/benefit of care, performing an examination including imaging studies and the provision of care) for competent practice in pregnancy care, combining the published evidence and clinical experience for the most beneficial approach to chiropractic care for the pregnant and postpartum populations.

2.4.3.8 Chiropractic Technique and Adjunctive Therapies

The SMT utilised in a number of studies involving pregnant women were generically described as spinal manipulation [248], manual therapy [247] or manual manipulation [255-257], an adjustment [256] or as high velocity, low amplitude (HVLA) SMT [246, 249, 251, 252, 260] and Diversified Technique. [54, 253, 261] Established or brand name chiropractic techniques were also described for pregnant women including the Webster Technique [53, 54, 114, 253, 259, 261], Thompson Technique [114, 253, 261], Gonstead Technique [114, 261] and Logan Technique [253, 261], Cranial Therapies [261], Network Spinal Analysis [261], National Upper Cervical Chiropractic Association (NUCCA Technique) [261], SOT [261], Torque Release [261], Koren Specific Technique [261], Total Body Modification [261], and Meric Technique [261]. Description of these chiropractic techniques are described in Table 2.15.

Adjunctive therapies involved the use of mobilisation of joints [248, 261], soft tissue therapies [248, 260-261], prescribed exercise either as self-administered [247, 253], supervised [246] or in an unspecified mode [256, 260-262] as well as patient education. [247-248, 253, 256, 260-261]

Table 2.15. Chiropractic Techniques Applied in Pregnant Women

Chiropractic Technique	Description
Activator Methods	Developed by Arlan Fuhr, DC, the technique is an alternative to hands-on SMT. A handheld, spring-loaded instrument is utilised to delivers a site-specific low-force impulse to targeted spinal and extraspinal articulations [399].
Cranial Therapies	Not a chiropractic technique per se but a manual therapy that applies a sustained and prolonged contact (i.e., non-HVLA thrust) to correct cranial segmental dysfunctions [399].
Diversified Technique	HVLA thrust that typically results in cavitation of articulations [399].

Chiropractic Technique	Description
Gonstead Technique	Developed by Clarence Gonstead, D.C., this technique applies X-ray analysis known as spinography as integral part of its assessment along with temperature gradient instrumentation (i.e., nervoscope) to assist in the analysis for spinal subluxation. The technique incorporates unique patient and doctor contact points and patient positioning to an HVLA thrust. [399]
Koren Specific Technique	Developed by Dr. Ted Koren, DC, Koren Specific Technique is a healing protocol used to locate and correct/release areas of blockage, distortion, subluxation, interference, stagnation and other stresses in the body. Correction is achieved by the use of the Arthrostim, a hand-held instrument that delivers 12 'taps' per second. [405]
Logan Technique	Created by Huey B. Logan, DC, Logan Basic emphasises the detection and correction of pelvic and spinal distortions and related spinal structures. Logan Basic Technique applies a light force, full spine adjusting procedure highlighting the correction of spinal and pelvic subluxations. [400]
Meric Technique	Modern concept of the Meric Technique embraces the phenomenon of reflex mechanisms as responsible for the effects of spinal lesions. Aberrant information from a dysfunction spinal level alter the behaviour of spinal motor neurons through reflex action(s), particularly sympathetic preganglionic neurons, at that level (and perhaps one or two adjacent levels). Based on somato-somatic reflexes, this mechanism produces localised responses in viscera. Correction of dysfunctional spinal levels would necessarily eliminate these aberrant impulses. [407]
Network Spinal Analysis (NSA)	Created by Donald Epstein, DC, NSA emphasises adverse mechanical cord tension (AMCT) in the spine. The AMCT is associated with areas of defensive physiology and relaxation and ease. Defensive physiology may be associated with defensive postures leading to static non-adaptive states and inefficient use of energy. In response to the non-thrust spinal contacts from the practitioner, over time, the spinal system moves from defensive physiology to one of ease. [401]
NUCCA Technique	Developed by Dr Ralph Gregory, DC, the NUCCA Technique focuses on correcting misalignment of the upper cervical spine with the use of x-ray views of the head and neck to assess the atlas subluxation complex. [402]
Sacro Occipital Technique (SOT)	Developed by Major Bertrand DeJarnette, DC, SOT is a method of understanding myofascial neurological distortion patterns common to chiropractic based on a category system of analysis and treatment to remove body distortions. [399]. Category I involves the dural between the occiput and sacrum that creates distortion patterns at the occiput, atlas vertebrae, and the sacrum with accompanying compensatory. Category II involves hypermobility of the sacroiliac joint causing a dysrelationship between the sacrum and its corresponding ileum. Category III is a complete failure to compensate from a primary subluxation and brings about neural failure as a result of nerve root compression/distraction. [403]

Chiropractic Technique	Description
Total Body Modification	Total Body Modification is an advanced technique in Applied Kinesiology that evaluates and corrects energy imbalances in organs of the body. Imbalances are located using muscle testing with restoration of balance in the nervous system by the stimulation of reflex points located along the spine. [406]
Thompson Technique	A variation of the Diversified Technique that utilises a special table with several drop-piece segments. When a high velocity, low force thrust is delivered over a spinal segment, the underlying table piece 'drops' a small distance carrying the spinal articulations over a range of motion. [399].
Torque Release Technique	Developed by Dr Jay Holder, DC, Torque Release Technique® utilises a multifactorial approach incorporating other chiropractic techniques such as Thomson Technique, SOT, Logan Basic, and Network Spinal Analysis. Spinal adjustments are provided utilising the Integrator™, a hand-held torque and recoil release adjusting instrument. [404].
Webster Technique	A specific chiropractic sacral analysis and correction of sacral subluxation and sacro-iliac joint dysfunction to restore neuro-biomechanical function in the pelvis. [358].

Note. AMCT = adverse mechanical cord tension; DC = Doctor of Chiropractic; HVLA = high velocity, low amplitude; NSA = Network Spinal Analysis; NUCCA = National Upper Cervical Chiropractic Association; SOT = Sacro Occipital Technique.

2.4.3.9 Outcome Instruments

Twelve studies did not utilise a validated PRO instrument. [253, 263-264] Two studies utilised ultrasound technology for foetal positioning and sex determination [53, 250]. One study used transperineal ultrasonography to measure levator hiatal surface area [252] while another study examined testosterone levels in amniotic fluid to differentiate foetal sex [250]. One study involved FHR monitoring. [264] Validated PROs included the use of the pain NRS [246-249, 251], the Oswestry Disability Index Questionnaire [248, 251], the EQ-5D Heath Questionnaire (EQ-5D) [248], the Quebec Taskforce Disability Questionnaire (QDQ) [247], the Roland Morris Disability Questionnaire [246], Patient's Global Impression of Change (PGIC) [251], the Bournemouth Disability Questionnaire (BDQ), and the Fear Avoidance Beliefs Questionnaire (FACBQ-Act) [250], the PROMIS-29 and RAND VSQ9 [113] and the SF-36. [54] None of these PROs are pregnancy specific.

2.4.3.10 Results of the Quality Appraisal

The results of the quality assessment with the JBI CATs are provided in Tables 2.16–2.21. The cross-sectional and prospective studies, which comprised the majority of the manuscripts reviewed, were assessed as of low-medium methodological quality.

Table 2.16. Quality Appraisal of the Randomised Clinical Trials

Criteria	Gausel et al. [248]	George et al. [247]	Peterson et al. [246]
1. Was true randomisation used for assignment of participants to treatment groups?	No	Yes	Unclear
2. Was allocation to treatment groups concealed?	No	No	No
3. Were treatment groups similar at the baseline?	Yes	Yes	Yes
4. Were participants blind to treatment assignment?	No	No	No
5. Were those delivering treatment blind to treatment assignment?	No	No	No
6. Were outcomes assessors blind to treatment assignment?	Yes	Yes	No
7. Were treatment groups treated identically other than the intervention of interest?	Unclear	Unclear	Unclear
8. Was follow up complete and if not, were differences between groups in terms of their follow up adequately described and analysed?	Yes	No	No
9. Were participants analysed in the groups to which they were randomised?	Yes	Yes	Yes
10. Were outcomes measured in the same way for treatment groups?	Yes	Yes	Yes
11. Were outcomes measured in a reliable way?	Yes	Yes	Yes
12. Was appropriate statistical analysis used?	Yes	Yes	Yes
13. Was the trial design appropriate, and any deviations from the standard RCT design (individual randomisation, parallel groups) accounted for in the conduct and analysis of the trial?	Yes	Yes	Yes

Note. RCT = randomised clinical trial.

Table 2.17. Quality Appraisal of Cohort Studies

Criteria	Alcantara et al. [113]	Haavik et al. [252]	Peterson et al. [251]	Alcantara et al. [53]	Peterson et al. [250]	Murphy et al. [249]	McCoy et al. [54]
1. Were the two groups similar and recruited from the same population?	N/A	No	N/A	N/A	N/A	N/A	N/A
2. Were the exposures measured similarly to assign people to both exposed and unexposed group?	N/A	No	N/A	N/A	N/A	N/A	N/A
3. Was the exposure measured in a valid and reliable way?	Unclear	No	No	Yes	Yes	Unclear	Unclear
4. Were confounding factors identified?	No	No	No	Yes	Yes	No	No
5. Were strategies to deal with confounding factors stated?	No	No	No	No	No	No	No
6. Were the groups/participants free of the outcome at the start of the study (or at the moment of exposure)?	No	No	No	No	No	No	No
7. Were the outcomes measured in a valid and reliable way?	Yes	Yes	Yes	Yes	Yes	Yes	Yes
8. Was the follow up time reported and sufficient to be long enough for outcomes to occur?	Yes	Yes	Yes	Yes	N/A	Yes	No
9. Was follow up complete, and if not, were the reasons to loss to follow up described and explored?	No	Yes	No	No	Yes	No	No
10. Were strategies to address incomplete follow up utilised?	No	N/A	No	No	N/A	No	No
11. Was appropriate statistical analysis used?	Yes	Yes	Yes	Yes	Yes	Yes	No

Note. N/A = not applicable.

Table 2.18. Quality Appraisal of Case Control Study

Criteria		Phillips and Meyer [253]
1.	Were the groups comparable other than the presence of disease in cases or the absence of disease in controls?	Yes
2.	Were cases and controls matched appropriately?	Yes
3.	Were the same criteria used for identification of cases and controls?	No
4.	Was exposure measured in a standard, valid and reliable way?	No
5.	Was exposure measured in the same way for cases and controls?	No
6.	Were confounding factors identified?	Yes
7.	Were strategies to deal with confounding factors stated?	No
8.	Were outcomes assessed in a standard, valid and reliable way for cases and controls?	Yes
9.	Was the exposure period of interest long enough to be meaningful?	Yes
10.	Was appropriate statistical analysis used?	Yes

Table 2.19. Quality Appraisal of Cross-Sectional Cohorts

Criteria	Edwards et al. [264]	Kawchuck et al. [263]	Weiss et al. [262]	Yuen et al. [261]	Alcantara et al. [114]	Aas-Jakobsen et al. [258]	Stuber [260]	Rubin [257]	Andrew & Pedersen [256]	Pistolese [259]	Diakow et al. [255]	Laufer [254]
1. Were the criteria for inclusion in sample clearly defined?	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	No	Yes	Unclear
2. Were the study subjects and the setting described in detail?	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Unclear	No	No	Yes	Yes
3. Was the exposure measured in a valid and reliable way?	Unclear	Yes	Yes	Yes	Yes	Yes	No	Yes	Yes	No	No	Yes
4. Were objective, standard criteria used for measurement of the condition?	Yes	No*	Yes	Yes	Yes	Yes	No	Yes	Yes	No	No	Yes
5. Were confounding factors identified?	Yes	N/A	N/A	N/A	Yes	Yes	Yes	Yes	Yes	No	No	N/A
6. Were strategies to deal with confounding factors stated?	No	N/A	N/A	N/A	No	No	No	No	No	No	No	N/A
7. Were the outcomes measured in a valid and reliable way?	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	No	No	Yes
8. Was appropriate statistical analysis used?	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes

*The authors choose to use the CCBC criteria that does not necessarily reflect a state licensing standard criteria or national Canadian standard criteria.

Table 2.20. Quality Appraisal of Systematic Reviews

Criteria	Weis et al. [55]	Weber-Hellstenius et al. [365]	Weis et al. [49]	Alcantara et al. [102]	Stuber et al. [56]	Khorsan et al. [101]	Stuber et al. [100]
1. Is the review question clearly and explicitly stated?	Yes	Yes	Yes	Yes	Yes	Yes	Yes
2. Were the inclusion criteria appropriate for the review question?	Yes	No	Yes	Yes	Yes	Yes	Yes
3. Was the search strategy appropriate?	Yes	Yes	Yes	Yes	Yes	Yes	Yes
4. Were the sources and resources used to search for studies adequate?	Yes	Unclear	Yes	Yes	Yes	Yes	Yes
5. Were the criteria for appraising studies appropriate?	Yes	No	Yes	No	Yes	Yes	Yes
6. Was critical appraisal conducted by two or more reviewers independently?	Yes	No	Yes	No	Yes	Yes	Yes
7. Were there methods to minimise errors in data extraction?	Yes	No	Yes	No	Yes	Yes	Yes
8. Were the methods used to combine studies appropriate?	Yes	No	Yes	Yes	Yes	Yes	Yes
9. Was the likelihood of publication bias assessed?	No	No	No	No	No	No	No
10. Were recommendations for policy and/or practice supported by the reported data?	Yes	Yes	Yes	Yes	Yes	Yes	Yes
11. Were the specific directives for new research appropriate?	Yes	No	Yes	Yes	Yes	Yes	Yes

Table 2.21. Quality Appraisal of Best Practices Recommendations Using AGREE II

Criteria	Rating* of Weiss et al. [366]
Domain 1. Scope and purpose	
1. The overall objective(s) of the guideline is (are) specifically described.	7
2. The health question(s) covered by the guideline is (are) specifically described.	7
3. The population (patients, public, etc.) to whom the guideline is meant to apply is specifically described.	7
Domain 2. Stakeholder involvement	
4. The guideline development group includes individuals from all relevant professional groups	7
5. The views and preferences of the target population (patients, public, etc.) have been sought.	1
6. The target users of the guideline are clearly defined.	7
Domain 3. Rigour of development4	
7. Systematic methods were used to search for evidence	7
8. The criteria for selecting the evidence are clearly described	7
9. The strengths and limitations of the body of evidence are clearly described.	7
10. The methods for formulating the recommendations are clearly described.	7
11. The health benefits, side effects, and risks have been considered in formulating the recommendations.	7
12. There is an explicit link between the recommendations and the supporting evidence.	7
13. The guideline has been externally reviewed by experts prior to its publication.	5
14. A procedure for updating the guideline is provided.	1
Domain 4. Clarity of presentation	
15. The recommendations are specific and unambiguous.	6
16. The different options for management of the condition or health issue are clearly presented.	6
17. Key recommendations are easily identifiable.	7
Domain 5. Applicability	
18. The guideline describes facilitators and barriers to its application.	6
19. The guideline provides advice and/or tools on how the recommendations can be put into practice.	6
20. The potential resource implications of applying the recommendations have been considered.	1
21. The guideline presents monitoring and/or auditing or criteria	1

Criteria	Rating* of Weiss et al. [366]
Domain 6. Editorial independence	
22. The views of the funding body have not influenced the content of the guideline.	4
23. Competing interests of guideline development group members have been recorded and addressed.	6

Note. Rated from 1 = *strongly disagree* to 7 = *strongly agree.*

2.4.4 Discussion

Since the 2009 publication of Khorsan et al. [101] that declared the evidence on SMT for back pain and other related symptoms during pregnancy as emergent, 21 manuscripts have since been published consisting of 3 RCTs [246-248], 7 prospective studies [53-54, 113, 249-252], 6 cross-sectional studies [114, 258, 261-264] and 5 SRs [49, 55-56, 102, 365] addressing a number of topics under chiropractic pregnancy care.

2.4.4.1 Patient Characteristics

Our findings of a mean age of 30 years are consistent with the mean age of Canadian and American women having children [408-409]. Our findings of a mean gestational age of 26.04 weeks indicated that pregnant women present commonly for chiropractic care in the second to third trimester for pregnancy-related LBP and/or PGP. [20].

2.4.4.2 Chiropractor and Practice Characteristics in the Care of Pregnant Patients

With respect to practitioner characteristics, Alcantara et al. [114] found a mean age of 33.96 years among chiropractor responders while Weis et al. [262] reported the majority of their practitioners as between the age of 30-40 years or 41-50 years. Chiropractors' mean years of practice experience was found to be < 15 years. [114, 258, 261-262]. Unlike studies comprised of a convenience sample of chiropractors [261-262], the study utilising

chiropractors with a specific interest in pregnancy care [114] found female responders were more common than males.

The study by Stuber [260] remains the only study examining chiropractors' cross-referral with other healthcare professionals. Despite a low sample size (n = 18) and lack of clinical experience, the responders indicated cross referrals commonly with massage therapists, followed by MDs, midwives and naturopaths. Alcantara et al. [114] found that midwives and nurse-midwives were common sources of referrals while Aas-Jakobsen et al. [258] found midwives, medical doctors and physiotherapists referred to chiropractors.

Yuen et al. [261] was the first to investigate the most commonly provided therapeutic interventions for pregnant women by chiropractors. Our literature review confirms their findings on the popularity of Diversified Technique [54, 246, 249, 251-253] in pregnancy care. Standardised kinematic application of Diversified Technique by chiropractors is difficult due to differing quantifiable parameters (i.e., pre-load and peak forces versus time) from one practitioner to another, depending on the practitioner's expertise and experience and the patient morphology and spinal region (i.e., cervical, thoracic and lumbo-sacral regions). [410] Diversified Technique therefore suffers from lack of replicability, a characteristic crucial for scientific progress. [411]

2.4.4.3 The Safety of Chiropractic Pregnancy Care

Thus far, a handful of studies [55-56, 260, 264, 366] have addressed the safety of SMT in pregnant patients. The findings by Edwards et al. [264] indicate possible safety for the foetus from SMT of the pregnant woman, Stuber [260] surveyed a small sample (n = 18) of chiropractors with limited clinical experience in pregnancy care and found that SMT was an appropriate treatment for pregnant women with a number of clinical presentations (i.e., LBP, mid-back pain, neck pain, headaches and vertigo) and comorbidities (i.e., multiple pregnancy, gestational diabetes, hypertension, and unexplained excessive

spotting) while the SRs [55-56] identified five articles documenting adverse events in seven subjects that were attributed to chiropractors [412-413], a physiotherapist [414] and a medical practitioner [415]. In a similar and more recent review Weiss et al. [55] further documented minor adverse events (i.e., soreness) [248-249, 251] and one case of dissection of the right internal carotid artery. [280] This case report on carotid dissection is a cautionary tale in the chiropractic care of pregnant women with comorbidities. Weber-Hellstenius [365] addressed stroke risk in the perinatal period to inform chiropractors. Pregnancy and systemic lupus erythematosus (SLE) has a risk odds ratio of 15.2 [416-417] indicating a higher odd of stroke while hypertension during pregnancy confers a six- to nine-fold increase in stroke.

The use of non-force techniques (i.e., Activator Methods) is recommended to mitigate thrombus formation given the increased blood hypercoagulability and blood vessel wall changes in pregnancy. [56]

Haavik et al. [252] found a significant increase in levator hiatal area by an average of 2.3 cm^2 in pregnant women receiving SMT. Levator ani trauma and hiatal overdistension has been associated with female pelvic organ prolapse (POP). [417-419] The benefit of relaxation of the pelvic floor muscles must be weighed against possible POP.

2.4.5 Strengths and Limitations of the Review

The strength of our review was the systematic search, identification, and screening of a diverse body of literature following the PRISMA protocol. [396] Our review provides a comprehensive examination of the literature with quantitative measures on chiropractic pregnancy care. The inclusion of English-only manuscripts along with the majority of the literature reporting in favor of chiropractic indicates publication bias. [109, 420] This

limitation was further compounded with our assessment of the poor methodological quality among the studies reviewed.

2.4.6 Quality Assessment

Common to all the RCTs (see Table 2.16) was the lack of allocation concealment and issues with blinding the participants and those providing the treatment. Furthermore, it was unclear if the treatment groups were treated identically other than the intervention of interest. These are factors contributing to risk of bias. Randomisation in the Gausel et al. study [248] was lacking while George et al. [247] and Peterson et al. [246] had incomplete follow-up. As such, the RCTs were assessed as of low-medium methodological quality.

The prospective studies (see Table 2.17) were also assessed as of low-medium methodological quality (i.e., high risk of bias). All the studies [53-54, 113, 249-252] failed to provide strategies to address confounders and strategies to address incomplete follow-up. Also, the outcomes measured were not free at the beginning of the study.

Except for the study by Haavik et al. [252], questions pertaining to within and across groups similarities and the measurement of exposure to assign exposed and unexposed groups did not apply as the prospective studies involved single cohorts. Furthermore, except for two studies [53, 250], the measurement of the exposure was not performed or unclear. The majority of studies failed to identify confounders [54, 113, 249, 251-252], had incomplete follow-up [53-54, 113, 249, 251] or failed (or unclear) to provide strategies to address incomplete follow-up. [53-54, 113, 249-252]

The case control study by Phillips et al. [253] (see Table 2.18) was of acceptable quality despite failing to use the same criteria for identification of cases and controls, lack of valid, reliable and similar way to measure the exposure and provide strategies to deal with confounding factors.

Of the cross-sectional studies (see Table 2.19), the studies by Pistolese [259] and Diakow et al. [255] had the lowest methodological quality as they failed to address the majority of factors list in the JBI checklist. The studies by Alcantara et al. [114] and Aas-Jakobsen et al. [258] were assessed of high methodological quality having failed only to provide strategies to deal with confounding factors. In 4 studies [254, 261-263], the identification of and strategies to deal with confounding factors were not applicable. We note that five studies [256, 258, 262-265] were retrospective file reviews and another five studies [114, 257, 259-263] did not necessarily conform to the exposure-disease scenario for infectious and chronic disease epidemiology [421-422] upon which the quality appraisals are based on. The inclusion criteria for study participation and appropriate use of statistical analysis were present in the studies. Overall, the cross-sectional studies were assessed as of low-medium methodological quality.

All of the SRs failed to assess the likelihood of publication bias, which is a major problem in systematic reviews identified in a number of fields. [423] Despite this deficiency, the majority of the SRs were otherwise assessed as having high methodological quality. Two of the SRs were deemed to have low methodological quality. The SR by Weber-Hellstenius et al. [365] failed to address 8 the 11 items and the SR by Borggren [99] that failed to address 7 of the 11 items with 3 unclear in the JBI checklist for SRs.

The best practices recommendations by Weiss et al. [366] was assessed as high quality with a mean score of 5.39 (*SD* = 2.43; 1 = *lowest possible quality* to 7 = *highest possible quality*; see Table 2.21). Weis et al. [366] failed to include the views and preferences of the target population (patients, public, etc.), failed to provide a procedure for updating their guideline and address potential resource implications in applying the recommendations and presents monitoring and/or auditing or criteria.

2.4.7 Recommendations for Future Studies

Overall, there is a need for higher level research designs (i.e., RCTs and large prospective cohort studies) in studies involving the chiropractic care of pregnant women. In addition to addressing safety and effectiveness of chiropractic pregnancy care, future studies should examine practitioner/practice and patient characteristics, clinical protocols (i.e., the effectiveness of the Webster Technique) and collaborative efforts among chiropractors. Although the focus of this review was on quantitative measures in chiropractic pregnancy care, the lack of qualitative studies was also apparent. Both types of studies will inform clinical care, research, consumers and policy makers.

2.4.8 Conclusion

The number of chiropractic quantitative studies on pregnancy care is limited and heterogenous in terms of their purpose and study design. Our findings indicate some support for chiropractic care in addressing pregnancy-related LBP and/or PGP. However, their poor methodological quality does not allow for definitive conclusions. Further high-quality studies in chiropractic and pregnancy care are needed.

2.5 Key Findings from the Systematic Reviews

2.5.1 Sense of Coherence in Pregnancy: A Systematic Review and Narrative Synthesis of the Literature

Our systematic review on measures of SOC in pregnancy found 49 studies consisting of mostly prospective (*n* = 31) or cross-sectional (*n* = 18) studies and assessed overall as of good methodological quality using the National Institute of Health (NIH) National Heart, Lung, and Blood Institute Study Quality Assessment Tools. Most (*n* = 35) of the studies utilised the SOC-13 while 7 studies utilised the SOC-29. SOC was measured throughout the trimesters of pregnancy but more commonly in the 2nd and 3rd trimester. Concurrent with measures of SOC were 67 outcome measures with the majority of these (*n* = 61) as validated PROs while 6 were nonvalidated self-reported questionnaires. Three studies examined SOC in conjunction with laboratory measures (i.e., glycated hemoglobin [HbA1c], cortisol and secretory immunoglobulin A [sIgA]). SOC scores were significantly negatively correlated with high hemoglobin (Hb) A1c levels while no correlation was found between measures of SOC scores and salivary cortisol or with secretory s-IgA. A low SOC was associated with compromised quality of life (QoL) or functioning while a high SOC was associated with more optimised QoL or functioning. For example, a low SOC was associated with low health promoting behavior trajectory, high depression and high anxiety, history of domestic violence, fear of childbirth, low life satisfaction, and lack of social support. The Edinburgh Postnatal Depression Scale (EPDS) was found to be inversely correlated with SOC and the most commonly used PRO in the reviewed studies.

A number of birth-related variables and birth outcomes were also observed with respect to SOC measures in pregnant women. A low SOC score was associated with greater use of epidural anaesthesia, the use of instruments or assisted vaginal birth or Caesarean births, the use of labour induction/augmentation, threatened premature birth,

and a less positive experience with pregnancy. Conversely, measures of optimum health or increasing functioning were positively correlated with SOC. For example, childbirth self-efficacy was positively correlated with SOC. A high SOC score was also associated with low levels of depression, low worry and low fear of childbirth, high couple relationship quality, high self-efficacy in diabetes management, high scores of well-being, high self-rated overall health and better functioning during pregnancy.

Despite these findings, our systematic review also found studies that demonstrated a lack of a relationship between SOC measures and some PROs. No relationship was found between SOC and induction of labour (i.e., use of oxytocin augmentation), the onset of labour or duration of labour from onset of labour to hospital admission or cervix dilation, mode of birth (i.e., spontaneous birth or normal birth in a primary care setting or Caesarean births), the use of epidural anaesthesia, newborn complications including stillbirths and neonatal deaths, infant Apgar score and low birth weight, maternal complications such as use of forceps or vacuum extraction, haemorrhage, and length of hospital stay.

These somewhat contradictory findings may be explained with the acknowledgement that pregnancy is a dynamic process, rendering a number of measures susceptible to significant fluctuations during the span of pregnancy. The results of the various studies may also be attributed to differences in study designs (i.e., prospective versus retrospective cohort), differences in sample size, the timeframe of SOC measurements (i.e., SOC measures during early or late pregnancy or prenatal versus postnatal measures), and differences in country of study. Finally, the relationship of SOC with PROs may also be attributed in how and for what purpose the outcome measures were applied, the levels of SOC among the pregnant respondents and what role SOC was interpreted to play by the pregnant women. Consider that pregnant women with high SOC

scores may have increased comprehension of their healthcare needs, are more capable of effectively using existing and potential resources and have higher motivation to manage their pregnancy and birth. They may also be perceived and treated differently by health professionals.

2.5.2 The Chiropractic Care of Pregnant Women: A Scoping Review of the Literature

To integrate the disparate literature (n = 129) of varied designs/methodologies (i.e., randomised controlled trials (RCTs), cohort studies, case reports/series, commentaries), data-based convergent synthesis method was utilised using Natural Language Processing (NLP) to quantify text from the reviewed manuscripts in order to facilitate a statistical analysis. Integration of the transformed text utilised K-means cluster analysis to identify similar groups or clusters of text. The manuscripts within and between clusters were then examined for patterns, trends and themes. This method identified four clusters of the published literature with themes that represented the care of pregnant women with complex musculoskeletal (MSK) presentations (Cluster 1), the care of pregnant women with simple MSK presentations (Cluster 2), the use of the Webster Technique (Cluster 3), and manuscripts characterised by advocacy or education in the chiropractic care of pregnant women (Cluster 4).

An examination of the research evidence demonstrated that in Cluster 2, the literature representing the care of pregnant women with simple MSK presentations (i.e., low back pain [LBP] and/or pelvic girdle pain [PGP]) involved studies that were relatively high in the research evidence hierarchy (i.e., systematic reviews, RCTs and cohort studies). The evidence hierarchy ranks study designs based on the rigour of their research methods so that study designs positioned high on the hierarchy pyramid, the more rigorous its methodology to minimise the effects of bias. [424] The literature on the Webster Technique (Cluster 3), a commonly used chiropractic technique for pregnant women was

comprised mostly of case reports and case series, two cohort studies and a commentary. Commentaries and case reports/series are at the lowest level of the evidence-hierarchy. [424] The cross-sectional survey study by Pistolese [259] on the use of the Webster Technique was assessed as of poor methodological quality having failed to address all of the quality criteria but for one. The study by Alcantara et al. [53] to examine reversion of breeched foetuses to vertex with from the Webster Technique was assessed as of poor-moderate quality. Furthermore, as acknowledged by Alcantara et al. [53], confounders exist to make cause and effect inferences difficult. The chiropractic care of pregnant women with complex MSK presentations (Cluster 1) was also composed of mainly case reports/series with two observational cohort studies and two commentaries. Cluster 4 - manuscripts characterised by advocacy or educational in the chiropractic care of pregnant women – was comprised of mostly commentaries or expert opinions on a number of topics germane to chiropractic pregnancy care (i.e., chiropractic technique for pregnant women, exercise for pregnant women, caring for the woman with gestational diabetes). As previously mentioned, commentaries and case reports/case series are the lowest levels of evidence in the evidence hierarchy. Expert opinion without explicit critical appraisal, or based on physiology, bench research or 'first principles.' [424] is the lowest form of evidence. Higher level research designs incorporating randomisation, the presence of a control group and manipulation of the intervention variables are required to make accurate assessment of cause-and-effect relationships between independent and dependent variables. [425]

2.5.3 Chiropractic Care During Pregnancy: A Quantitative Systematic Review and Narrative Synthesis of the Literature

This systematic review found 32 manuscripts consisting of three RCTs, seven prospective cohort studies, one case control study, 12 cross-sectional studies, eight

systematic reviews and one best practice recommendations document. The majority were published in the last 20 years from the United States followed by Canada and were assessed as of low-medium methodological quality using the Joana Briggs critical appraisal tools. Of the 32 studies, 40% (*n* = 13) [49, 99-101, 114, 246-249, 251, 255-256, 258] were focused on the care of pregnant women with LBP and/or PGP. Four papers addressed safety of pregnancy care [55-56, 260, 365], two studies on the use of the Webster Technique to address foetal malposition/malpresentation [53, 259] and two studies on measures of QoL. [54, 113] One study each addressed patient socio-demographic [254], the use of validated outcome measures in pregnancy research [102], triage in pregnancy care [257], effects of chiropractic on obstetrics interventions [53, 253], the use of foetal heart rate (FHR) [264], regulatory monitoring [263], knowledge on exercise [262] , clinical protocols for pregnancy care [261], measures of hiatal hernia area [252], determination of foetal sex [250] and best practices recommendations. [366] Ultrasound technology was applied to assess foetal positioning, to measure levator hiatal surface area and foetal heart rate monitoring. [53, 252, 264] One study examined the amniotic fluid to detect foetal sex. [250] Validated PROs included the use of the pain NRS, the Oswestry Disability Index Questionnaire, the EuroQul 5 Dimensions Heath Questionnaire (EQ-5D), the Quebec Taskforce Disability Questionnaire, the Roland Morris Disability Questionnaire, Patient's Global Impression of Change (PGIC), the Bournemouth Disability Questionnaire (BDQ), the Fear Avoidance Beliefs Questionnaire (FABQ), the Patient-Reported Outcomes Measurement Information System 29-item profile questionnaire (PROMIS-29), and the RAND 9-item visit specific questionnaire (VSQ9) and short form 36 item (SF-36). Our systematic review found no study measuring SOC, locus of control (LOC), general self-efficacy (GSE) and interpersonal process of care (IPC) experience in pregnant women under chiropractic care. Future research should

address this deficit in the scientific literature and examine the SOC, LOC, GSE and IPC experience of pregnant women.

2.6 Overall Discussion

Our scoping and systematic review of the literature on the chiropractic care of pregnant women identified a number of gaps in the scientific literature. Research on pregnancy care has focused mainly on the effectiveness of chiropractic spinal manipulative therapy (SMT) in women with pregnancy-related LBP and/or PGP. In this regard, a number of validated PROs have been utilised. However, other aspects of chiropractic pregnancy care remain to be addressed with research. As evidenced in our reviews, only a handful of studies provide insights into practitioner characteristics. [114, 256, 260-262] Furthermore, these studies only provide a partial or incomplete characterisation of chiropractors involved in pregnancy care with a lack of in-depth examination of practitioner characteristics such as practitioner socio-demographics (i.e., age, gender), core aspects of chiropractic practice (i.e., practice environment, patient workload, clinical experience, postgraduate training), and clinical management (chiropractic technique and technique modification for pregnant women, adjunctive therapies, and safety attitudes). The same could also be said about studies examining patient characteristics. Topics addressing the chiropractic care of pregnant women in the existing scientific literature are drawn from small sample of informants and/or drawn from informants with very little if no clinical experience in pregnancy care.

Our systematic review established that pregnant women commonly present for chiropractic care with complaints associated with pregnancy related MSK complaints such as LBP and/or PGP. However, we also know that pregnant women present for wellness care [113] or to optimise their chances for a natural childbirth with the Webster Technique. [53] These types of motivation deserve further investigation. Information on practitioner

and patient characteristics is vital to understanding the current environment of chiropractic pregnancy care, ensure that clinical practice is reflected in chiropractic education and research and provide support for future workforce planning. Furthermore, practitioner and patient data may facilitate current and future collaboration of chiropractors with other health providers in the care of pregnant women. [426]

To address the deficits in characterising chiropractic pregnancy care, an aim of this thesis is to examine practitioner and patient characteristics as informed by chiropractors versed in chiropractic pregnancy care.

As evidenced in our systematic review on measures of SOC in pregnancy, high SOC is associated with many positive outcomes as measured by a number of validated PROs and may provide an alternative framework for pregnancy care. That is, pregnancy care with a focus on health rather than pathogenesis. Despite the measures of SOC and PROs being made in a number of clinical situations, no examination of SOC has been performed in chiropractic pregnant patients. Furthermore, the association between physical health domains of QoL and SOC have not been well studied in pregnant women. Using the 12-item short form (SF-12) questionnaire and family SOC questionnaires, Ngai and Ngu [181] found that family SOC did not have a direct effect on physical health but did on mental health. The use of the physical well-being index by Hildingsson et al. [191] found that pregnant women experiencing dissatisfaction with partner support experienced more physical symptoms and lower SOC. Staneva et al. [171] found that lower levels of SOC was highly and significantly associated with pregnancy-specific distress, including physical health constructs. In terms of experience, our systematic review on SOC in pregnancy confirm that a low SOC was associated with a history of violence [158, 176] or that as the level of SOC increased, the levels of maternal and relationship satisfaction also increased. [157] In terms of interpersonal relationships, Staneva et al. [171] found that a

lower SOC was highly and significantly associated impaired interpersonal relationships between the pregnant women with both her partner and her mother.

According to Antonovsky [427], SOC is also similar to a number of health constructs that he referred to as generalised personality orientations such as self-efficacy and locus of control. These constructs indicate the degree to which individuals react or adapt to stress and how this may affect their health. [428] According to Trap et al. [429] SOC and self-efficacy include a cognitive component that enables individuals to anticipate and predict events, a motivational component that efforts are worthy of expenditure and meaningful and a capability component in that personal resources are adequate or personal belief in their coping capability. Each of the key components of SOC (comprehensibility, meaningfulness and manageability) can include all four learning processes for self-efficacy (mastery experience, vicarious experience, social persuasion, psychological factors) and the extent of this overlap may be quantified by their correlation and interaction.

Weismann and Hannich [430] have postulated that self-efficacy may be a possible generalised resistance resource in that self-efficacy is characterised by being consistent, contributes to shaping outcomes and provides the correct overload/underload balance. Self-efficacy differs from SOC in that self-efficacy necessitates control over one's life, including outcome expectancies and its causal attributions. There are no outcome expectancies in SOC. The manageability component of SOC deals with the perception or ability to mobilise resources while in self-efficacy, executing a behaviour is determined by the degree of perception of one's capability, and avoid activities and situations that exceed one's ability to cope. Our systematic review found three studies examining SOC in relation to self-efficacy. Einav et al. [157] found that there was no link found between maternal self-efficacy (as measured by Parental Self-Efficacy Scale and Future Parental Self-Efficacy Scale) and SOC. Linden et al. [168] found that high SOC was associated with

high/positive scores for self-efficacy in gestational diabetes management. Carlsson et al. [92] found that those with high childbirth self-efficacy (as measured by the Swedish Childbirth Self-Efficacy Inventory scale) also had higher SOC scores.

According to Fallby et al. [431], at the core of both SOC and LOC is 'control.' Rotter's LOC is a measure of the degree of an individual's internal versus external control whereas Antonovsky's SOC is a measure of an individual's feelings of control to the extent that one's environment is structured, predictable, and understandable. According to Kalimo and Vuori [432] SOC refers to an internalised sense of control and provides guidance to coping with upcoming events. SOC assists individuals to understand the various facets of control and their consequences through individuals' experience of the environment. Therefore, SOC and LOC both lead to anticipatory health promoting orientations. [433] According to Sullivan [434], the sense of control as defined by Rotter and Seligman is often mistakenly equated with the SOC component of manageability. Antonovsky viewed control as composed of two related factors: (1) a sense that events are comprehensible rather than bewildering, and (2) a sense that events are under some kind of control, and not necessarily one's own. Shaping one's destiny without the perception of mastery may be sufficient to foster a SOC and SOC can exist in an individual in the absence of control.

There are differences between SOC and LOC. SOC views resources (i.e., general resistance resources) as under the control of others (external resources) and are valuable whereas LOC views such external resources as part of external LOC and can contribute to failure to take control of one's own destiny. [435] In our SR on SOC measures in pregnancy, we found no studies examining the relationship between SOC and LOC in pregnant women.

Given these deficits on measures of SOC and its relationship to GSE or LOC, an aim of this study was to assess the SOC and associated factors (QoL, GSE, LOC and IPC) in pregnant women under chiropractic care.

Chapter 3. Theoretical Framework, the Mixed Methods Approach, Validity and Reliability of Research Instruments and Hypotheses

3.1 Introduction

This chapter provides a description of the theoretical framework to address the research question(s) posed in this thesis and discuss its advantages and disadvantages. A mixed methods approach is introduced that intricately integrates both qualitative and quantitative strategies. A comprehensive exploration of the advantages and challenges of these strategies is undertaken, contextualised within the backdrop of the ongoing paradigm wars between quantitative and qualitative research. The method of triangulation is then described with the intention of providing a more comprehensive approach to understanding the study findings. Given the importance of reliability and validity of outcome measures in quantitative research and trustworthiness in qualitative research, a description of the reliability and validity of the patient-reported outcome (PRO) instruments utilised in the proposed studies is provided along with a discussion of the trustworthiness of the qualitative research performed. The chapter concludes with statements of the research hypotheses tested in this thesis.

3.2 Theoretical Framework/Research Paradigm – Pragmatism

According to Omodan [436], theoretical frameworks provide the lens from which research is viewed and interpreted, how it impacts the research findings (i.e., determine what is included and excluded from the analysis), and how it facilitates our understanding of what may be a complex phenomenon. Subsequently, the theoretical framework or research paradigm is crucial to designing an effective strategy from which hypotheses are tested. The selection of a research paradigm must go beyond simply the researcher's personal convictions and interests but must take into account the ontological commitments,

epistemological beliefs and methodological preferences that resonate with how best to address the research question(s). [124]

The research described in this thesis was informed by the research paradigm of pragmatism. Pragmatism emphasises research questions that are relevant and have practical significance, recognises that different research methods have unique strengths and limitations, acknowledge the importance of engaging stakeholders and incorporating their perspective and the creation of knowledge that has meaningful implications for clinical practice. [437-439] This view of pragmatism follows a hands-on empirical approach to research and aligns with the approach to addressing the questions posed in this thesis. Kivinen and Piiroinen [440] appealed to researchers to focus on their methodology, avoid metaphysical conjectures, and supplant with operationalising the research questions. Van Bouwel and Weber [441] also argued for a more pragmatic and pluralistic approach to explaining social phenomenon and suggested that ontological and conceptual analysis of explanation should be left behind. Tsilipakos [442] agreed with this suggestion that one does not require ontology to justify one's methods to acquire empirical data. According to Lohse [443], the motivation for this position is three-fold. First, the prioritisation of ontological investigations retards or obstructs real progress in research. Second, the realist perception of theories and explanations are rejected. According to pragmatists, reasonable social theories and explanation do not necessarily have to provide the structure of the social world and that good theories and explanations are not necessarily derived from ontological premises. Pragmatists argue that the choice of one's methodological tools should be guided by epistemology and for its efficiency or simplicity. Third, pragmatists see pluralism as providing a need for different explanatory tools and theoretical perspectives for different research questions, and not as a deficiency.

The philosophy of pragmatism began in the 1870s in the United States and its origins attributed to Charles Sanders Peirce, William James, Josiah Joyce, Chauncey Wright, Oliver Wendell Holmes Jr., and Nicholas St. Johns Green. [437] Other notable proponents of pragmatism include John Dewey, George Herbert Mead, CI Lewis, Jane Addams, and Oliver Wendell Holmes Jr. along with many others further developed the doctrine over the past century. The word pragmatism is derived from the Greek word 'pragma,' meaning love based on duty, obligation, or logic and was first used in 1898 by William James in a public speech and referenced his source of pragmatic philosophy from Charles Sanders Peirce, who borrowed the term 'pragmatic' from Kant's *Kritik der reinen Vernunft* (*Critique of Pure Reasons*). [437, 444] Richard Rorty has been credited with introducing the term in 1979 to a larger audience as part of the American research vocabulary. [437]

Pragmatism began as a consequence of the rejection of the idea of a universal ethical principle or universal value. [437] According to pragmatist philosophy, the world is complex with an unlimited number of interacting variables. Reality is constantly changing and there can be single or multiple realities. This complexity leads to uncertainty and unpredictability so that truth can never be determined once and for all. Knowledge and reality are based on beliefs, habits, and experiences that are socially constructed with some social constructions matching an individual's experiences more than others. Reality is only true if it resonates with other parts of one's experiences. Meaning is inseparable from human experience and its consequences and context dependent. [437]

Several leading pragmatist scholars have adopted the works of John Dewey, one of the founding leaders of pragmatism [445] Dewey's philosophical roots were grounded in transactional realism, which rejected the traditional dualism of objectivity and subjectivity. Transactional realism suggests that the mind and the world are in constant interaction with

each other through an ‘adjustive process’ where individuals actively engage, transform, or change the environment. [446-447] These transactional experiences also produce knowledge that has the ability to reconstruct reality in a continuous manner. The environment is therefore in flux and constantly changing. This constant change presents situations that require adaptive behaviours from individuals. [447] Dewey rejected the term epistemology (i.e., how knowledge is created and what is possible to know) and replaced it instead with the term ‘theory of inquiry’: to achieve knowledge from a naturalistic perspective. [437, 448] According to Ormerod [444], Dewey defined inquiry as the controlled transformation of a problematic situation into one that is adequately integrated into a unified whole to warrant coherent action. Inquiry, therefore, is an investigation to understand some part of reality and to create knowledge to bring about change and improvement in that part of reality. According to Morgan [449], Dewey did not distinguish between everyday life and research in that research is inquiry that is performed more consciously and intentionally. Inquiry is just one form of experience and research is just one form of inquiry. [449]

In designing and conducting a research project, a pragmatic researcher must consider the potential consequences of various choices based on their beliefs - beliefs that are shaped by the researcher’s previous experiences and beliefs/experiences that are shared by the larger research communities of which the individual researcher is a member. As a chiropractic researcher, I am keenly aware of the dominance of quantitative studies in my own research and those of other researchers on pregnancy care and the need for qualitative studies to provide insight and understanding of the research topic at hand. The choice of the methodology is dictated by the original research question and the aims and goals of the research project. The most important consideration among pragmatists, therefore, is whether the underlying philosophical assumptions, the methodology, or the findings are

useful and instrumental in producing the desired or anticipated outcomes. For pragmatic researchers, a pluralistic approach to addressing the research question(s) allows for different perspectives, interests, and forms of knowledge. [124] Pragmatist researchers therefore place a greater emphasis on 'what works' to find answers to the research question(s) in an innovative and creative manner. [444, 450]

As previously mentioned, Dewey rejected the traditional dualism of objectivity and subjectivity or the dualism between realism and idealism. [437] This contrast is closely related to the separation between post-positivism and constructivism, two research paradigms that guide research in terms of how we view reality (ontology), the nature of knowledge (epistemology), and the systematic methods applied to acquire that knowledge (methodology). Post-positivists claim that we can never fully understand the world as it exists and requires objective measurements, while constructivists claim that the world is created by our subjective experience. [450] From a Deweyan point of view, these two paradigms make equally important claims about the nature of human experience. [450] Our experiences and our reflections of those experiences in the world are constrained by the nature of that world while our understanding of the world is intrinsically limited by our interpretations of our experiences. With an emphasis on experience, Deweyan pragmatism looks at ontological arguments about the nature or conceptions of the outside world as just arguments about two sides of the same coin. [450]

Pragmatists believe that acquiring knowledge falls along a continuum anchored at each end either by objectivity or subjectivity. [437] The pragmatic approach is situated somewhere within this continuum, dependent on its approach to acquiring knowledge. Post-positivism is typically associated with quantitative methods and deductive reasoning (i.e., progress from general ideas to specific conclusions), while constructivism is associated with qualitative approaches and inductive reasoning (i.e., multiple premises are

combined to obtain a specific conclusion). [437] Pragmatism embraces these two approaches and is more flexible in terms of a research design. [444, 451-453] With abductive reasoning, pragmatism moves back and forth between deductive and inductive reasoning. [454]

Abductive reasoning is not without barriers or challenges. According to Onwuegbuzie and Leech [123], quantitative and qualitative research methodologies are often taught as two independent approaches to research or there is inadequate or nonexistent instruction in mixed methods techniques. Other barriers include the continuing 'paradigm wars' and the misleading myths about the nature of quantitative and qualitative research, the teaching of research methods by unqualified instructors, or the unwillingness or refusal by some to accept that the epistemological purity is no longer is consistent with best practices and are now considered as inappropriate, unreliable, invalid or outmoded.

To overcome these barriers, Onwuegbuzie and Leech [123] cited the work of Onwuegbuzie and Teddlie [455] that minimised the use of quantitative and qualitative terms and replaced them with exploratory and confirmatory methods in an effort to place quantitative and qualitative data collection and data analysis under the same conceptual framework. Onwuegbuzie and Teddlie [455] proposed a model containing both exploratory quantitative data analysis (i.e., generation of new information with descriptive statistics, exploratory factor analysis (EFA), and cluster analysis), and exploratory qualitative data analysis (i.e., thematic analyses). With confirmatory analysis (i.e., to test theoretical suppositions), quantitative data would undergo inferential statistics, while qualitative data analysis involved confirmatory thematic analyses to assess the replicability of previous emergent themes (i.e., research-driven) or to test an extant theory (i.e., theory-driven). The pragmatist researcher therefore has the flexibility to select the research design and methodology that are most appropriate to address the research question as shown in

this thesis. Pragmatism does not venerate one type of knowledge or research method over another. This pluralistic approach allows for the acceptance and recognition of validity amongst different perspectives, interests and forms of knowledge. [456]

3.2.1 Limitations of Pragmatism

Like other paradigms, pragmatism has its limitations. Researchers applying pragmatism in their research efforts should be cognisant, reflexive, and strategic of these limitations in order to strengthen the quality of their work. [125] Pragmatism has been criticised for a number of reasons. [125, 457] Firstly, pragmatists focus on empiricism and ignore the underlying philosophical and theoretical constructs of a research undertaking. [457-458] Theory assists in the conceptualisation of the research question(s) by providing the theoretical frameworks and foundational principles to data collection and analysis, and interpretation of data in a broader context. Without critically examining the underlying assumptions or theoretical implications of a research approach, the research may lack depth and provide a shallow understanding and insight of the phenomenon of interest. The researcher may struggle to make generalisations and transferability of their findings and ultimately present challenges in communication and dissemination of the study findings. Secondly, pragmatists place great importance to the research question or questions and reject the traditional dualist paradigms (i.e., subjective versus objective) and philosophical alignment of the research and embrace eclecticism and pluralism in their methodology. [459-460] Pragmatists, as a consequence, fail to provide a solution to many philosophical disputes such as the need for knowledge to be tested against some objective truth or that truths need to be grounded in some foundation of knowledge. [125] The methodological focus on ‘what works’ fails to address the question of who this is working for and to what end. [125, 459] This emphasis on what works can subvert the pursuit of objective truth or place less emphasis on foundational ethical or moral principles. [125] Thirdly, the

pragmatic researcher's worldview can influence the way research is conducted. Consequently, the research may be influenced by the researcher's sociopolitical beliefs, personal history, and overall belief system. For example, someone who is a member of a dominant social group and who benefits from structural inequality would not necessarily consider hegemonic power structures as problematic and worthy of inquiry [441] Another example may be that a pragmatic researcher rejects or fails to reject the findings of research that do not meet the desired outcomes. [461]. Additionally, pragmatic theories of truth have difficulty addressing cases of useful but non-true beliefs/propositions and non-useful but true beliefs/propositions. [125] Ultimately, determining what is true or morally right may be undermined. Four, in terms of its application, the amount of time and resources to prepare and execute pragmatic research may be greater relative to other paradigms due to its multiple research approaches. Moreover, different methods of inquiry may result in different types of data that may prove challenging with required expertise in terms of the timing of data collection (i.e., sequential versus concurrent or parallel) and interpretation (i.e., qualitative versus quantitative data) and integration (i.e., triangulation). [441]

3.3 Pragmatism as a Paradigm for Mixed Methods Research

As previously stated, for pragmatist researchers, the research question is of the greatest significance. First, the chosen methodology is based on the appropriate method(s) to address the research question(s) and not based on the researcher's choice of paradigm and philosophical doctrine. Second, the application of quantitative and qualitative research is feasible only if it is capable of addressing the research question(s). In summary, pragmatic researchers address research questions with the methodological tool(s) available to them based on 'what works.' [441] The worldview of pragmatism, therefore, embraces the plurality of methods and resonates with the use of the mixed method approach.

3.4 Research Approach – Mixed Methods Research

According to Azzopardi and Nash [462], mixed methods as a research approach involves the collection and analysis of data, integration of the research findings and inferences from both qualitative and quantitative methods. Philosophically, mixed methods are referred to as the 'third wave' or third research movement that moves past the purely quantitative and purely qualitative approaches. Mixed methods research proposes a pragmatic methodology that combines qualitative and quantitative research designs, involves the mixing of methods with respect to data collection, data analysis, and interpretation at different stages of the research process in a single study or in a series of studies. [125, 460, 462] Its logic of inquiry includes the use of induction (i.e., drawing conclusion from the specifics to the general), deduction (i.e., drawing conclusions from the general to specifics), and abduction (i.e., logical inference that makes the simplest and most likely conclusion from a set of observations).

Mixed methods research is eclectic, inclusive, pluralistic, and complementary in terms of its approach to what is most fundamental – the research question. The research method(s) is dictated by the research question(s). According to Regnault et al. [463], mixed methods as a research framework is characterised by three key defining features: (a) both quantitative and qualitative methods are applied to address a research question, (b) a specific research design is described for both qualitative and quantitative approaches, and (c) the responses to the research questions are supported by complementary and/or integrated findings from both the qualitative and quantitative methods (meta-inference). Although the quantitative and qualitative approaches may address different or distinct research questions, they ultimately complement each other and contribute to the same overall means or purpose (i.e., to better understand and characterise a phenomenon).

The use of a mixed methods approach in this thesis was justified in the following manner. [126] First, the relative importance of the qualitative and quantitative data to address the research questions were considered of equal importance and as such were of equal priority. Second, in terms of data interaction (i.e., the degree to which the qualitative and quantitative interact), the data are kept independent until the final stage of triangulation so that the data are first analysed individually in order to obtain different but complementary data. Third, both qualitative and quantitative data acquisition and analysis were implemented concurrently and independently. [464] This mixed methods approach is referred to as a parallel mixed method design [465] with a parallel mixed data analysis where the quantitative data was analysed with descriptive and inferential statistics [466] and the qualitative data was analysed using phenomenology. [461] The intent of the proposed mixed methods research was to understand a phenomenon as it happens so that the qualitative approach could provide context and meaning to the quantitative data. To achieve integration, a clear plan for interaction between the qualitative and quantitative data was needed. This involves meta-inference [467], where evidence from the qualitative and quantitative research are finally interpreted together with equal weighing to draw inferences and interpretations within the context of the research aims and questions. The meta-inference for the research in this thesis applied data-related methodological triangulation. [468]

3.4.1 Benefits and Challenges of Mixed Methods Research

There are benefits to the utilisation of a mixed methods research design in health outcomes research. [463] An eclectic approach may lead to many different applications of the research methods and its findings. For example, in this thesis, using a quantitative approach enabled data to be collected from a relatively large number of participants (i.e., relative to qualitative studies) and increased the possibility of generalising the findings to a

wider population insofar as chiropractic pregnancy care is concerned. The qualitative approach involving semistructured interviews provide for a deeper understanding of the phenomenon being investigated (i.e., the lived experience of pregnant women), and honour the voices of its participants. In terms of complementarity, it is acknowledged that qualitative and quantitative research have distinct strengths and limitations with a mixed methods approach synergistically compensating the limitations of one method with the strength of other. In terms of triangulation, the use of diverse types of data can provide greater insights, a more comprehensive understanding of a phenomenon and more valid and stronger inferences that a single method cannot offer. Data triangulation can result in a well-validated conclusion and promote the credibility of inferences obtained from one approach. Mixed methods research method can also ensure that the patient perspective from multiple viewpoints is considered and that the research is focused on the needs and priorities of patients and improvement in patient outcomes. [123, 126]

Despite the benefits of mixed methods research, there are also challenges. [463] The mixed methods approach requires that researcher(s) are experienced in both qualitative and quantitative research. The researcher(s) must be familiar with mixed methods research designs (i.e., parallel and sequential mixed methods) and ways to connect the datasets through meta-inference (i.e., triangulation). Furthermore, the mixed methods approach to research requires additional resources and time with ongoing debate and controversy as to whether quantitative and qualitative paradigms can be mixed. [469]

3.4.2 Quantitative versus Qualitative Research

Quantitative methods result in numerical or arithmetic data that are analysed by statistical testing and modeling. Qualitative methods result in textual data that is often analysed in terms of content, themes, discourse, and narratives to provide meaningful insights of the subject at hand. [470] The goal of inquiry in qualitative research is to

describe, understand and find meaning in a phenomenon as opposed to seeking an explanation or causation as in quantitative research. [461, 470] The questions posed in quantitative research aims to be more conclusive and have generalisability in its findings. A central tenet of quantitative research therefore is the ability to capture data in a manner that incorporates control, randomisations, and manipulation of variables. [471] On the other hand, qualitative research utilises relatively small nonrandom (i.e., purposeful) samples. [472-473] In terms of analysis, qualitative research is often inductive to generate abstractions, concepts, hypotheses, and theories from empirical observations. [474] Quantitative research is deductive with the application of hypothesis testing to predict and make generalisations. [470] Qualitative research poses questions for exploratory purposes with its design flexible and evolving over time to gain a thorough understanding of a phenomenon. [475] Mixed methods research, with its pluralistic approach, allows questions to be examined from different perspectives with the strengths of one study design (i.e., quantitative study) complementing the weaknesses of the other (i.e., qualitative study) and vice vera (see Figures 3.1 and 3.2). [123]

Quantitative study	
Strengths	Weaknesses
• Validates the constructed theories on the how and the why of a phenomenon. • Allows for generalisability from random samples of sufficient power or when the research findings have been replicated on many different populations and subpopulations. • Allows for quantitative predictions from the data acquired. • Can be designed to address or eliminate the effects of confounders from many variables and facilitate cause-and-effect relationships. • Data collection may be relatively quick. • Data are numerical. • Data analysis can be relatively quick with the use of statistical software. • Produces results that are relatively independent of the researcher (e.g., effect size, statistical significance). • May be looked at with greater credibility by people in power, such those who fund research. • Useful for studying large numbers of people.	• The researcher's findings may not reflect the local subjects' perspectives. • The proposed theory to be tested may not reflect local constituencies' understandings. • Confirmation bias may occur due to a focus on hypothesis testing rather than hypothesis generation. • Findings may not have direct application to specific contexts or individual situations due to their generalities and abstract characteristics.

Figure 3.1. Strengths and Weakness of the Quantitative Study Design

Note. Adopted from Johnson and Onwuegbuzie [125].

Qualitative study	
Strengths	Weaknesses
• Data reflect the participants' own categories of meaning. • Involves a limited sample size or cases. • Practical for describing complex phenomena. • Practical for individual cases. • Facilitates cross-case comparisons and analysis. • Facilitates an understanding and description of people's personal experiences of a phenomena (i.e., the 'emic' or insider's viewpoint). • Allows for rich and detailed descriptions of a phenomenon rooted in local contexts. • Phenomenon could be described based on context and setting. • Facilitates the study of dynamic processes (e.g., documenting sequential patterns and change). • Grounded theory allows inductive generation of an explanation about a phenomenon. • Allows for studies to determine how participants interpret 'constructs.' • Data are usually collected in a naturalistic setting. • Sensitive to locale, conditions, and stakeholders' needs. • Can be adapted to changes that occur during the study (e.g., fieldwork extended, shift in focus of the study). • Facilitates exploring how and why a phenomenon occurs. • Cases may be used to demonstrate a phenomenon of interest. • Facilitates cause-and-effect inferences.	• Generalisability and cause-and-effect inferences may be difficult to make. • Testing of hypotheses and theories may be difficult. • May have lower credibility with people in power, such those who fund research. • Data collection and analysis may be more time consuming. • Results are easily influenced by researcher bias.

Figure 3.2. Strengths and Weakness of the Qualitative Study Design

Note. Adopted from Johnson and Onwuegbuzie [125].

3.4.3 Triangulation

The triangulation metaphor finds its origins from navigation and military strategy that use known multiple reference points to locate an object's exact position or distance. According to Farmer et al. [464], triangulation was originally used in the health and social sciences by Campbell and Fiske [476], who suggested using multiple tests to measure the same constructs to look for 'convergent validity' such that the variance in data reflected

that of the trait and not a methodological artifact. The purpose of triangulation is to explore for the presence of convergence, complementarity, dissonance/divergence and possible theoretical suppositions of the data and reflect the belief that such a process can lead to a multidimensional or holistic understanding of complex subjects. [468] To be inclusive of the processes and outcomes of research, Teddie and Tashakkori [477] defined triangulation as the combination and comparisons of multiple data sources, data collection and analysis, research methods and inferences that occurs at the end of a study.

Triangulation can be differentiated as within methods or between methods and can be performed simultaneously, sequentially or combinations thereof. [468] The between (or across) method of triangulation involves the use of multiple methods (i.e., a quantitative method and a qualitative method) to examine the phenomenon of interest to address a research question. The within methods of triangulation uses multiple techniques within a single method to collect and interpret data. For example, in a quantitative study using a research survey, multiple scales of instruments may be used to measure the same construct. The 'within-method' triangulation therefore involves cross-checking for internal consistency or reliability while 'between-method' triangulation involves checking for the degree of external validity. [478]

The research in this thesis utilised a between (or across) method of triangulation involving quantitative and qualitative research. A data-related and methodological triangulation approach (i.e., quantitative and qualitative data/methods are interpreted simultaneously and of equal weighing) was adopted to allow for inferences and interpretations of the study findings. However, we cannot discount the use of theoretical triangulation (i.e., the use of validated patient-reported outcome measures alongside the lived experience perspective) or analytical triangulation (i.e., the use of inferential statistics versus phenomenology to consolidate the data and grasp the completeness of the

study). [479-480] In the present study, methodological triangulation will occur by means of meta-analysis, a second order analysis utilising a meta-matrix. [480] The meta-matrix is based on the initial assumptions of the study and provides for a pragmatic approach to data management (i.e., thorough and explicit) with data linkage from multiple sources and types to reveal underlying constructs. [481] Following the initial analysis of the data (i.e., inferential statistics and phenomenology), the meta-matrix as a method of analysis consists of the following stages: formulation of the matrix structure (i.e., quantitative findings, qualitative findings and the researcher's assumption(s), observation(s), reflection(s), consideration(s), and conclusion(s)), entry of data into the matrix (i.e., , key results and their significance), coding of data and recording of the researcher's thoughts evoked by the coding process, search for general features or common phrases in the identification/isolation of models, patterns and processes. [480-481] Data display with the meta-matrix can assist in pattern recognition (or lack thereof) across data sets, particularly in light of the theoretical underpinnings of the research. Thoughts and impressions by the researcher while reflecting about the data are entered directly into the meta-matrix. Gradually, possible relationships (i.e., convergent, divergent, complementary, and theoretical suppositions) between the results may be revealed in order to gain a holistic view of the data. [480-481]

While triangulation has generally been regarded as a vital validation technique in mixed methods research, there are challenges and potential conflicts to performing the procedure. This includes the cost and amount of time to performing triangulation, the complexities of dealing with relatively large data, the incompatibility of different research methods or paradigms, of contrasting philosophical issues, of static and dynamic realities, of objective and subjective perspectives, of inductive and deductive approaches or of integral and particular visions. There are difficulties in mixing numerical and text data and

the interpretation of such data when they do not converge (i.e., data complementarity) or diverge. [482]

3.4.4 The Research Package

The research package is comprised of three studies and summarised in Table 3.1. To complement the quantitative data from Study 2, a sample of pregnant women under chiropractic care were recruited for semistructured interviews to assess their lived experience as pregnant women under chiropractic care. The use of quantitative and qualitative research methods should generate a rich and comprehensive picture of the lived experience of pregnant women along with measures of their sense of coherence (SOC) and associated factors while under chiropractic care.

Table 3.1. Summary of Research Package for This Thesis

Study	Aim of the research	Research design	Primary outcomes
1	To profile the chiropractors, their patients and practice features involved in chiropractic pregnancy care	Quantitative	• Sociodemographic information • Practitioner characteristics • Practice characteristics • Patient characteristics • Management protocols • Safety attitudes • Collaborative care efforts
2	To obtain measures of health constructs from pregnant and non-pregnant women	Quantitative	• Sense of coherence (SOC) • Quality of life (QoL) • General Self-Efficacy (GSE) • Health Locus of Control (HLOC) • Interpersonal Process of Care (IPC) experience
3	To gain an in-depth understanding of patient experiences and the nature of the therapeutic encounter between a pregnant woman and their chiropractor	Qualitative	The lived experiences of pregnant women under chiropractic care

3.5 Validity and Utility of Survey Instruments

3.5.1 SOC-29 Instrument

To assess the SOC of pregnant and non-pregnant women, the SOC-29 was applied. Permission to use the SOC-29 was provided by Avishai Antonovsky, PhD, Department of Evaluation, The Open University, Israel (see Appendix C). The SOC-29 [74] is a 29-item instrument utilising a 7-level scale response (i.e., 1 = lowest to 7 = highest). Items in the same scale are summed to create individual subdomains (i.e., Comprehensibility, Manageability, or Meaning) with the summed score from the 29 items defining the respondent's SOC (i.e., minimum = 29; maximum = 203). The greater the score, the greater the measured subdomain or SOC. [222]

Eriksson and Lindstrom [226] examined the validity of the SOC scale and concluded that the SOC-13 and SOC-29 scales were reliable, valid, and cross-culturally applicable. In a more recent review on the validity and reliability of the SOC scale, Eriksson and Mittelmark [222] found the SOC scale such as the SOC-29 and SOC-13 to have demonstrated face validity (i.e., they appear to measure what it purports to measure) in that the SOC-29 and the SOC-13 have been used in at least 49 different languages in at least 48 different countries.

The construct validity (i.e., the extent that the SOC scale aligns with the construct that is being measured) of the SOC-29 scale was demonstrated via confirmatory factor analysis (CFA) to have a general structure [483-484] with three dimensions – comprehensibility, manageability, and meaningfulness. [485-486] However, Boelen et al. [487] found via CFA that the one-factor and three-factor models for the SOC-29 did not fit the data due to low comparative fit index (CFI) and low Tucker–Lewis Index (TLI).

Smrekar et al. [488] also found the Croatian version of the SOC-29 did not fit the data due to a low CFI and low TLI.

In terms of consensual validity (i.e., the extent to which various scientists agree on the properties of an instrument), the evidence is somewhat weak. Although many researchers either used the SOC-29 or the SOC-13, there are different or modified versions of the SOC scale, with different numbers of items and different response options. [222] The review by Eriksson and Lindström [226] between 1992 and 2003 found 15 different modified forms of the SOC scale consisting of three items to 28 items.

In light of the correlations between SOC and various PROs from our systematic review of the literature on quantitative measures of SOC in pregnancy (see Chapter 2), the criterion validity (i.e., how closely the SOC-29 correspond to other instruments) for the SOC-29 has been demonstrated with correlations with other health measures ranging from weak to strong.

The predictive validity (i.e., the ability of the SOC scale to predict health) is supported by a number of studies. Individuals with a weak SOC had a relatively higher risk of cancer (i.e., RR = 1.52; 95% confidence interval (CI): 1.12-2.06) than those with a strong SOC. [489]. One-year mortality was significantly associated with the SOC score (odds ratio (OR) = 0.945, confidence interval (CI) = 0.898-0.995, p = .032), but not the 4-year mortality (OR = 0.995, CI = 0.973-1.018, p = .674) while SOC did not predict depression at 5-year follow-up (OR = 0.977, CI = 0.937-1.018, p = .267). [490] A low or weak SOC (as measured by SOC-13) predicted depressive symptoms in the short- (i.e., 1 year) and long-term (i.e., 9 years) perspective. [491] A strong SOC was associated with a 30% reduction in mortality from all causes (rate ratio = 0.69, p < .0001), cardiovascular disease (rate ratio = 0.70, p = .001), and cancer (rate ratio = 0.74, p = .003), independent of

age, sex, and prevalent chronic disease. [492] However, SOC (as measured by SOC-29) did not predict adverse events (i.e., major adverse cardiac and cerebral events). [493]

In terms of reliability, the SOC-29 is highly reliable with test–retest correlations ranging from 0.69 to 0.78 (at 1 year), 0.64 (at 3 years), 0.42 to 0.45 (at 4 years), 0.59 to 0.67 (at 5 years), and finally 0.54 after the 10-year follow-up. [226] The internal consistency measured by Cronbach's alpha ranges from 0.70 to 0.95 for the SOC-29 (124 studies) and 0.70 to 0.92 (127 studies) with the SOC-13. [226] Of interest in this thesis is the study by Ferguson et al. [173] on the reliability and validity of the SOC-13 among pregnant Australian women. The investigators found that the construct validity of the SOC-13 was difficult to establish. EFA of the SOC-13 resulted in the removal of items 2, 3, 7 and 9 resulting in SOC-9. No similar studies have been performed with the SOC-29. To date, three publications have described the use of the SOC-29 in chiropractic patients. [83, 85-86]

3.5.2 PROMIS-29 Instrument

The QoL of pregnant and non-pregnant women was assessed using the 29-item profile instrument from the Patient-Reported Outcomes Measurement Information System or PROMIS-29. The PROMIS-29 is publicly available for use without licensing or royalty fees for individual research or individual clinical use according to HealthMeasures™ Terms of Use. [494] The PROMIS-29 [495] measures anxiety and depression, fatigue, pain interference and intensity, physical functioning, sleep disturbance, and satisfaction with participation in social roles and activities. For each PROMIS short form (i.e., anxiety, physical functioning, pain interference), a scoring table was developed to convert the summed raw score to a *T*-score metric with a mean of 50 and standard deviation of 10. The greater the *T*-score, the greater the measured QoL domain such that it may reflect a detrimental (i.e., anxiety, depression, fatigue, pain interference, sleep disturbance) or

beneficial (i.e., physical functioning and satisfaction with participation in social roles and activities) health outcome.

The PROMIS-29 has been shown to have good face validity. A quick perusal of Pubmed indexed literature on the PROMIS-29 revealed 200 abstracts. The PROMIS-29 has been translated in French [496], Dutch-Flemish [497], Norwegian [498], Korean [499], Chinese [500] as well as Bengali, Czech, Georgian, Hindi, Nepali, Odia, Punjabi, Romanian, Sinhala, and Xhosa to list a few. [501]

Construct validity of the PROMIS-29 (along with and the VR-36) was demonstrated by Rose et al. [495] with a survey of Kaiser Permanente Colorado patients aged 65 years and older who had at least 2 of 13 pre-specified chronic health conditions. The investigators demonstrated the construct validity of the PROMIS-29 using three methods: (a) bivariate analyses to examine the relationship between PROMIS-29 v2.0 scores and important stratifying patient-level variables, (b) evidence of differential item functioning (DIF) for the items of the PROMIS-29 v2.0, based on key stratifying variables, and (c) correlations between PROMIS-29 v2.0 scores and scores of the VR-36. Construct validity of the PROMIS-29 was also demonstrated in a population of spine surgery recipients [502], among systemic sclerosis-associated interstitial lung disease (SSc-ILD) [503], among kidney transplant patients [504] and burn survivors. [505]

The PROMIS-29 has been found to have good test-retest reliability with intraclass correlation coefficient (ICC) of 0.94 in patients with systemic lupus erythematosus [506], an ICC greater than 0.6 and Cronbach's α greater than 0.88 among a sample of stable kidney transplant recipients [504] and ICC greater than 0.8 and Cronbach's α ranging from .91(Physical Function) to .98 (Sleep Disturbance) among ankylosing spondylitis patients. [507] Among adult burn survivors, Cronbach's α ranged from .70 to .95 [505] while in adults with haemophilia, Cronbach's α ranged from .79 for Sleep Disturbance to 0.96 for

Pain Interference. [497] and in patients with systemic sclerosis-associated interstitial lung disease, Cronbach's alpha ranged from .77 to .98. [503]

The PROMIS-29 has been applied successfully in chiropractic patients [83, 508-509] and pregnant chiropractic patients. [113, 328].

3.5.3 The General Self-Efficacy Scale

Permission to use the GSE scale has been provided by Schwarzer et al. [510] (see Appendix D). The GSE scale by Schwarzer and Jerusalem [511] is a 10-item instrument. Each item has a 4-level response (1 = *not at all true*, 2 = *hardly true*, 3 = *moderately true*, 4 = *exactly true*). Scoring is performed by a summation of the responses with a range of 10–40. The higher the score, the greater the measured GSE.

The reliability and validity of the GSE scale by Schweitzer and Jerusalem [511] has been demonstrated in multicultural validation studies. Relationships between GSE and social cognitive variables (i.e., intention, implementation intentions, outcome expectancies, and self-regulation), behavior-specific self-efficacy, health behaviors, well-being, and coping strategies were examined among 1933 respondents in three countries: Germany (n = 633), Poland (n = 359), and South Korea (n = 941). The participants were between 16 and 86 years of age, and some were dealing with stressful situations such as recovery from myocardial events, tumor surgery or gastrointestinal diseases. The mean Cronbach's alpha of the GSE scale ranged from 0.86 (among participants from South Korea) to .94 (patients with cardiovascular diseases, Germany). [511]

Dahlberg et al. [512] psychometrically evaluated the GSE scale in patients planned for bariatric surgery in Sweden. Structural validity with CFA indicated a one-factor construct with a satisfactory goodness of fit with a CFI of 0.927, a root mean square error of approximation (RMSEA) of 0.092 and standardised root mean square residual of 0.045. The factor GSE explained almost half or over half of the variance of each item (i.e., 0.45-

0.75, *p*-values < .001). Correlation coefficients were weak or negligible between the GSE and the mental component summary score of $r = .18$ ($p < .00$); and the GSE and physical component summary ($r = .07$, $p = .138$) of the RAND SF-36; GSE and obesity-related problem scale ($r = -.15$, $p = .001$); and GSE and education level ($r = .04$, $p = .35$). Internal consistency was high with Cronbach's alpha of .89 for the GSE. The authors concluded that the GSE scale was a valid and reliable scale that can be used to assess GSE in patients undergoing bariatric surgery.

Hurst et al. [513] examined the psychometric properties of the Thai version of the GSE scale among Thais living with Type 2 diabetes and demonstrated its validity and reliability. Structural validity of the GSE scale was demonstrated with a TLI of 0.994, Cumulative Fit Index of 0.995, Adjusted Goodness of Fit Index of 0.998, and RMSEA of 0.025 (95% CI [0.06-0.039]). GSE was found to overlap with the Diabetes Management Self-Efficacy Scale (DMSES) with correlations among GSE and the DMSES domains ranging from 0.18 to 0.26. Cronbach's alpha was found to be .87 (95% CI [.86, .88]).

Nilsson et al. [514] demonstrated GSE scores were significantly ($p < .001$) associated with disease severity as measured by Hoehn and Yahr scale. GSE scores correlated significantly ($p < .001$) with autonomy ($r_s = .30$), life satisfaction ($r_s = .39$), depressive symptoms ($r_s = -.42$), and fall-related activity avoidance ($r_s = -.49$). However, GSE scores were not significantly correlated with pain severity ($r_s = -.14$, $p = .078$) or age ($r_s = -.087$, $p = .180$). The GSE's reliability was demonstrated with a high internal consistency (i.e., Cronbach's alpha = .95) and test-retest reliability yielded (i.e., intraclass correlation coefficient) values from 0.69 to 0.80. The GSE scale has been applied successfully in pregnant women. [515-522]

3.5.4 Multi-Dimensional Health Locus of Control

One of the most commonly used instruments in adults to assess HLOC is the Multidimensional Health Locus of Control (MHLOC) scale developed by Wallston, Wallston, and DeVellis. [523-524] There are two equivalent forms of the MHLOC – Form A and Form B – that assess three HLOC domains: Internal LOC, Chance LOC, and Powerful Others LOC. A third form - Form C - was developed to assess MHLOC beliefs related to specific medical problems by replacing the word 'condition' in each item with the medical problem of interest (i.e., pregnancy). [525] Form C has similar items to Forms A and B except the Powerful Others scale was divided into two 3-item scales - Doctors LOC and Other People LOC. [526]

The MHLOC Scale (Form C) and scoring instructions are readily available from Dr Ken Wallston and Vanderbilt University. [527] The MHLOC by Wallston et al. [528] is an 18-item instrument. Each item has a 6-level response (i.e., 1 = *strongly disagree* to 6 = *strongly agree*). The MHLOC has the subscales of Internal LOC, Chance LOC, Doctor LOC and Other People LOC. The sum of the scores within each subscale is a measure of that subscale LOC so that the greater the score, the greater is an individual's measure of LOC. The MHLOC scoring instructions are readily available from Dr Wallston. [527]

Although there may be support for a three-factor or two-factor structure for the underlying dimensions of the MHLOC [528], the literature review by LaNoue et al. [529] found 15 EFA studies, 8 CFA studies, and 2 studies that presented both EFA and CFA of the MHLOC scale and failed to find unequivocal support for either a two- or a three-factor model structure for the MHLOC scale, including their own study.

Castarlenas et al. [526] assessed the factor structure, reliability, and validity of the Form C of the MHLOC scales in adolescents. The Pain Coping Questionnaire for children (PCQ-C), the 10-item Pain Self-Efficacy Questionnaire (PSEQ), and the Child Pain

Anxiety Symptoms Scale (CPASS) were also implemented. The CFA results indicated an adequate fit of the four-factor model (χ^2 = 283.93, df = 129, p < .001, CFI = 0.91, RMSEA = 0.06, standardised root mean square residual [SRMR] = 0.05), with the factor loadings of each item ranging from 0.56 to 0.79. Cronbach's alphas indicated an adequate internal consistency for three of the scales (Internal = .72, Chance = .75, and Doctors = .70) and marginal reliability for one of scales (Other People = .69). The MHLOC Form C Internal scale correlated positively with scores of self-efficacy as measured by the PSEQ (r = .52, p < .01) and negatively with a measure of pain-related anxiety (r = -.47, p < .01). Scores on the Chance LOC, Doctors LOC, and Other People LOC scales were associated negatively with self-efficacy (r = -.34, r = -.42, and r = -.38, respectively; all p < .01), and positively with pain-related anxiety (r = .43, p < .001; r = .31. p < .05; and r = .39, p < .01, respectively). Similar findings on the reliability and validity of the MHLOC Form C has been demonstrated by Bonafé et al. [530]

The MHLOC scale has been applied in studies involving pregnant women. [96, 531-532]

3.5.5 The IPC-18 Scale

Although the IPC-18 scale is copyrighted, it is available without charge and no written permission is required for use. It is licensed under a Creative Commons Attribution-Non-Commercial-ShareAlike 4.0 International License (CC-BY-NC-SA). [533] The IPC-18 [530] is an 18 -item questionnaire that assesses the interpersonal process of care experience of patients during care in three broad domains (with subdomains): Communication (Lack of clarity; Elicited concerns, responded; Explained results), Decision-making (Decided together), and Interpersonal Style (Emotional support, compassion; Discriminated due to race/ethnicity; Disrespectful office staff). Response to the 18 items is based on a 5-level response (1 = *never*; 5 = *always*). Each subdomain score

is a mean of the individual scored items within that domain. The scale scores range from 1-5 and allows for individual scale scores to be calculated whenever at least one item per scale has a valid response. The higher the mean score for a subdomain, the greater the measure. The reliability of the IPC-18 has been demonstrated [534] but not its validity. Using baseline data from diverse patients with diabetes (n = 410) enrolled in a randomised trial of a health communication intervention, White et al. [535] found from multivariable modelling that patients with higher mistrust had lower adjusted odds of reporting a higher Communication Assessment Tool score (adjusted odds ratio (AOR) = 0.67, 95% CI [0.52, 0.86], p = 0.003) and higher scores on the Communication (AOR = 0.69, 95% CI [0.55, 0.88], p = .008), Decision-making (AOR = 0.74, 95% CI [0.59, 0.93], p = .02), and Interpersonal Style (AOR = 0.69, 95% CI [0.53, 0.90], p = .015) subscales of the IPC-18. The authors concluded that medical mistrust was associated with poorer communication with providers in this public health setting. To the best of this Doctor of Philosophy (PhD) candidate's knowledge, the IPC-18 has never been applied to pregnant women respondents.

3.6 Trustworthiness in Qualitative Research

The seminal work of Lincoln and Guba in the 1980s made a case for assessing qualitative research not with measures of reliability and validity but with the term trustworthiness. For Lincoln and Guba, trustworthiness should be evaluated based on credibility, transferability, dependability, and confirmability. [536] Credibility is the degree of congruence in the qualitative study findings and reality and analogous to internal validity in quantitative studies. However, unlike quantitative research, there is no expectation that all reactions to coherence credibility would result with the same answer. Credibility is said to be a construction on the part of the investigator(s) and subsequent readers. To establish credibility, techniques such as prolonged engagement with

participants or the data, persistent observation, peer-debriefing, member-checking, and reflective journaling as well as triangulation are applied.

Analogous to generalisability in quantitative research, transferability refers to the extent that the study findings in qualitative research are applicable or useful to persons in other settings. [537] Unlike quantitative research however, qualitative researchers do not make the claim that the study findings apply to everyone. Transferability is supported by being transparent and providing a detailed description of the context, location, and people studied. Somewhat similar to reliability in quantitative research, dependability refers to the stability of the data over time and over the conditions of the study, dependent on the nature and context of the study. [537] To ensure dependability, the investigator(s) may create an audit trail of investigator notes of study activities and peer-debriefings with a colleague. Confirmability refers to achieving as close as possible to objective reality in a qualitative study. [537] Methods to achieve confirmability include keeping detailed notes of all their decisions and their analysis as it progresses and the possibility of involvement of other researchers as reviewers or auditors of these notes as well as peer-debriefing to prevent biases and member-checking with study participants. In addition to the above criteria, authenticity or the extent to which different realities and realistic reflection of the participants' lives are conveyed. The selection of the appropriate people for the study sample and the use of rich, detailed descriptions of the study findings are ways that this criterion is addressed. [536-538]

Insofar as the criteria applies to the present study, analysis of the semistructured interview transcripts was guided by transcendental phenomenology. Credibility was achieved by prolonged engagement with participants and the data, persistent observation was made with multiple interviews of subjects until data saturation/sufficiency was achieved. Regularly scheduled peer-debriefing occurred between the PhD candidate and

his supervisors. Epoche or bracketing and triangulation were also applied. By providing a rich, detailed description of the study findings and transparency with the methods applied in this study, transferability was achieved. Regularly scheduled peer-debriefing with the PhD supervisors about the study findings and its interpretations contributed to the dependability and confirmability of the study presented. The aim of the study was to assess the lived experience of pregnant women under chiropractic care. Pregnant women currently under chiropractic care were interviewed to achieve this aim and contributed to the authenticity of the study findings.

Despite the fulfilment of the above criteria for trustworthiness of the qualitative study proposed, tensions exist in the analysis of data in Husserlian phenomenology. [539] According to Priest [539], Husserlian phenomenology is about describing in its purest form the essential structure or essence of an experience. This is in contrast to most of qualitative research in which reality and experience are socially constructed and represent but one of many truths rather than absolute truth. Furthermore, Husserlian phenomenology examines individual personal experience rather than the experience of other people. Some have questioned the legitimacy of finding the 'essence' of an experience of a phenomenon. These tensions challenge the notion of credibility, transferability, dependability, and confirmability.

3.7 Research Questions

The research questions were outlined in Chapter 1 Page 36-37 and are repeated here to allow the reader to understand their alignment with the research hypotheses outlined below,

1. What are practitioner characteristics (i.e., socio-demographics characteristics, clinical experience, postgraduate training) of chiropractors with a focus on pregnancy care?

2. What are the characteristics (i.e., clinical presentations, motivation for care) of women attending chiropractic care during pregnancy?
3. What are the practice characteristics (i.e., patient volume, fee structure, patient referrals) of chiropractors associated with caring for pregnant women?
4. What are the clinical protocols (i.e., chiropractic technique and adjunctive therapies) employed by chiropractors in caring for pregnant women
5. What are the attitudes of chiropractors on the safety of chiropractic in pregnancy care.
6. What are measures of SOC in pregnant and non-pregnant women under chiropractic care?
7. What are measures of general self-efficacy in pregnant and non-pregnant women under chiropractic care?
8. What are measures of health locus of control in pregnant and non-pregnant women under chiropractic care?
9. What are measures of interpersonal process of care experience of pregnant and non-pregnant women under chiropractic care?
10. What is the lived experience of pregnant women under chiropractic care?

3.7 Research Hypotheses

In light of the research questions proposed, the following hypothesis were developed for testing:

1. The QoL of pregnant women will be more compromised compared to non-pregnant women under chiropractic care.
2. The SOC of pregnant women will be stronger than their non-pregnant counterparts under chiropractic care.

3. SOC will be strongly positively correlated with the PROMIS-29 domains of physical functioning and satisfaction with participation in social roles and activities and strongly negatively correlated with anxiety, depression, fatigue, pain interference and pain intensity.
4. SOC will be strongly positively correlated with GSE among pregnant and non-pregnant women.
5. SOC will be strongly positively correlated with the Internal LOC and strongly negatively correlated with Chance, Doctor, and Other People LOC among pregnant and non-pregnant women.
6. SOC is strongly and negatively correlated with Communication (Lack of clarity), Interpersonal Style (Discriminated due to race/ethnicity), and Interpersonal Style (Disrespectful office staff) and strongly positively correlated with Communication (Elicited concerns, responded), Communication (Explained results), Decision-making (Decided together), and Interpersonal Style (Emotional support, compassion).

Chapter 4. Methods

4.1 Introduction

This chapter describes the research methods used in this thesis. The appropriateness and rationale of the proposed mixed methods approach is justified based on the research paradigm guiding this research. The aims of this research thesis and the questions addressed were described in detail in Chapter 1 (see Research Aims and Research Questions) and the research hypotheses in Chapter 3. This thesis is comprised of three studies. Under each study, the aims and the questions posed within each study are briefly described.

4.2 Study 1 (Quantitative Study): Chiropractic Care During Pregnancy and the Postpartum Period: A Survey of Chiropractors

The aim of this study was to characterise chiropractic pregnancy care from the perspective of chiropractors versed in the care of pregnant women. Therefore, questions in the survey inquired from the respondents their sociodemographic information, clinical experience, and postgraduate education. In terms of their pregnancy practice, we inquired from the respondents their pregnant patients' characteristics such as their presenting complaints and motivation for care. The survey inquired from the respondents their clinical care protocols (e.g., chiropractic spinal manipulative technique and adjunctive therapies), their collaborative care efforts with other healthcare providers, and their attitudes on the safety of pregnancy care.

4.2.1 Recruitment of Chiropractor Respondents

This was a cross-sectional survey of chiropractors. Email invitations were sent to American and Canadian members of the International Chiropractic Pediatric Association (ICPA) [540], a chiropractic professional organisation with 8000+ members worldwide

that advocates for comprehensive family care by the chiropractic profession and provide postgraduate seminars to chiropractors on paediatric, perinatal, and family wellness care. The email invitation (see Appendix E) asked chiropractors to participate in a study to characterise the chiropractic care of pregnant women.

Inclusion criteria for study participation by chiropractors were: (a) active membership with the ICPA, (b) in good standing with their licensing board or regulator, (c) practising in Canada or the United States (US), (d) completed or currently enrolled in the Certification from the Academy Council of Chiropractic Pediatrics (CACCP) and the Diplomate from the Academy Council of Chiropractic Pediatrics (DACC) program of the ICPA and (e) actively engaged in the care of pregnant and non-pregnant women. Study participation implied informed consent. In addition, the study posed minimal risk as study participation was completely anonymous, and potential respondents were provided sufficient information to make an informed decision about completing or declining the survey.

4.2.2 Survey Content

The survey was implemented online using the Research Electronic Data Capture (RedCap) as provided by Vanderbilt University. [541] RedCap is compliant with the Health Insurance Portability and Accountability Act (HIPAA) [542] and those requiring Health Canada and Good Clinical Practice compliant environments. [543-544]

The survey examined practitioner demographics (e.g., age, sex, years in practice), practitioner characteristics (e.g., chiropractic alma mater, postgraduate training in perinatal care, country and province/state of practice), the extent to which the Covid-19 pandemic [545] affected their patient volume (e.g., patient visits per week), practice characteristics (e.g., practice environment, fee structures, overall and pregnant weekly patient visits, clinical protocols such as their chiropractic technique and adjunctive therapies), patient

characteristics (e.g., musculoskeletal (MSK) and non-MSK clinical presentation(s) and motivation for care based on trimester of pregnancy or postpartum status), concurrent care of family members, safety ratings on the care of pregnant women, and collaborative efforts with other practitioners. The Chiropractor Survey along with the Information Sheet is provided in Appendix F. Reminder emails were sent out 2 weeks after initiating the Baseline Survey (i.e., based on date and providing email addresses) and every two weeks thereafter for a period of 3 months. The respondents were also reminded that the follow-up survey was to be completed after attending 6-12 visits since completing the Baseline Survey.

4.2.3 Method of Quantitative Analysis: Statistical Analysis

The data was analysed using descriptive statistics (e.g., means, standard deviations (*SD*) and proportions) [546]. To examine differences in means between two groups, the *t*-test of independence [547] or the Mann-Whitney *U* test was applied [548] depending on normality of data. Differences between means of ≥ 3 groups utilised the analysis of variance (ANOVA). [549] Statistical significance was set at $p < .05$.

4.2.4 Data Storage

The data collected from the survey responses is stored at the ICPA server, at Southern Cross University and in the laptops of the principal researcher. Access to these storage devices is username and password protected. The data will be maintained for a minimum of 5 years after publication, after which the data will be electronically deleted from the storage devices.

4.2.5 Research Ethics

Prior to study implementation, application for Ethics Approval from both Southern Cross University (See Appendix G) and Life University (see Appendix H) was made.

Appendix G contains the coversheet, questionnaire, and systematic review of the literature to support the ethics application. This study was approved by Southern Cross University Human Research Ethics Committee (Approval Number 2021-073) (see Appendix I) and the Institutional Review Board (IRB) of Life University (Marietta, GA, USA) (see Appendix J). In Canada, the Tri-Council Policy Statement: Ethical Conduct for Research Involving Humans (TCPS) [550] provides the following guidance when conducting research in Canada by researchers from abroad. The Tri-Council Policy Statement: Ethical Conduct for Research Involving Humans does not require research conducted by researchers from abroad to undergo Research Ethics Board review in Canada unless at least one or more of following is true:

1. The research was conducted under the auspices of a Canadian institution eligible to receive and administer research funds from one of three agencies – the Canadian Institutes of Health Research, the Natural Sciences and Engineering Research Council of Canada, and the Social Sciences and Humanities Research Council of Canada.
2. The source of funding comes from a Canadian institution or is administered through a Canadian institution.
3. At least one of the research collaborators is affiliated with a Canadian institution.

None of the above conditions is true and ethics approval from both Southern Cross University and Life University was sufficient for this study involving Canadian chiropractors.

4.3 Study 2 (Quantitative Method): Sense of Coherence and Associated Factors in Pregnant and Non-Pregnant Women Attending Care in a Practice-Based Research Network

The aim of this study was to obtain measures of SOC and its associated factors. The survey of pregnant and non-pregnant women addressed questions aligned with this aim by obtaining measures of SOC with the SOC-29 [79], assessments of QoL with the PROMIS-29 [495], GSE with GSE scale by Schwarzer and Jerusalem [510], HLOC with Form C of the HLOC scale Wallston et al. [525] and IPC experience with chiropractic care with the IPC-18 scale by Stewart et al. [534]

4.3.1 Recruitment of Pregnant and Non-Pregnant Women under Chiropractic Care

Utilising a practice-based research network (PBRN) [551], members of the ICPA versed in and actively involved in the care of pregnant and non-pregnant women were emailed to ask for assistance to recruit their pregnant and non-pregnant female patients to participate in this study. Along with the email invitation (see Appendix K), a Study Flyer (see Appendix L) was attached for copies to be provided to their pregnant and non-pregnant patients.

Inclusion criteria for study participation were: (a) the woman was a current chiropractic patient during the study period, (b) the patient was ≥ 18 years of age, (c) the woman was pregnant or non-pregnant, and (d) the woman was capable of reading and responding in English. In the Study Flyer (see Appendix L), willing study participants were provided a study hyperlink to the baseline or T1 survey, specific to their pregnant or non-pregnant status. The survey instruments were prefaced with a Participant Information Sheet (see Appendix M). The baseline or T1 survey instruments for pregnant and non-pregnant respondents are shown in Appendix N and Appendix O, respectively.

Following a course of chiropractic care (i.e., 6-12 visits), the study participants were invited to access another hyperlink to the follow-up or comparative survey (i.e., T2 survey), specific to their pregnancy status. The follow-up survey for the pregnant respondents is shown in Appendix P. The follow-up survey for the non-pregnant respondents is shown in Appendix Q. The baseline (T1 survey) and follow-up (T2 survey) responses from respondents (i.e., pregnant or non-pregnant) were linked using a unique participant identifier consisting of the first three letters of the respondents' mother's first name and the last three digits of the participants' phone number. This prospective cohort study was implemented online via Redcap [541], a secure web-based application as outlined in Section 4.2.2.

In this study, non-pregnant women were utilised as a comparative group in this study given the physical/biomechanical, physiological differences between pregnant and non-pregnant women and differences in their health behaviours. For example, relative to non-pregnant women, hormonal and metabolic changes occur in the pregnant woman that helps the growth and survival of the foetus. [133] Biomechanically, the lumbar lordosis of pregnant women in the third trimester is significantly greater when compared to non-pregnant women. The resulting biomechanical change in pregnant women results in alterations of their sitting and standing posture, and changes in the kinematics of their limbs during gait (i.e., reduced flexion and extension in the hip). Consequently, the gait speed of pregnant women in their second and third trimester is significantly reduced when compared to nonpregnant women. [552] A woman's lifestyle choices before and during pregnancy have important implications for her unborn child. Crozier et al. [552] found that women significantly reduce their consumption of cigarettes, alcohol and caffeinated drinks during pregnancy when compared to their non-pregnant status. Pregnant women adopt healthier lifestyles compared to non-pregnant women by adopting a better diet (i.e., higher

intake in fruits, vegetables and grain products and lower intake of foods that are high in fat, sugar or salt). [553-554] These differentiating factors suggest that pregnant and non-pregnant women may respond to chiropractic care differently but more importantly, respond differently in measures of their sense of coherence (SOC) and associated constructs.

4.3.2 Survey Content

The survey set out to determine the respondents' sociodemographic information (age, educational level, family income) and clinical information pertinent to their care ((i.e., clinical presentation, weeks of gestation, the type of care received, concurrent care with other healthcare professionals). To assess the respondents' quality of life (QoL), the 29-item profile instruments of the Patient-Reported Outcomes Measurement Information System (PROMIS-29 V2) [495] was incorporated into the survey instrument. Similarly, to assess the respondents' SOC, general self-efficacy (GSE), multidimensional health locus of control (MHLOC), and interpersonal process of care (IPC) experience, the SOC-29 [80], the GSE survey [511], the condition-specific Form C of the MHLOC survey [525] and the IPC-18 [534], respectively, were applied. The reliability, validity and clinical utility of these instruments have been described in Chapter 3 of this thesis.

4.3.3 Method of Quantitative Analysis: Statistical Analysis

Statistical analysis utilised the following methods. In addition to descriptive statistic (i.e., frequencies, means and *SD* and proportions) [546], significant differences in means involving 2 levels utilised both parametric (independent *t*-test) [547] and nonparametric (Mann-Whitney *U* test) testing. [548] To determine if two categorical variables are related, the χ^2 test of independence was applied. [555] Pearson's *r* was applied to determine the linear relationships between two continuous variables. [556-557]

Cronbach's alpha (α) is a measure of the internal consistency or reliability between several items, measurements, or ratings. [558-559]. The possible value of Cronbach's alpha ranges from 0 to 1 with α values closer to 1 implying the items are measuring the same dimension while α value towards 0 indicates that some or all of the survey items are not measuring the same dimension.

In addition to the acknowledged intrinsic differences between pregnant and non-pregnant women, further efforts were made to minimise differences between the two groups for further comparison of the patient-reported outcomes (PROs). Efforts were made to compare the PROs of respondents with similar age and anchored to the United State reproductive age of 15-44 years. [560] Comparisons of the PROs were also made with respondents with similar patient visits and anchored to the pregnant women's patient visits ranging from 2 to 110. Studies have demonstrated that SOC, GSE, MHLOC change with age. [561-563] In terms of patient visits, it has been demonstrated that visit frequency can affect patient outcomes (i.e., pain and functional outcomes) in chiropractic patients. [564-565] Comparisons of the primary outcomes were also made based on quartiles of age and patient visits in the two group of respondents using Excel. [557]

To determine if clinically significant differences in the primary outcome measures between pregnant and non-pregnant women existed, the minimally clinically important difference (MCID) was measured for each primary outcome measure at baseline based on the distribution-based method of calculating the standard error of measurement (SEM). This method does not require the use of reference values or anchor states, thus allowing for the clinically relevant change to be estimated from the questionnaire scores and accounts for questionnaire precision, an aspect not considered in anchor-based estimates of score changes. [566] According to Rejas et al. [567], the 1SEM criterion is a valid alternative to the MCID criterion to evaluate the magnitude of the change or differences produced in

patient-reported outcome measures (PROMs). Additionally, since many studies with different outcomes universally accept the rule of thumb for MCID as equal to 0.5 *SD* [568] and since there is no universally applied interpretation of the MCID for the PROs applied in this study, the MCID as 0.5SD was also calculated as a basis for further comparison. For the 11-point pain NRS, we applied a difference of 1.39 (*SD* = 1.05, 95% CI: [1.27, 1.51]) as clinically significant. [569] A difference in measures between pregnant and non-pregnant respondents that is smaller than the SEM value is likely the result of measurement error rather than a true observed (i.e., clinically significant) difference. [570] The SEM was calculated as follows: SEM = $SD\sqrt{(1-r)}$ where *SD* = standard deviation and *r* = Cronbach's alpha of the PRO instrument. Calculation of the MCID was also calculated using the 0.5 *SD*. [568] To analyse the relationship with a single dependent variable to several independent variables, a multiple regression analysis was performed. [554] Statistical significance was set a $p < .05$.

4.3.4 Data Storage

The data collected during and after the study period are stored at the International Chiropractic Pediatric Association server, at Southern Cross University and laptops or desktops of the researchers. Access to these storage devices is username and password protected. Upon study completion, all data collected in this project is stored safely and securely for a minimum of 5 years after publication. Upon storage expiration, the data will be electronically deleted from the storage devices.

4.3.5 Human Research Ethics

Prior to study implementation, ethics approval was sought from Ethics Lismore (see Appendix R). The application contains the coversheet, application questionnaire, and the Human Research Ethics Application (HREA) [571]. The ethics application with Life

University's IRB is shown in Appendix S). Ethics approval was received from Southern Cross University Human Ethics Research Committee (Approval Number: 2021/112) (see Appendix T) and the IRB of Life University (Marietta, GA, USA) (see Appendix U). As described for Study 1, ethics approval from either Southern Cross University or Life University was sufficient for this study involving Canadian chiropractors. [550]

4.4 Study 3 (Qualitative Method): The Lived Experience of Pregnant Women Under Chiropractic Care: A Phenomenological Analysis

The aim of this study was to gain an in-depth understanding of patient experiences and the nature of the therapeutic encounter between a pregnant woman and their chiropractor. To achieve this aim, the lived experience of pregnant women under chiropractic care was assessed using a qualitative approach guided by transcendental phenomenology.

4.4.1 Criterion Sampling and Recruitment of Pregnant Women

This qualitative study utilised criterion sampling where study participants must meet predefined criteria. Inclusion criteria for study participation were: (a) the woman was currently pregnant, regardless of weeks of gestation, (b) currently receiving chiropractic care for both musculoskeletal and/or non-musculoskeletal conditions as well as general wellness care (c) able to read and speak English, and (d) has access to the internet and possesses a video conferencing service (i.e., Zoom, Skype).

The phenomenon under study was the lived experience of pregnant women under chiropractic care. The chosen participants had a shared experience of being pregnant and under chiropractic care, but varied in characteristics (i.e., age, weeks of gestation, chiropractor) and in their individual experiences. [572]

The initial recruitment of pregnant women for Study 3 was embedded at the end of the follow-up or T2 survey of pregnant respondents in Study 2 (see Appendix P). This method of recruitment was unsuccessful. New recruitment efforts were made by recruiting pregnant women for the semistructured interviews through the professional contacts of the PhD candidate. Six chiropractors having a significant pregnancy care practice were requested to assist in recruiting pregnant women in their clinics for interviews. As this was a change in the original ethics application with Southern Cross University and Life University, an application to amend the ethics application was made to both ethics review board. The application for a Change in Protocol with Southern Cross University and Life University is shown in Appendix V and Appendix W, respectively. Appendix V contains the coversheet for the ethics application with Southern Cross University, and the questionnaire associated with the application. The HREA application provided in Appendix R is similar to the HREA attached for this Change in Protocol application except with respect to the section pertaining to Recruitment Questions. Pregnant study participants for Study 3 were now recruited from specific chiropractic practices as described above. The Change in Protocol application with Life University also included a Request for Renewal to extend the ethics approval (see Appendix X). Approval in the Change in Protocol was approved by Southern Cross University (see Appendix Y) and Life University (see Appendix Z).

A Recruitment Flyer/Information Sheet (Appendix AA) was made available in the waiting rooms of the chiropractic practices involved in recruiting study participants. Interested individuals contacted the PhD candidate by text messaging or email and were scheduled for a Zoom meeting for the interviews. Prior to the interviews, potential participants signed an Informed Consent document (see Appendix AB) that were emailed to the PhD candidate. Interviews by Zoom were performed sequentially until data

sufficiency (i.e., qualitative findings are sufficient to achieve the aims of the study given the specificity of the sample (i.e., defined inclusion and exclusion criteria), the strategy for analysis (i.e., phenomenology), and the quality of the interviews) [573] was obtained at n = 10 and thereupon interviews were ceased.

4.4.2 Semistructured Interviews

The purpose of the interviews was to explore the views, experiences, beliefs and/or motivations of individuals on a particular subject (i.e., the lived experiences of pregnant women under chiropractic care) beyond the use of purely quantitative methods. [574] Qualitative interview research consists of the structured, semistructured and unstructured interviews. [575] Structured interviews are verbally administered with predefined questions without variation or follow-up to responses for further elaboration. They are quick and easy to implement but limited in terms of the participants' responses, particularly when in-depth interviews are warranted or required. Unstructured interviews involve no formal organisation or structure. The interview begins with an opening/initial question with follow-up questions based on the interviewee's response but without little guidance. Unstructured interviews can be time consuming, difficult to manage and analyse but used when very little is known about a subject matter. Semistructured interviews are guided by key questions that assist in focusing topics to be explored but allow for follow-up with diverging questions to further explore a response in more detail. [575] In this way, two-way communication is encouraged and allows for comparison of responses in previous or future interviews. However, semistructured interviews are time consuming, may require a larger sample of interviewees and leading questions may be biased.

To explore the lived experience of pregnant women under chiropractic care and gain insight into their SOC, GSE and MHLOC, a series of questions were developed to initiate and guide the semistructured interviews along with follow-up questions (see

below). Note that the interview guide provided were paraphrased for everyday conversation and is only a partial list of the questions asked of the interviewees given the iterative process of the interview with revisions of the interview guide as an ongoing process. The questions were informed by the literature reviews and the clinical experience of the PhD candidate in the care of pregnant women.

Broad Topic with nested exploratory questions?

1. How did you become a chiropractic patient?
    a. Did you do any research on chiropractic before you decided on chiropractic care during your pregnancy?
    b. Is chiropractic something that resonates with your view of health and healthcare?
        - How does chiropractic fit in with other types of care you may be receiving?
    c. Did you experience any barriers (or facilitators) to becoming a chiropractic patient? If so:

        (Facilitators:)

        - How did the facilitators help you to become a chiropractic patient?

        (Barriers:)

        - How did you overcome these barriers?
        - Did you feel that these barriers were out of your control?
        - Without identifying your chiropractor, did your chiropractor or their staff help you in any way to overcome these barriers? If so, how did they do that?
2. What has been your experience with chiropractic care so far?

a. How has chiropractic addressed the complaints/symptoms you were experiencing?
b. What other types of benefits have you experienced with chiropractic care?
c. Now that you have experienced chiropractic care, do you feel that chiropractic care is safe?
    - Have you ever experienced any symptoms that didn't feel good with the chiropractic adjustment?
d. Are there things that stand out to you in the way your chiropractor or their staff treated you? If so, please tell me about them.
    - Did you feel that you were part of the decision-making process with your care plan? Why or why not?

4.4.3 Zoom Interviews

All interviews were performed via Zoom. Zoom is a cloud-based video conferencing service that offers online meetings, group messaging services, and secure real-time audio and video conferencing with recording of sessions. [576]. Access to the Zoom session requires the provision of a meeting identification number and a password or accessing a unique hyperlink provided in the email to the interviewee. Zoom is compliant with the Health Insurance Portability and Accountability Act (HIPAA) of 1996 and the Canadian Data Protection regulations, including the Personal Information Protection and Electronic Documents Act (PIPEDA) and the Personal Health information Protection Act (PHIPA). [577] Advantages and disadvantages with Zoom technology have been identified [578] and are briefly described below.

Key advantages of using Zoom for qualitative interviewing include:

- Convenience of use. The technology facilitates the interviews regardless of geographic locale and ease of scheduling. Since interviews do not require travel

by one or both parties, Zoom allows for flexibility of scheduling, time and cost effectiveness due to lack of required travel or cost of venue for interviews.

- Zoom has been identified as simple and user-friendly with ease of connection and intuitive functionality with robust privacy and security options.
- Despite the lack face-to-face interviews, Zoom facilitates rapport between participants. The researcher can respond to nonverbal cues (i.e., facial expressions and gestures) from the interviewee and establish trust and rapport, and an interpersonal connection for a lively and engaging discussion for rich data.

Disadvantages of Zoom include:

- Requirements for an internet connection and hardware/software. Participants are required to have access to the internet via a hardware (i.e., desktop, laptop, iPad, phone) and download of the Zoom software.
- Difficulty connecting and low quality and reliability issues may occur. Participants may experience some degree of difficulty in joining the session due to low internet bandwidth, outdated hardware or software, or limited webcam and/or microphone functionality resulting in dropped calls, lost call connection, or lag and muffled voices.

Interviews in this study were performed by the PhD candidate until data sufficiency was obtained to ensure comprehensibility (depth) to identify emergent or recurrent thematic patterns and to account for discrepant examples (breadth) of the phenomenon under study. [569]

4.4.4 Method of Qualitative Analysis

All Zoom interviews were recorded as video and audio recordings. The audio recordings were labelled using the participants initials and the last four digits of their

phone number (i.e., JA0893). The audio recordings were sent to a consultant computer scientist via Dropbox (Dropbox, Inc., San Francisco, 2007), a file hosting service that offers cloud storage, file synchronisation, personal cloud, and client software. The audio recordings were transcribed for analysis using Microsoft 365 software for transcription [Microsoft, Redmond, Washington, 2017]. The audio recordings ranged from 23 to 51 minutes per person in duration. Each transcribed interview was read carefully prior to the next interview to inform subsequent interviews with any new lines of questioning.

To examine the meaning of the lived experience of pregnant patients under chiropractic care, an approach informed by phenomenology was used [467, 579]. Edmund Husserl (1859–1938), a German mathematician-philosopher and founder of phenomenology defined phenomenology as 'the science of essence of consciousness' and focused on defining the concept of intentionality and the meaning of lived experience, from the first-person point of view. [580] According to Mabaquiao [581], bracketing (whereby presuppositions and biases are put aside) is carried out within the framework of the relationship between consciousness and the objects towards which it is directed. This essential feature of consciousness that directs or relates it to its objects is called 'intentionality.' Intentionality is the act of being present in a situation. Noesis gives meaning to the intentional act while noema is the meaning given to the intentional act. According to Husserl, by establishing intersubjectivity with participants, the researcher is able to step into their subject's experiential shoes. [582] Intentionality, as a necessary structure of consciousness, is said to be a 'phenomenological residue' that is not something that can be suspended or be included in the bracketing, for it is the very framework within which the reductions are carried out. This, in general, is the sense in which the analysis of the nature of intentionality constitutes an integral part of Husserl's phenomenological investigations.

Husserl's quest was to 'go back to the things themselves' and by going back to the source of the experience itself, phenomenology advocates for the investigation of phenomenon as consciously experienced, or the appearance of things as lived experience. Phenomenology is also a method to examine the meanings ascribed by individuals to the experienced phenomenon. By this method, researchers may gain an understanding of the meaning and perceptions of an individual's lifeworld [581, 583-585].

There are three schools of phenomenology. The first school follows the Husserlian approach of inductive, transcendental, or descriptive phenomenology. The second school follows the Heideggerian approach, utilising interpretive hermeneutics as its basis. The third school is referred to as the Dutch or Utrecht school with its approach combining the characteristics of descriptive and interpretive phenomenology [586] In this thesis, a transcendental phenomenological approach was applied. According to Moustakas [587-588], the processes of transcendental phenomenology analysis involve the following steps: (1) phenomenal reduction and epoche or bracketing to acknowledge one's conscious and unconscious a priori beliefs and biases [580], (2) the identification of significant nonoverlapping, nonrepetitive and meaningful statements (i.e., invariant horizons) and placed into themes to gain a description of each participant's experience, and (3) imaginative variation to create structural descriptions from the textural descriptions and synthesis of meaning, where textural-structural descriptions are examined to describe the essence of the respondents' lived experience. [589]

4.4.4.1 Phenomenal Reduction and Epoche or Bracketing

Prior to analysis, bracketing or epoche, was performed to acknowledge and set aside or suspend my experiences, any possible biases and preconceived notions that I may have about the chiropractic care of pregnant women that would affect data collection and analysis. According to Husserl, bracketing enables the researcher to maintain their

intentionality and the experiences of those who inhabit the lifeworld of the phenomenon being studied. However, bracketing in phenomenological research is challenging. Phenomenology is 'involved and subjective', and distinct from the 'empirical, scientific method', which is 'detached and objective, not involved.' [590] Although the procedure of bracketing was daunting, particularly when the procedure was juxtaposed with reflexivity, the process of a continuous internal dialogue and critical self-evaluation of one's positionality or point of view in the research along with active acknowledgement and explicit recognition that this position may affect the research process and outcome, this process was nonetheless performed. [590] This critical self-reflection further assisted in the bracketing process. Another complicating factor to bracketing and reflexivity is my role as a clinician. As a chiropractor, I was trained to listen and engage appropriately, to be understanding and be emphatic to the patient's situation and needs. Therefore, every interview is very much like a history examination, which is part of the whole process of care or intervention. I considered how my research knowledge and clinical experience in pregnancy care could affect/influence my analysis of the data. In defense of bracketing, Drew noted that Husserl insisted an awareness of the researcher's own experience of the phenomenon under study to ensure objectivity and that self-awareness is an integral aspect of exploring phenomena and is the foundation of objectivity in phenomenological research. [579] Paley [589] acknowledged Drew's phenomenological objectivity as different from the objectivity associated with 'positivistic-oriented research,' where study objectivity is achieved by eliminating a researcher's personal connections to the study. Berger [590] pointed out that knowledge and awareness of one's positioning in a research endeavor facilitates the understanding of the role of 'self' in the co-creation of knowledge and a means to monitor the dissonance between subjectivity and objectivity of the researcher to the research that ultimately leads to enhancing the rigor and ethics of the

study. For me, the process of bracketing and reflexivity led to self-discovery, rediscovery, and revelations of both conscious and unconscious experiences, biases and preconceived notions I had about pregnancy care. These diary entries are summarised below:

- Pregnant women present for care with complaints of low back pain (LBP) and/or pelvic girdle pain (PGP), the use of the Webster Technique to address foetal breech and for advice on exercise and general nutrition.
- Pregnant women present typically in the second to third trimester of their pregnancy and sometimes in their first trimester.
- Chiropractic care using drop table technique is effective in alleviating their LBP and/or PGP.
- Most pregnant women presenting for care have previous experience with chiropractic either as a patient or a family member such as their child.
- Most published research on chiropractic pregnancy care has examined pregnancy-related LBP and/or PGP.

4.4.4.2 Description of Each Participant's Experience

The transcripts for each interview were imported to NVivo [591] for coding and analysis. For each transcript, significant nonoverlapping, nonrepetitive and meaningful statements (i.e., invariant horizons) were identified, examined for their meaning and placed into themes. The themes and meaning were then analysed to create textural descriptions to underscore 'what is experienced.'

4.4.4.3 Imaginative Variation

Through imaginative variation and reflection, structural descriptions were created from the textural descriptions to illustrate 'how' the phenomenon was experienced. Imaginative variation is a means of examining the possible meanings/interpretations of

each participant's experiences from different perspectives (i.e., context, patient characteristics).

4.4.4.4 Synthesis of Meaning

An amalgamation or a creation of the composite the textural-structural descriptions from all the transcripts was generated to describe the essence or meaning of the respondents' experience with chiropractic care.

4.4.5 Trustworthiness of Qualitative Research

As a means to developing and establishing trust and confidence in the study findings and provide an accurate representation of the population studied, qualitative trustworthiness or rigor must be established. A number of attributes for trustworthiness or rigor and quality must be satisfied during the design, execution and reporting of the qualitative research undertaken. [592] These were addressed in more detail in Chapter 3. The study question(s) and research design were informed by systematic reviews of the literature. Reflexivity of the researcher prior to and throughout the qualitative study is a critical aspect of rigor. Bracketing or epoche was performed to attempt to set aside or suspend any possible biases and preconceived notions that I may have had about chiropractic pregnancy care.

The mixed methods study design was justified to assist readers to trust the research and the researcher. As described in Chapter 3, mixed methods combine inductive and deductive reasoning, to some extent compensating for the limitations of exclusively quantitative and qualitative research and drawing on the strength of each data type to facilitate a more comprehensive picture of the phenomenon under study. In terms of sampling and data collection, a clear rationale for my sampling approach (i.e., criterion sampling) and data collection (i.e., semistructured interviews) was provided, data

sufficiency was addressed, along with prolonged engagement with and persistent observation of the study participants, and triangulation of data sources (see Discussion Chapter 8).

As a practising chiropractor, I not only have clinical experience in caring for pregnant women but this clinical experience has afforded me prolonged engagement with pregnant women to become familiar with and to understand their needs (e.g., relief of LBP) and culture (e.g., desire for a natural childbirth), to gain their trust in their use of chiropractic care and to reflect upon (as part of the process of bracketing) the potential distortions introduced by me as the researcher and the research performed.

During the interviews, data sufficiency was grounded in persistent observations of the phenomenon under study and critical to ensuring the depth (i.e., comprehensiveness to identify recurrent themes) and breadth (i.e., accounting for discrepant examples) of the phenomenon under study [591] as well as for confirmability standard. Data triangulation, a method of convergence of data from multiple data sources (in this case, semistructured interviews and a survey of pregnant women) was performed. To facilitate the organisation and analysis (i.e., coding construction of themes, integration of textural and structural descriptions to gain the essence of the experience [583]) and to assure readers of the trustworthiness and integrity of the data analysis, NVivo [591] was utilised for this purpose following the method of Moustakas. [587-588] Trustworthiness or rigor of a study refers to the degree of confidence or trust in the methods used to obtain the data, the data itself and in its analysis and interpretation, to ensure the quality of a study. [538, 592]

To further improve the quality of reporting of the qualitative study in terms of its design, conduct, analysis, and findings as well as inform its critical appraisal, the Consolidated Criteria for Reporting Qualitative Research (COREQ) [593] was applied.

4.4.6 Data Storage

The data collected during and after the study period are stored similarly to those in Study 1 and Study 2 (i.e., at the ICPA server and laptops or desktops of the researchers). Upon study completion, all data collected in this project will be stored safely and securely at Southern Cross University for a minimum of 5 years after publication. Upon storage expiration, the data will be electronically deleted from the storage devices.

4.4.7 Human Research Ethics

The application for ethics approval for this study was concurrently applied with Study 2 (see Appendix R and Appendix S). Ethics approval was received from Southern Cross University Human Research Ethics Committee (Approval Number: 2021/112) (see Appendix T) and from the IRB of Life University (Marietta, Georgia, USA) (see Appendix U). Initial recruitment of pregnant women for semistructured interviews occurred via a non-probability sampling by inviting pregnant respondents at the end of the follow-up or comparative survey implemented in Study 2. Pregnant women were invited to participate in an interview by phone, Zoom or Skype to explore their lived experience with pregnancy under chiropractic care. Unfortunately, this mode of recruitment was not successful, and a Change in Protocol with the recruitment method was made. The PhD candidate contacted six professional colleagues known to care for pregnant women and requested their assistance in recruiting pregnant women in their clinics for interviews. The Change in Protocol was approved by Southern Cross University Human Research Ethics Committee (see Appendix Y) and the Institutional Review Board (IRB) of Life University (see Appendix Z). As described for Study 1 and Study 2, the proposed research did not meet the requirements by TCPS 2 for Research Ethics Board approval in Canada prior to implementation [550].

4.5 Conclusion

This chapter provided an overview of the three studies that comprise the research outlined in this thesis. Informed by a systematic review of the literature on measures of SOC during pregnancy and a systematic and scoping review of the literature on the chiropractic care of pregnant women, a number of research gaps in the chiropractic care of pregnant women were identified to inform the impetus for this research. Research questions were formulated, and hypotheses were proposed to drive the development of the research aims of this thesis. To achieve the aims of this thesis, the research worldview of pragmatism was described to justify the use of a mixed method approach. A quantitative approach was undertaken to first characterise the practice of chiropractic in the care of women during pregnancy and the postpartum period (Study 1). Secondly, a prospective observational study examined a cohort of pregnant and non-pregnant women with respect to their SOC, quality of life, self-efficacy, health locus of control and patient satisfaction with a course of chiropractic care (Study 2). Finally, a phenomenological study, investigated the lived experience of pregnant women while under chiropractic care.

Chapter 5. Results of Study 1: Chiropractic Care During Pregnancy and the Postpartum Period: A Survey of Chiropractors

5.1 Introduction

This chapter presents the results of the first quantitative study which aimed to characterise the chiropractic care of pregnant women from the perspective of chiropractors versed in chiropractic pregnancy care. In this survey, respondents provided their sociodemographic information and practitioner characteristics, their patient and practice characteristics, their clinical protocols and collaborative efforts with other healthcare providers, and their safety attitudes to chiropractic pregnancy care.

Details of the data collection, preparation and analysis applied in this study were provided in Chapter 3 Methods. A brief review of the study methods is presented here prior to presenting the results of this study.

5.2 Data Collection

The inclusion criteria for chiropractor study participation were: (a) active membership with the International Chiropractic Pediatric Association (ICPA), (b) in good standing with their respective regulatory board, (c) practising in Canada or the United States, and (d) completed or currently enrolled in the Certification from the Academy Council of Chiropractic Pediatrics (CACCP) and the Diplomate from the Academy Council of Chiropractic Pediatrics (DACC) program of the ICPA and (e) actively engaged in the care of pregnant and non-pregnant women.

Data collection was implemented online using a secure web-based application known as RedCap (Research Electronic Data Capture). [541, 594] The 84-item questionnaire obtained respondents' sociodemographic information (i.e., gender, age), practitioner characteristics (e.g., years in practice, chiropractic alma mater, country of

practice, and postgraduate training in pregnancy care), practice characteristics (e.g., practice environment, patient visits per week, framework of care, fee structures and modes of reimbursement), pregnant and postpartum patient characteristics (e.g., age, presenting musculoskeletal (MSK) or non-MSK complaints, motivation for care, and care of family members), respondents' attitude on patient safety, and clinical care pathways for pregnant women with various comorbidities, clinical protocols (e.g., chiropractic techniques and adjunctive therapies), and collaborative efforts with other healthcare professionals.

5.3 Data Preparation and Analysis

The RedCap data was imported as a comma separated values (CSV) file and converted to an Excel file [557] for analysis. The data were analysed using descriptive statistics (i.e., mean, standard deviation [*SD*]). [546] To examine differences in means between two groups, the *t*-test of independence [547] or the Mann Whitney *U* Test [544] was applied, depending on data normality. Differences in means of ≥ 3 groups utilised the analysis of variance (ANOVA) [549] or the Kruskall Wallis Test. [595] Chi square test of independence was applied to determine the independence of two categorical variables. [555] Statistical significance was set at $p < .05$.

5.4 Results

5.4.1 Response Rate

Email invitations were disseminated to 2076 chiropractors. Sixty eight percent of the recipients ($n = 1412$) opened the email invitation and 542 accessed the study hyperlink. Three hundred ninety-nine initiated the survey and 247 completed the survey. A response rate of 19.2% was calculated based on the number of recipients accessing the survey hyperlink and a completion rate of 61.9% based on the number of recipients initiating and completing the survey. [596]

5.4.2 Practitioner Characteristics

5.4.2.1 Practitioner Sociodemographics

The convenience sample of 247 chiropractors (i.e., 196 [79.4%] females; 51 males [20.6%]) had an average age of 39.02 years (n = 236, SD = 9.08, range = 24–71 years). The majority (n = 74; 29.9%) had practice experience of 6-10 years, followed by 2-5 years (n = 56; 22.7%), 11-15 years (n = 48; 19.4%), 21+ years (n = 36; 14.6%), 16-20 years (n = 27; 10.9%), and 0-1 years (n = 6). A χ^2 test of independence to determine the relationship between female and male practitioners with respect to their practice experience (see Table 5.1) indicated a significant difference (i.e., $\chi^2_{(5)} = 109.332$, $p < .05$) with the majority of female practitioners (n = 115; 46.6%) practising ≤ 10 years compared to 21 (8.50%) male practitioners with the same years in practice.

Table 5.1. Number of Female and Male Practitioners Based on Years of Clinical Experience

Experience	Female *n* (%)	Male *n* (%)
0-1 year	6 (2.4)	0 (0)
2-5 years	47 (19.0)	9 (3.6)
6-10 years	62 (25.1)	12 (4.9)
11-15 years	37 (15.0)	11 (4.4)
16-20 years	20 (8.1)	7 (2.8)
21+ years	24 (9.7)	12 (4.9)
Total	196 (79.4)	51 (20.6)

Most respondents were from the US (n = 217; 87.9%) with only 27 (10.9%) from Canada and three (1.21%) not indicating their country of practice. Most respondents graduated from the Palmer University System (n = 61; 24.7%), followed by Life University (n = 42; 17.0%) and Parker University (n = 30; 12.4%) (see Table 5.2).

Table 5.2. Distribution of Respondents' Alma Mater

	Total		Canada		USA	
Chiropractic institution	*n*	%	*n*	%	*n*	%
Palmer College of Chiropractic						
Davenport	47	19.0	2	0.8	45	18.2
Florida	11	4.5	–	–	11	4.5
West	3	1.2	–	–	3	1.2
Life University	42	17.0	–	–	42	17.0
Parker University	30	12.1	2	0.8	28	11.3
New York College	16	6.5	1	0.4	15	6.1
Northwestern University	16	6.5	1	0.4	15	6.1
Life West Chiropractic College	13	5.3	2	0.8	11	4.5
Logan University	15	6.1	1	0.4	14	5.7
Canadian Memorial College of Chiropractic	12	4.9	12	4.9	–	–
Los Angeles College of Chiropractic / Southern Calif. Univ. of Health Sciences	6	2.4	–	–	6	2.4
National University of Health Sciences	7	2.8	–	–	7	2.8
University of Western States	4	1.6	2	0.8	2	0.8
Sherman College of Chiropractic	5	2.0	–	–	5	2.0
Cleveland College						
Kansas City	6	2.4	–	–	6	2.4
Los Angeles	4	1.6	–	–	4	1.6
Texas College of Chiropractic	4	1.6	–	–	4	1.6
University of Trois Rivieres	4	1.6	4	1.6	–	–
Macquarie University	1	0.4	–	–	1	0.4
Other (Penn Straight College of Chiropractic)	1	0.4	–	–	1	0.4

5.4.2.2 Practitioner Postgraduate Training

The majority (*n* = 199; 80.6%) of respondents indicated completing a postgraduate course in pregnancy care, while 48 (19.4%) were currently in a program. The majority (*n* = 221; 89.5%) indicated as training with the ICPA and obtained a Certification from the Academy Council of Chiropractic Pediatrics (CACCP) or a Diplomate from the Academy Council of Chiropractic Pediatrics (DACCP) (*n* = 18; 7.3%). [597] A few respondents (*n* = 5; 2.0%) indicated training with the International Chiropractic Association (ICA) Pediatric

Program. [598] Three (1.2%) respondents indicated 'Other' with their postgraduate education.

Ninety-eight percent (n = 244) of respondents indicated as having trained in the Webster Technique [358], one (< 1%) respondent was currently enrolled in a Webster Technique course and two (< 1%) indicated never receiving any training in the technique. The ICPA trained the majority (i.e., n = 241; 97.6%) of respondents in the Webster Technique with only three (1.2%) indicating 'Other' as their source of training, while three (1.2%) were nonrespondents.

5.4.3 Practice Characteristics

5.4.3.1 Practice Environment

Most respondents (n = 129; 52.1%) indicated practising with other chiropractors (n = 93; 37.7%) or as practice associates (n = 36; 14.5%), followed by chiropractors in solo practice (n = 103; 41.7%). Other respondents indicated practising within a complementary, alternative and integrative medicine (CAIM) [29] setting (e.g., acupuncturists, naturopaths) (n = 14; 5.7%), with one respondent indicating practicing in a free-standing birthing centre (i.e., facility where birth is away from both hospital and home) (n = 1; < 1%).

5.4.3.2 Effect of the COVID-19 Pandemic on Chiropractic Practice

As the survey was implemented during the COVID-19 pandemic [599], information on the effects on the respondents' practice volume (i.e., number of patients attending care) was sought. The majority (n = 153; 61.9%) of practitioners indicated that their overall patient volume was not affected by the pandemic while 36.8% (n = 91) were affected by the pandemic, with three (1.2%) nonrespondents. For those affected by the pandemic, their patient volume decreased by a mean decrease of 12.6% (n = 209, SD = 18.45, range: 0–100%).

5.4.3.3 Patient Visits per Week

Prior to the pandemic, 235 (95.1%) respondents indicated providing care to patients at a mean of 140.3 patient visits per week (PVperW) (*SD* = 135.76, range: 8–1500). A mean of 25.8 PVperW (*n* = 232 [93.93%], *SD* = 67.58, range: 0–1000) or 18.4% of their overall mean patient volume involved the care of pregnant women. Respondents (*n* = 241; 97.6%) indicated a mean of 24.6% (*SD* = 26.05, range: 0–100%) of their pregnant patients began care prior to their pregnancy, while 235 (95.1%) of respondents indicated a mean of 60.9% (*SD* = 28.03, range: 0–100%) of their pregnant patients continued care postpartum.

To determine if overall patient visits, pregnant patient visits and the mean percentage of female patients receiving care prior to pregnancy by years of practice experience, an ANOVA was performed (see Table 5.3). A statistically significant difference was found in the percentage of patients receiving care prior to pregnancy. Tukey HSD determined that practitioners with 16-20 years of clinical practice (35.8%) differed from those with 0-5 years of clinical practice (18.5%) in this regard.

Table 5.3. Analysis of Patient Visits per Week Based on Years of Practice

		Years of practice					
Measure		0-5	6-10	11-15	16-20	21+	ANOVA
Pregnant patient visits per week	*n*	58	74	47	25	35	$F_{2,234} = 0.5526$
	Mean	19.6	34.4	20.0	20.5	24.5	$p = .6973$
	SD	20.19	115.83	24.99	15.82	18.85	
Overall patient visits per week	*n*	59	73	47	26	35	$F_{4,235} = 1.5564$
	Mean	102.3	159.9	143.8	132.9	144.5	$p = .1868$
	SD	86.88	191.44	134.77	92.58	70.44	
% of patients who began care prior to being pregnant	*n*	59	74	47	26	35	$F_{4,236} = 2.6151$
	Mean	18.5	28.1	21.1	35.8	24.0	$p = .0360$
	SD	23.28	28.45	21.23	33.04	22.64	

To determine if mean PVperW and mean percentage of patients continuing care into their pregnancy differed based on practitioner sex, a *t*-test of independence was performed (see Table 5.4). First, the results demonstrated that male chiropractors attended to, on average, a greater number of patient visits per week. Male chiropractors attended to a mean of 64.9 PVperW greater and this difference was statistically significantly. Second, no statistically significant difference was found in the number of pregnant PVperW between male and female chiropractors. Third, the mean difference of female patients continuing chiropractic care into pregnancy of 3.6% did not differ in statistically significant manner between male and female chiropractors.

Table 5.4. *t*-Test of Independence of Patient Visits per Week between Female and Male Practitioners

	Female DCs		Male DCs					
Measure	*n*	Mean (*SD*)	*n*	Mean (*SD*)	$\lvert\Delta\rvert_{Mean}$	df	*t*-statistic	*p*-value
Overall patient visits per week	189	123.6 (140.53)	51	188.5 (102.66)	64.8 PVperW	238	3.0797	.0023
Pregnant women patient visits per week	188	25.0 (74.08)	51	25.2 (25.79)	0.2 PVperW	237	0.0179	.9857
% patients who began care prior to being pregnant	190	25.4 (26.61)	51	21.8 (23.87)	3.6	239	0.8841	.3776

Note. DC = Doctor of Chiropractic; PVperW = patient visits per week.

To determine if the mean overall PVperW, the mean pregnant PVperW and mean percentage of pregnant patients cared for prior to pregnancy differed by country of practice, a *t*-test of independence (see Table 5.5) revealed no statistically significant differences were noted based on country of practice.

Table 5.5. *t*-Test of Independence of Patient Visits per Week between Canadian and American Practitioners

	Canadian		American					
Measure	*n*	Mean (*SD*)	*n*	Mean (*SD*)	$\lvert\Delta\rvert_{\text{Mean}}$	df	*t*-statistic	*p*-value
Overall patient visits per week	27	118.9 (80.06)	210	139.7 (141.81)	20.9 PVperW	235	0.7483	.4550
Pregnant women patient visits per week	26	13.8 (16.80)	210	26.4 (70.81)	12.6 PVperW	234	0.9014	.3683
% pregnant patients cared for prior to pregnancy	27	30.1 (32.95)	211	23.6 (25.05)	6.4%	236	1.2082	.2282

Note. PVperW = patient visits per week.

5.4.3.4 Fee Structures, Modes of Reimbursement, and Reimbursement Categories

This study examined chiropractor mean fee structures (i.e., fees charged for the initial consultation, on re-examination and for follow-up visits) for their pregnant and postpartum patients. Unless otherwise stated, the dollar amounts are indicated regardless of the currency type or exchange rate between the United States and Canadian dollar. This study also examined practitioners' modes of reimbursement (i.e., out-of-pocket or cost incurred by the patient versus insurance reimbursement) for pregnant and non-pregnant women and reimbursement categories (i.e., pro bono versus out-of-pocket only or combination of out-of-pocket and insurance reimbursement) for pregnant women. Differences in the fee structures, modes of reimbursement, and reimbursement categories were examined based on practitioner gender, country of practice, and years of clinical experience.

Prior to the examination of the respondents' fee structures for pregnant and postpartum patients, respondents were asked to indicate if they had different fee structures for pregnant and postpartum patients. The majority (n = 235; 95.1%) indicated that they did not have different fee structures for pregnant and postpartum patients. The

respondents' fee structures, regardless of currency type, for pregnant and postpartum patients are shown in Table 5.6. A *t*-test of independence was performed to determine differences in the mean fees charged to pregnant and postpartum patients. The mean fees charged for the initial consultation, on re-examination and for follow-up visits, by the respondents to pregnant and postpartum women did not differ in a statistically significant manner. The absolute mean difference in fees charged to pregnant and postpartum women ranged from $0.57 for follow-up visits to $3.97 for the initial consultation.

Table 5.6. *t*-Test of Independence of Fees Charged for Pregnant and Postpartum Patients

	Pregnant		Postpartum					
Fee category	*n*	Mean (*SD*)	*n*	Mean (*SD*)	$\lvert\Delta\rvert_{Mean}$	df	*t*-statistic	*p*-value
Initial consultation	223	$126.52 (51.43)	223	$130.50 (75.63)	$3.97	444	0.6487	.5168
Re-examination	219	$61.17 (28.19)	221	$64.71 (60.91)	$3.54	438	0.7815	.4349
Follow-up visit	224	$53.08 (19.62)	224	$52.51 (19.11)	$0.57	446	0.3098	.7568

The mean fees charged, regardless of currency type, for the initial visit, re-examinations and regular patient visits by pregnant and postpartum women based on practitioner gender are shown in Table 5.7. A *t*-test of independence found the difference in the fee structures between female and male chiropractors as not statistically significantly except for the fees on re-examination of postpartum women (t [219] = 2.1063, p = .0363). Male chiropractors charged, on average, the amount of $20.93 greater than female chiropractors. Whether this amount is economically significant remains to be addressed.

Table 5.7. *t*-Test of Independence of the Fee Structures of Pregnant and Postpartum Patients Based on Practitioner Gender

	Female		Male					
Fee category	*n*	Mean (*SD*)	*n*	Mean (*SD*)	$\lvert\Delta\rvert_{\text{Mean}}$	df	*t*-statistic	*p*-value
Pregnant patient								
Initial consult.	176	$125.73 (50.48)	47	$129.51 (55.32)	$3.78	221	0.4472	.6551
Re-examination	173	$60.24 (29.17)	46	$64.70 (24.08)	$4.46	217	0.9534	.3415
Follow-up visit	177	$53.25 (21.07)	47	$52.43 (12.94)	$0.83	222	0.2568	.7975
Postpartum patient								
Initial consult.	176	$126.98 (57.95)	47	$140.66 (120.84)	$16.68	221	1.3455	.1798
Re-examination	174	$60.26 (29.83)	47	$81.19 (118.51)	$20.93	219	2.1063	.0363
Follow-up visit	177	$52.83 (20.48)	47	$51.32 (12.77)	$1.51	222	0.4813	.6308

The mean fees charged, regardless of currency type, for initial examinations, re-examinations and regular patient visits to pregnant and postpartum women based on practitioners' years of clinical practice are shown in Table 5.8. An ANOVA of the fees charged to pregnant and postpartum patients for initial consultations, re-examinations and for regular patient visits did not differ in a statistically significant based on practitioners' years of clinical practice except for the mean fees charged for the initial consultation and re-examination of postpartum women. Tukey HSD found that practitioners with 0-5 years and 16-20 years of clinical experience had different mean fee structures for the initial consultation for postpartum women while practitioners with 0-5 years, 6-10 years and 11-15 years of clinical experience had different fee structures from those with 16-20 years' experience for re-examining postpartum women.

Table 5.8. Analysis of Fee Structures Based on Years of Clinical Practice Experience of Respondents

Fee category		Years of practice A 0-5	B 6-10	C 11-15	D 16-20	E 21+	ANOVA
Pregnant patient							
Initial consultation	*n*	52	68	42	27	34	$F_{4,218} = 1.3026$
	Mean	$121.40	$125.21	$119.95	$145.81	$129.79	$p = .2700$
	SD	41.79	56.05	53.99	61.79	40.88	
Re-examination	*n*	52	67	40	26	34	$F_{4,214} = 1.4167$
	Mean	$61.27	$56.48	$58.78	$63.31	$68.41	$p = .2295$
	SD	26.34	27.22	25.00	38.89	25.96	
Follow-up visit	*N*	53	68	42	27	34	$F_{4,219} = 0.4336$
	Mean	$52.34	$51.72	$54.67	$56.81	$52.03	$p = .7843$
	SD	29.13	16.36	17.09	14.76	12.88	
Postpartum patient							
Initial consultation	*n*	52	68	42	27	34	$F_{4,218} = 2.5543$
	Mean	$115.42	$130.94	$121.98	$169.89	$131.91	$p = .0399$
	SD	46.20	68.25	60.20	147.72	47.99	A vs D
Re-examination	*n*	52	67	41	27	34	$F_{4,216} = 2.9102$
	Mean	$58.38	$56.55	$58.56	$99.44	$70.32	$p = .0225$
	SD	28.73	27.43	24.66	155.01	31.91	A, B, C vs D
Follow-up visit	*n*	53	68	42	27	34	$F_{4,219} = 0.1887$
	Mean	$52.43	$51.47	$53.00	$55.15	$52.03	$p = .9441$
	SD	9.051	6.40	13.62	15.36	12.88	

A *t* test of independence of the mean fees charged, regardless of currency type, by Canadian and American chiropractors with respect to pregnant and postpartum patients are shown in Table 5.9. No statistically significant differences were found for the mean fees charged by Canadian and American chiropractors for the initial examination, re-examination, and regular office visits by pregnant and postpartum patients. Whether the mean difference in the fees charged by Canadian and American chiropractors is economically significantly different remains to be addressed.

Table 5.9. *t*-Test of Independence of the Mean Fee Structures of Canadian and American Chiropractors Charged to Pregnant and Postpartum Patients

	Canadian*		American**					
Fee category	*n*	Mean (*SD*)	*n*	Mean (*SD*)	$\lvert\Delta\rvert_{\text{Mean}}$	df	*t*-statistic	*p*-value
Pregnant patients								
Initial consultation	27	$118.52 (28.12)	195	$127.51 (53.93)	$8.99	220	0.8496	.3965
Re-examination	27	$53.89 (26.31)	191	$62.05 (28.36)	$8.16	216	1.4121	.1594
Follow-up visit	27	$54.19 (8.77)	196	$52.95 (20.73)	$1.24	221	0.3056	.7602
Postpartum patients								
Initial consultation	27	$123.89 (41.34)	195	$131.31 (79.42)	$7.42	220	0.4762	.6344
Re-examination	27	$53.89 (26.31)	193	$66.10 (64.31)	$12.21	218	0.9736	.3313
Follow-up visit	27	$54.19 (8.77)	196	$52.30 (20.17)	$1.88	221	0.4785	.6327

*in Canadian dollar, **in US dollar

To examine the practitioners' mode of reimbursement, respondents were asked to indicate (i.e., yes/no) if they had different fees for services reimbursed out-of-pocket (i.e., 100% cash) or services reimbursed by insurance. The majority (n = 194; 78.5%) of respondents indicated no differential fee structures for patients paying out-of-pocket versus patients with insurance. The mean fees charged out-of-pocket and for insurance reimbursement, regardless of currency type, by the general patient population, pregnant and non-pregnant women are summarised in Table 5.10.

For the general patient population, the average fee charged out-of-pocket or charged for insurance reimbursement for the initial consultation and regular office visits, regardless of American or Canadian currency, differed in a statistically significant manner. The mean difference for the initial consultation was $41.86 and the mean difference for regular visits was $21.76. For pregnant patients, the mean fees charged for the initial consultation and regular visits as reimbursed out-of-pocket or by insurance were not statistically significant. The mean difference for the initial consultation was $3.75 and the

mean difference for regular visits was $0.63. For non-pregnant women, the mean fees charge to insurance versus out-of-pocket reimbursement for the initial consultation and regular visits also did not differ in a statistically significant manner. The mean difference for the initial consultation was $23.96 and the mean difference for regular visits was $1.46. Whether the differences in mean fees charged to general patients, pregnant patients and non-pregnant patients are economically significantly different remains to be addressed.

Table 5.10. Fee Schedules for Out-of-Pocket versus Insurance Reimbursement for General, Pregnant, and Non-Pregnant Patients

	Out-of-pocket			Insurance						
Fee category	*n*	Mean (*SD*)	Range	*n*	Mean (*SD*)	Range	$\lvert\Delta\rvert_{\text{Mean}}$	df	*t*-statistic	*p*-value
General patients										
Initial consultation	45	$102.49 (50.59)	$0-200	41	$144.34 (89.41)	$0-470	$41.86	84	2.7021	.0083
Regular visit	45	$44.87 (8.98)	$30-75	41	$66.63 (25.61)	$35-160	$21.76	84	5.3518	.0001
								U-value	*z*-score	*p*-value
Pregnant women										
Initial consultation	8	$103.75 (21.17)	$75-140	7	$100 (25.33)	$65-140	$3.75	31	0.2997	.7644
Regular visit	8	50.63 (7.29)	$40-60	7	$50 (8.16)	$40-60	$0.63	30	0.1789	.8580
Non-pregnant women										
Initial consultation	8	$184.38 (95.26)	$50-300	6	$208.33 (97.91)	$65-300	$23.96	20.5	-0.3894	.6969
Regular visit	8	$49.38 (10.50)	$30-60	6	$50.83 (7.36)	$45-60	$1.46	23	-0.0689	.9450

To determine if out-of-pocket or insurance reimbursements differed between pregnant and non-pregnant women, regardless of currency type, a Mann Whitney *U* test was performed (see Table 5.11). The mean fees charged to pregnant and non-pregnant women on initial consultation or regular office visits did not differ in a statistically significant manner, regardless of out-of-pocket or insurance reimbursement. However, the

mean differences have not been assessed if they are economically significantly different. For example, the non-pregnant women paid, on average a greater amount of $80.63 for the initial consultation if paying out-of-pocket and a greater amount, on average, of $108.33 for the initial consultation if reimbursed by insurance.

Table 5.11. Mann-Whitney *U* Test to Determine Differences in the Fees of Pregnant and Non-Pregnant Patients

		Pregnant		Non-pregnant					
Payer	Visit type	*n*	Mean (*SD*)	*n*	Mean (*SD*)	$\lvert\Delta\rvert_{Mean}$	*U*-value	*z*-score	*p*-value
Out-of-pocket reimbursement	Initial consultation	8	$103.75 (21.17)	8	$184.38 (95.25)	$80.63	13	-1.9515	.0510
	Regular visit	8	50.63 (7.29)	8	49.38 (10.50)	$1.25	33	0.0543	.9567
Insurance reimbursement	Initial consultation	7	100.00 (25.33)	6	208.33 (97.91)	$108.33	8	-1.8006	.0718
	Regular visit	7	50.00 (8.16)	6	50.83 (7.36)	$0.83	18.5	-0.3052	.7602

In terms of reimbursement categories, respondents were asked what percentage of their pregnancy practice was reimbursed pro bono, solely out of pocket (i.e., 100% cash) or a combination of out-of-pocket and insurance. Of 208 (84.2%) acceptable responses, 36 (14.6%) respondents indicated as providing pro bono work and indicated a mean of 8.9% (*SD* = 14.95) of their pregnancy practice was reimbursed pro bono. Two hundred (80.9%) respondents indicated as having patients paying solely out-of-pocket and indicated, on average, that 70.8% (*SD* = 32.26) of their pregnancy practice was reimbursed solely as out-of-pocket. Interestingly, of the 200 respondents, 40% (*n* = 80) indicated that 100% of their pregnancy practice was reimbursed solely out-of-pocket. One hundred fourteen (46.1%) respondents indicated as having pregnant patient services reimbursed by a combination of out-of-pocket and insurance. These respondents indicated, on average, that 55.5% (*SD* = 27.19) of their pregnancy practice was reimbursed by a combination of out-of-pocket and

insurance reimbursement. Only 7 of the 114 respondents indicated that 100% of their pregnancy practice was reimbursed by a combination of out-pocket and insurance. Based on these findings, chiropractic pregnancy care is reimbursed largely as out-of-pocket given the greater number of respondents (i.e., n = 200) indicating their pregnant patients (i.e., a mean of 71.0%) as paying out of pocket for chiropractic services.

To determine differences among female and male chiropractors in terms of the reimbursement categories, a *t*-test of independence was performed to compare the mean percentage of their pregnancy practice as reimbursed pro bono, 100% out-of-pocket or combination of out-of-pocket and insurance (see Table 5.12). The mean percent of pregnancy practice reimbursed as solely out-of-pocket and reimbursed as a combination of out-of-pocket and insurance did not differ in a statistically significant manner between male and female chiropractors. The mean percent of pregnancy practice reimbursed as pro bono differed in a statistically significant manner between male and female chiropractors.

Table 5.12. Mann-Whitney *U* Test to Determine Differences in the Fee Reimbursement of Female and Male Chiropractors

	Female		Male					
Reimbursement	*n*	Mean (*SD*)	*n*	Mean (*SD*)	$\lvert\Delta\rvert_{Mean}$	*U*	*z*-score	*p*-value
%pregnancy practice as pro bono	42	8.0 (14.16)	9	10.0 (5.00)	2.0	102.5	-2.1881	.0287
% pregnancy practice as paid solely as out-of-pocket	183	66.2 (33.80)	47	76.4 (29.92)	10.2	228*	1.8897†	.0601
% pregnancy practice as paid by combination of out-of-pocket and insurance	114	57.6 (28.33)	22	62.1 (32.39)	-4.4	1127	-0.7506	.4529

†*t*-statistic value. * *t*-test degrees of freedom (df).

A comparison of reimbursement categories by Canadian and US chiropractors is shown in Table 5.13. The differences in the mean percentage of patients as pro bono (6.8%), paid solely as out-of-pocket (mean difference = 8.4%) or a combination of out-of-

pocket/insurance (10.2%) were not statistically significantly between Canadian and American chiropractors.

Table 5.13. Mann-Whitney *U* Test of Reimbursement Categories of Canadian and American Chiropractors for Pregnant Patients

% pregnancy practice paid …	Canadian		American		$\lvert\Delta\rvert_{Mean}$	*U*-value	*z*-score	*p*-value
	n	Mean % (*SD*)	*n*	Mean % (*SD*)				
Pro bono	3	2.7 (15.50)	33	9.4 (15.50)	6.8	25.5	-1.388	.1651
Out-of-pocket only	172	72.4 (31.10)	25	64.0 (36.49)	8.4	1953	-0.7638	.4450
Out-of-pocket and insurance	98	53.5 (27.48)	14	63.7 (22.53)	10.2	840.5	1.3619	.1732

Comparison of reimbursement categories based on years in practice was performed using ANOVA or Kruskall Wallis Test and the results shown in Table 5.14. The mean percent of practice characterised as reimbursed pro bono, solely out-of-pocket and a combination of out-of-pocket and insurance did not differ in statistically significant manner based on years of clinical experience.

Table 5.14. Analysis of Mean Percentage of Reimbursement Categories Based on Years of Practice

% pregnancy practice paid …		Years of practice					ANOVA
		0-5	6-10	11-15	16-20	21+	
Pro bono	*n*	15	10	3	7.5	10	$H = 2.86$*
	Median	5	3.5	5	5.6	1.7	$p = .5815$
Out-of-pocket only	*n*	49	63	37	21	30	df = 4199
	Mean	79.0	73.2	65.7	60.7	66.1	$F = 1.8002$
	SD	30.05	31.44	33.96	36.34	30.66	$p = .1303$
Out-of-pocket and insurance	*n*	22	34	24	13	22	$H = 6.9301$*
	Median	40	50	65	60	52.5	$p = .1396$

* Kruskal-Wallis test.

5.4.3.5 Theoretical and Clinical Framework for Chiropractic Care

The majority (*n* = 212; 85.8%) of practitioners characterised their practices as founded on the theoretical and clinical framework of wellness or salutogenic care (both for asymptomatic and symptomatic care), while 16 (6.5%) respondents indicated their practice as providing mainly MSK care, 13 (5.3%) as neurologically based and 2 (< 1%) as symptom care only. Four (1.6%) categorised their practice as 'other.'

5.4.3.6 Chiropractic Technique and Adjunctive Therapies

The primary and secondary chiropractic techniques applied by the respondents in the care of pregnant women are shown in Table 5.15. The Webster Technique [358] was indicated as the most common primary technique (*n* = 131; 53.0%) in the care of pregnant women followed by Diversified Technique (*n* = 131; 53.0%) Of secondary techniques, Diversified Technique (i.e., described as a combination of techniques) (*n* = 64; 25.9%) was again commonly employed followed by the Thompson Technique (*n* = 48; 19.4%), the Webster Technique (*n* = 39; 15.8%), and Activator Methods (*n* = 30; 12.2%).

Table 5.15. Primary Chiropractic Technique Utilised in the Care of Pregnant Women

	Primary			Secondary	
Chiropractic technique	*n*	%	Chiropractic technique	*n*	%
Webster Technique	131	53.0	Diversified Technique, described as combination of techniques	64	25.9
Diversified Technique, described as combination of techniques	38	15.4	Thompson Technique	48	19.4
Thompson Technique	29	11.7	Webster Technique	39	15.8
Activator Methods	12	4.9	Activator Methods	30	12.2
Gonstead Technique	10	4.1	Diversified Technique, described as force-modified high velocity, low amplitude thrusts	20	8.1
Diversified Technique, described as force-modified high velocity, low amplitude thrusts	8	3.2	Sacro Occipital Technique	11	4.5
Torque Release Technique	6	2.4	Logan Basic	8	3.2

	Primary			Secondary	
Chiropractic technique	*n*	%	Chiropractic technique	*n*	%
Sacro Occipital Technique	6	2.4	MC2 Technique	5	2.0
Chiropractic cranio-sacral therapy	1	0.4	Gonstead Technique	5	2.0
MC2 Technique	3	1.2	Torque Release Technique	5	2.0
Logan Basic	1	0.4	Chiropractic cranio-sacral therapy	4	1.6
Kale Specific Upper Cervical Technique	0	0	Kale Specific Upper Cervical Technique	1	0.4
Other	2	0.8	Other	5	2.0
Nonrespondent	0	0	Nonrespondent	2	0.8

The adjunctive therapies employed by chiropractors for pregnant women are summarised in Table 5.16. In the first trimester, Exercise and Active Rehabilitation, Nutritional Interventions, Myofascial Release and Passive Rehabilitation were commonly employed. In the second trimester, an increase in the use of Massage was observed with concomitant decrease in the use of Nutritional Interventions. In the third trimester, these same adjunctive therapies were utilised by a larger proportion of respondents reflecting the use of soft-tissue work to address possible pregnancy-related MSK complaints.

Table 5.16. Primary Adjunctive Technique Utilised in the Care of Pregnant Women

	1st trimester		2nd trimester		3rd trimester	
Adjunctive therapy	*n*	%	*n*	%	*n*	%
Myofascial release & passive rehabilitation	36	14.6	48	19.4	64	25.9
Exercise & active rehabilitation	71	28.7	100	40.5	78	31.6
Nutritional intervention	71	28.3	29	11.7	13	5.3
Massage	16	6.5	34	13.8	45	18.2
Herbal remedies	4	1.6	3	1.2	4	1.6
Homeopathic remedies	8	3.2	1	0.4	5	2.0
Naturopathic remedies	2	0.8	1	0.4	2	0.8
Other	20	8.1	16	6.5	20	8.1
Nonrespondents	19	7.7	15	6.1	16	6.5

5.4.3.7 Chiropractic Technique Modification

As a pregnant woman transitions from the first to the second trimester, the majority (*n* = 157; 63.6%) of respondents indicated as modifying their chiropractic technique (i.e., changing patient positioning, contact points, chiropractic technique or the amount of force applied) while 90 (36.4%) indicated they did not. As a pregnant woman transitioned from the second to third trimester, the majority (*n* = 163; 66.0%) indicated that they modified their chiropractic technique while 83 (33.60%) indicated they did not. One (< 1%) respondent provided no response.

In an open-ended question, the respondents were asked to describe the most common modification of their chiropractic technique in pregnant patients. Respondents were allowed to provide more than one modification. These are summarised in Table 5.17.

Table 5.17. Modification to Chiropractic Technique in the Care of Pregnant Women

	Patient transition to 2nd trimester			Patient transition to 3rd trimester	
Modification	*n*	%	Modification	*n*	%
Modify force	71	22.0	Modify force	73	26.9
Use of pregnancy pillows to accommodate foetus	62	19.2	Use of pregnancy pillows to accommodate foetus	42	15.5
Patient positioning to avoid torque on lumbopelvic	41	12.7	Incorporate Webster Technique	25	9.2
Avoidance of side posture patient position and change in patient positioning	22	6.8	Change patient positioning for care	18	6.6
Use abdominal drop for growing foetus	20	6.2	Use abdominal drop for growing foetus	17	6.3
Change technique (to drop table)	17	5.3	Change technique (i.e., avoid side posture)	15	5.5
Change or modify technique in general	15	4.6	Change technique (i.e., to drop table)	10	3.7
incorporate Webster Technique	13	4.0	Change technique (focus on ligaments)	9	3.3
Change technique (to Thompson Technique)	10	3.1	Change or modify technique in general	8	3.0

	Patient transition to 2nd trimester			Patient transition to 3rd trimester	
Modification	*n*	%	Modification	*n*	%
Change technique (cranial technique, hi-lo table, focus on ligaments, tonal technique, more time with patient, focus on pubic symphysis)	6	1.9	Change technique or incorporate Logan Technique	7	2.6
Change technique (to Activator Technique)	5	1.6	Change in technique (patient positioning and ensure comfort; avoid prone position)	7	2.6
Change technique or incorporate Logan Technique	4	1.2	Change technique (to Thompson Technique)	6	2.2
Change technique or incorporate to SOT	3	0.9	More soft tissue work	6	2.2
More soft tissue work	2	0.6	Change technique (to Activator Technique)	5	1.9
Change technique (to drop table)	17	5.3	Change in technique (to tonal technique)	5	1.9
Change or modify technique in general	15	4.6	Change technique (focus on parasympathetic nervous system)	4	1.5
			Change technique (to Instrument adjusting)	3	1.1
			Change technique or incorporate to SOT	2	0.7
			Change technique (focus on pelvic girdle including SI joint, pubic symphysis, and coccyx)	1	0.4
			Change technique (to hi-lo table, use craniosacral technique, use Bio-Energy Synchronization Technique (BEST), less manual technique, focus on atlas and occiput, rib cage/rib fascia, and psoas)	8	3.0
Nonrespondents	91	23.8	Nonrespondents	88	35.6

A total of 323 modifications were indicated by 104 practitioners. As a woman transitioned from the first to the second trimester, the most common modification was the amount of force delivered during the spinal adjustment (*n* = 71; 22.0%), followed by the

use of pregnancy pillows (*n* = 62; 19.2%) or the use of a table with a drop piece (*n* = 20; 6.2%) to accommodate a growing foetus, avoidance of placing undue rotation to the lumbopelvic region (*n* = 41; 12.7%), and the avoidance of placing the woman in a side posture position (*n* = 22; 6.8%). The respondents also indicated major modifications in their chiropractic technique as a whole such as transitioning to the use of the Thompson Technique or drop table technique, the use of the Webster Technique or Activator Technique.

As patients transitioned from the second to the third trimester, a total of 271 modifications were indicated by 159 respondents. The modifications were similar to those mentioned for transitioning from the first to the second trimester (i.e., force modification, avoidance of rotation of the lumbopelvic region, change in technique), but in the third trimester the Webster Technique was the technique of choice among respondents.

5.4.3.8 Correction of Sacral Malposition

The Webster Technique involves an analysis (i.e., determination of the direction of sacral malposition) and the application of spinal adjustment or spinal manipulation to correct the sacral malposition followed by the application of a sustained thumb contact on the abdomen overlying the round ligament of the uterus. The intent of the question pertaining to the correction of sacral malposition was to assess the chiropractic technique (i.e., the use of a high velocity, low amplitude thrust, the use of a hand-held instrument or drop table technique) applied by the respondent. As shown in Table 5.18, the most common chiropractic techniques indicated were the Thompson Technique, Diversified Technique described as combination of techniques or as a force-modified high velocity, low amplitude thrusts, Activator Methods and Logan Basic. The respondents also indicated the use of the Webster Technique. This was not incorrect per se but rather a lack of specificity with the wording of the survey item.

Table 5.18. Chiropractic Technique to Address Sacral Malposition in Webster Technique

Technique	*n*	%
Thompson Drop	115	46.6
Webster Technique	57	23.1
Diversified Technique, described as combination of techniques	19	7.7
Activator Methods	17	6.9
Diversified Technique, described as force-modified high velocity, low amplitude thrusts	13	5.3
Logan Basic	10	4.1
Gonstead Technique	7	2.8
Sacro Occipital Technique	2	0.8
MC2 Technique	2	0.8
Torque Release technique	1	0.4
Other	3	1.2
No response	32	13.0

5.4.3.9 Collaborative Care Efforts

The largest proportion (*n* = 204; 82.6%) of respondents indicated a professional relationship (i.e., for the purpose of cross referral) with massage therapists, followed by a professional relationship with midwives (*n* = 193; 78.1%), acupuncturists (*n* = 140; 56.7%), medical doctors (*n* = 130; 52.6%), mental health professionals (*n* = 118; 47.8%), and naturopathic physicians (*n* = 96; 38.9%). The summary of the cross-referral efforts of the respondents with other healthcare professionals in the care of pregnant women is summarised in Table 5.19.

Table 5.19. Cross-Referral Patterns between Chiropractors and Other Healthcare Providers

Source	Indications for referral	MD	Midwife	Acupuncturist	Massage therapist	ND	Mental health professional	Postpartum*
Referrals to chiropractor	Foetal positioning	28.7%	53.3%	21.2%	4.6%	3.7%	2.7%	7.1%
	MSK	69.7%	38.1%	70.8%	74.9%	87.7%	61.7%	84.5%
	Non-MSK	< 1%	1.1%	5.1%	11.6%	3.7%	24.7%	7.8%
	Other	< 1%	7.6%	2.9%	8.9%	4.9%	11.0%	0.7%
Referrals by chiropractor	Foetal positioning			20.0%				
	MSK			14.9%	61.7%			
	Non-MSK		0.5%	26.7%	30.5%		100%	
	Birth option		85.2%	19.0%				
	Out of scope	86.3%	14.3%	1.0%				
	Patient request	10.8%						
	Referral/collaborative	2.9%		15.9%		19.0%		
	Other			2.6%	7.8%	9.5%		
	General nutrition/ herbal remedies					30.5%		
	Condition-based care					41.0%		

Note. MD = medical doctor; ND = Doctor of Naturopathy; MSK = musculoskeletal.
* Medical referrals to chiropractor for postpartum care.

The respondents indicated that the most common pregnancy referrals received was to address symptoms/complaints associated with the MSK system regardless of the type of healthcare professional making the referral. In this regard, the respondents indicated that 87.7% of referrals received from naturopathic physicians involved patients with MSK conditions. This was followed by referrals from massage therapists (74.9%), acupuncturists (70.8%), medical doctors (69.7%), mental health professionals (61.7%), and midwives (38.1%). Referrals to the respondents were also made to address foetal malposition/malpresentation. The respondents indicated that 53.3% of their referrals from midwives was for this purpose followed by medical doctors (28.7%), acupuncturists (21.2%) while referrals from massage therapists, naturopaths, and mental health professionals for this purpose was less than 5%.

The motivations/clinical indicators for referral to other healthcare professionals by the respondents varied. Referrals to medical doctors by the respondents were for conditions deemed outside the scope of practice of chiropractors (86.34%) and for possible collaboration (2.9%) or the patient requested the referral (10.8%). Referrals to midwives were identified commonly as due to a desire for birth options (85.2%) provided by midwives (i.e., home birth, a natural childbirth, or a birth experience different from that attended by an obstetrician) or a clinical scenario outside the scope or expertise of the chiropractor (14.3%). Referrals to massage therapists were to address both MSK and non-MSK conditions while referrals to mental health professionals were exclusively to address mental health issues. Referrals to naturopathic physicians were motivated to address specific clinical conditions that may be outside the clinical expertise of the referring chiropractor (41.0%), for general nutrition/herbal remedies (30.5%), and for collaborative care purposes (19.0%).

5.4.3.10 Safety Attitudes of Chiropractors on Pregnancy Care

To examine the safety attitudes of the respondents on pregnancy chiropractic, we asked respondents to provide a safety rating (from 0 = *not very safe* to 10 = *very safe*) on chiropractic pregnancy care and the use/application of a number of chiropractic techniques on pregnant women. These are summarised in Table 5.20.

Table 5.20. Safety Ratings of Chiropractors on Issues of Pregnancy Care

Question*	*n*	Mean	*SD*	Range
Overall, how would you rate the safety of the chiropractic care of pregnant women?	247	9.9	0.34	7-10
How would you rate the safety of high-velocity, low amplitude (HVLA) thrust type spinal adjusting of pregnant women?	247	8.7	1.76	2-10
How would you rate the safety of the use of manually assisted instruments (i.e., Activator instrument) in spinal adjusting of pregnant women?	247	9.9	0.48	6-10
How would you rate the safety of the use of drop table or drop piece in spinal adjusting of pregnant women?	247	9.5	1.15	0-10
How would you rate the safety of the Webster Technique in the chiropractic care of pregnant women?	247	9.9	0.33	8-10

***** Rated from 0 = *not very safe* to 10 = *very safe*.

The respondents assessed safety based on a rating scale ranging from 0 (*not very safe*) to 10 (*very safe*) and provided high safety ratings (range: 8.7–9.9), particularly with overall pregnancy care and the use of the Webster technique (mean rating = 9.9; range: 7/8 -10). Interestingly, the use of HVLA thrust type spinal adjusting of pregnant women was rated the lowest at a mean of 8.7 (range: 2–10). To further assess the respondents' safety attitudes, respondents were asked to indicate their professional opinion to a number of morbidities associated with pregnancy either as an absolute contraindication to chiropractic care (i.e., under no circumstances is spinal adjusting performed), a relative contraindication to chiropractic care (under certain circumstances, spinal adjusting can be performed), perform a clinical work-up, provide spinal adjustment(s) and refer to a

specialist, perform a clinical work-up and make an immediate referral to a specialist or there is not enough clinical information to make an opinion. The results are summarised in Table 5.21. The majority of chiropractors indicated as performing a clinical work-up, provide spinal manipulative therapy (SMT) care and refer to a specialist for a majority of the comorbidities (i.e., low back pain [LBP], pelvic girdle pain [PGP], cramping, urinary calculus, ovarian cyst in the first trimester, inguinal hernia, placenta previa, fibroids, pre-eclampsia/eclampsia, gestational diabetes, and gestational hypertension. Five comorbidities were indicated by a majority of the respondents as requiring immediate referral (i.e., Vaginal bleeding due to spotting due to irritation of the cervix and spotting due to ectopic pregnancy, premature labour, appendicitis, and ectopic pregnancy. Ruptured amniotic membrane in the 2nd trimester and placenta abruptio were indicated by the majority as an absolute contraindication to chiropractic care.

Table 5.21. Respondents Choosing a Clinical Pathway towards Comorbidities During Pregnancy

	Non-respondent		Absolute contraindication		Relative contraindication		Clinical work-up, adjustment, and refer to a specialist		Clinical work-up and/or immediate referral to a specialist		Not enough information to make an opinion	
Comorbidity	*n*	%	*n*	%	*n*	%	*n*	%	*n*	%	*n*	%
Low back pain	22	8.9	0	0	55	22.3	124	50.2	13	5.3	60	24.3
Pelvic girdle pain	22	8.9	0	0	59	23.9	125	50.6	18	7.3	54	21.8
Vaginal bleeding (spotting due to irritation of the cervix)	9	3.6	32	13.0	86	34.8	74	30.0	83	33.6	26	10.5
Vaginal bleeding (spotting due to ectopic pregnancy)	7	2.8	104	42.1	38	15.4	26	10.5	116	47.0	19	7.7
Ruptured amniotic membrane in the 2nd trimester	3	1.2	164	66.4	20	8.1	7	2.8	107	43.3	8	3.2
Cramping	10	4.1	7	2.8	80	32.4	110	44.5	36	14.6	54	21.9
Urinary calculus	21	8.5	8	3.2	49	19.8	105	42.5	39	15.8	64	25.9
Ovarian cyst in the first trimester	14	5.7	5	2.0	57	23.1	135	54.7	38	15.4	41	16.6
Inguinal hernia	13	5.3	7	2.8	57	23.1	137	55.5	39	15.8	36	14.6
Premature labour	7	2.8	75	30.4	48	19.4	58	23.5	92	37.3	34	13.8
Placenta previa	10	4.1	37	15.0	71	28.7	116	47.0	56	22.7	30	12.2
Placenta abruptio	5	2.0	155	62.8	24	9.7	20	8.1	95	38.5	16	6.5
Appendicitis	5	2.0	115	46.6	23	9.3	22	8.9	121	49.0	18	7.3
Presence of fibroids	18	7.3	1	0.4	57	23.1	145	58.7	21	8.5	47	19.0
Ectopic pregnancy	10	4.1	90	36.4	35	14.2	39	15.8	99	40.1	31	12.6
Eclampsia and pre-eclampsia	7	2.8	44	17.8	52	21.1	101	40.9	88	35.6	25	10.1
Gestational diabetes	10	4.1	1	0.4	49	19.8	180	72.9	31	12.6	20	8.1
Gestational hypertension	9	3.6	4	1.6	59	23.9	160	64.8	44	17.8	24	9.7

5.4.4 Patient Characteristics

5.4.4.1 Clinical Presentations Associated with the Musculoskeletal System

Women present commonly for chiropractic care in their 3rd trimester (mean = 38.4%, *SD* = 20.86, range: 0–100%) followed by those in the 2nd trimester (mean = 32.4%, *SD* = 19.35, range: 0–100%) and 1st trimester (mean = 21.9%, *SD* = 19.93, range: 0–100%).

The common clinical presentations in the perinatal period associated with the musculoskeletal systems as indicated by the chiropractor respondents are shown in Table 5.22

Table 5.22. Common Presenting Complaints Associated with the MSK System

Trimester	MSK condition/symptom	*n*	%
1st trimester	Low back pain with/without radiculopathy	122	62.2
	SI joint dysfunction	20	1.0
	Round ligament pain	9	2.0
	Pelvic pain	8	10.2
	Neck pain	7	4.1
	Hip pain	5	2.0
	Thoracic pain	4	2.1
	Pubic symphysis dysfunction	4	2.6
	Sacral pain	4	4.6
	Midback pain	2	1.0
	Rib pain	2	4.6
	Other	9	3.6
	Total	196	100.0
	Nonrespondent	31	
2nd trimester	Low back pain with/without radiculopathy	145	54.3
	SI joint dysfunction	22	8.2
	Pubic symphysis dysfunction	20	7.5
	Pelvic pain	16	6.0
	Round ligament pain	16	6.0
	Hip pain	15	5.6
	Rib and intercostal pain	11	4.1
	Neck pain	3	1.1
	Sacral pain	3	1.1
	Midback pain	2	0.8
	Thoracic pain	2	0.8

Trimester	MSK condition/symptom	*n*	%
	Diaphragm pain	2	0.8
	Coccyx pain	1	0.4
	Other	9	3.4
	Total	267	100.0
	Nonrespondent	8	
3rd trimester	Low back pain with/without radiculopathy	136	48.4
	Pubic symphysis dysfunction	49	17.4
	Pelvic pain	27	9.6
	Ligament and round ligament pain	18	6.4
	SI joint pain	17	6.1
	Hip pain	13	4.6
	Sacral pain	3	1.1
	Neck & upper back pain	2	0.7
	Rib pain	2	0.7
	Other	14	5.0
	Total	281	100.0
	Nonrespondent	4	
Postpartum period	Thoracic pain	87	29.3
	Neck pain	72	24.2
	Low back pain	28	9.4
	Mid back pain	25	8.4
	Pelvic pain	25	8.4
	Shoulder pain	14	4.7
	Pubic symphysis dysfunction	7	2.4
	SI Joint Dysfunction	6	2.0
	Hip pain	5	1.7
	Diastasis recti abdominis and abdominal pain	5	1.7
	Coccyx pain	3	1.0
	Headaches	3	1.0
	Sacral pain	2	0.7
	Ligament pain/laxity	2	0.7
	Breastfeeding difficulties	2	0.7
	Other	11	3.7
	Total	297	100.0
	Nonrespondent	15	

For symptoms associated with the MSK system, LBP (with or without radiculopathy) was the most common clinical presentation with increasing prevalence as pregnancy progressed. Complaints associated with the articulations of the pelvic bones

(i.e., sacroiliac joints, pubic symphysis joints, lumbosacral joint and hip joint) also steadily increased as patients progressed in their pregnancy with 25.5% (*n* = 50) in the first trimester, 34.3% (*n* = 93) in the second trimester, 45.2% (*n* = 127) in the third trimester and then decreased to 16.2% (*n* = 48) in the postpartum period. Also observed in the postpartum period are the increase in prevalence of other regions of the spine involved. Complaints associated with midback pain (*n* = 25; 8.4%), thoracic spine pain (*n* = 87; 29.3%), and neck pain (*n* = 72; 24.2%) became notable.

5.4.4.2 Non-Musculoskeletal Clinical Presentations

The non-musculoskeletal clinical presentations during pregnancy are summarised in Table 5.23.

Table 5.23. Common Presenting Complaints Associated with the Non-MSK System

Trimester	Non-MSK condition/symptom	*n*	%
1st trimester	Nausea and/or vomiting; morning sickness	138	51.1
	Fatigue	53	19.6
	Headache	40	14.8
	Acid reflux	7	2.6
	Constipation	5	1.9
	For optimal health and birthing	5	1.9
	Sleep disturbance	4	1.5
	Other	4	1.5
	Wellness care	3	1.1
	Dizziness	3	1.1
	Gastrointestinal problems	2	0.7
	Dyspepsia	2	0.7
	Lack of appetite	2	0.7
	Anxiety and stress	2	0.7
	Total	270	100.0
	Nonrespondent	21	8.5
2nd trimester	Acid reflux	52	30.4
	Fatigue	27	15.8
	Nausea; morning sickness	16	9.4
	Headache	14	5.9
	Sleep disturbance	12	7.0
	Constipation	10	5.9

Trimester	Non-MSK condition/symptom	*n*	%
	Dizziness including vertigo	7	4.1
	Dyspepsia	4	2.3
	GI problems	4	2.3
	Stress	3	1.8
	Optimal health and birth	2	1.2
	Wellness care	2	1.2
	Other	22	12.9
	Total	175	100.0
	Nonrespondent	87	35.2
3rd trimester	Abnormal foetal position or breech	56	21.8
	Heartburn / acid reflux / dyspepsia	28	10.5
	Abdominal pain	27	10.5
	Constipation	27	10.9
	Other	27	1.2
	Braxton-Hicks contractions	18	7.0
	Fatigue	15	5.8
	Sleep disturbance	14	5.5
	Swelling & edema	9	3.5
	Hemorrhoids	7	2.7
	Pre-eclampsia & eclampsia	6	2.3
	GI problems	3	1.2
	Stress and anxiety	3	0.8
	Difficulty breathing	2	10.5
	Total	242	100.0
	Nonrespondent	15	
Postpartum period	Sleep disturbance	74	32.9
	Fatigue	33	14.7
	Postpartum depression	32	14.2
	Breastfeeding difficulties	26	11.6
	Postpartum anxiety	18	8.0
	Mood swings/mental health issues	14	6.2
	Postpartum healing	6	2.7
	Stress	4	1.8
	Breastfeeding support	3	1.3
	Mastitis and nipple pain	3	1.3
	Hormonal changes	3	1.3
	Headache	2	0.9
	Wellness care	1	0.4
	Other	6	2.7
	Total	225	100.0
	Nonrespondent	29	

Note. GI = gastrointestinal; MSK = musculoskeletal.

In the first trimester, the most common non-MSK presenting complaint were symptoms associated with hyperemesis gravidarum (i.e., nausea and/or vomiting) (*n* = 152; 55.9%) followed by fatigue, low energy, being tired, and exhaustion (*n* = 54; 19.9%), and symptoms associated with the gastrointestinal system (i.e., heartburn/acid reflux, constipation, indigestion/digestive upset).

In the second trimester, symptoms associated with the gastrointestinal system (i.e., acid reflux, constipation, dyspepsia, and general complaints) became more prominent (*n* = 70; 40.9%) followed by symptoms of fatigue (*n* = 27; 15.8%), nausea and morning sickness (*n* = 16; 9.4%), and headaches (*n* = 14; 5.9%).

In the third trimester, gastrointestinal symptoms again dominate (*n* = 58; 22.6%) followed by abnormal foetal positioning or breech presentations (*n* = 56; 21.8%), Braxton-Hicks contractions (*n* = 18; 7.0%), and fatigue (*n* = 15; 5.8%).

In the postpartum period, sleep disturbance (*n* = 74; 32.9%) and fatigue (*n* = 33; 14.7%) were the most common followed by mental health challenges such as postpartum depression (*n* = 32; 14.2%), anxiety (*n* = 18; 8.0%), mood swings and general mental health issues (*n* = 14; 6.2%), in addition to breastfeeding difficulties.

5.4.4.3 Motivation for Care Based on Trimester of Pregnancy

The motivation for care based on trimester of pregnancy as indicated by the respondents are shown in Table 5.24. Wellness care defined as enhancement of functioning and wellbeing [115] was the most indicated followed by motivations to address both pregnancy related MSK and non-MSK complaints. A significant proportion of the pregnant women (28.7% and 37.7%, respectively) were indicated as continuing patient care into their pregnancy or continuing care after giving birth.

Table 5.24. Patient Motivation for Care by Trimester, as Indicated by Chiropractor

	1st trimester			2nd trimester			3rd trimester			Postpartum		
Motivation	*n*	%	Rank	*n*	%	Rank	*n*	%	Rank	*n*	%	Rank
Continuing patient prior to or after pregnant	71	28.7	2	—	—		—	—		93	37.7	1
To enhance functioning and wellbeing for both symptomatic and asymptomatic care	83	33.6	1	93	37.7	1	109	44.1	1	81	32.8	2
To enhance functioning and wellbeing for asymptomatic care	12	4.9	5	6	2.4	5	3	1.2	7	5	2.0	5
To enhance functioning and wellbeing for symptomatic care	5	2.0	6	13	5.3	4	12	4.9	4	2	0.8	7
Both pregnancy related MSK and non-MSK care	43	17.4	3	73	29.6	2	66	26.7	2	—	—	
For pregnancy-related musculoskeletal (MSK) care	25	10.1	4	58	23.5	3	42	17.0	3	22*	8.9	4
For pregnancy related non-MSK care	1	0.4	8	1	0.4		6	2.4	5	1**	0.4	8
Unresolved pregnancy-related complaints	—	—		—	—		—	—		4	1.6	6
Postpartum-related MSK care	—	—		—	—		—	—		35	14.2	3
Other	2	0.8	7	1	0.4	6	4	1.6	6	1	0.4	9
Nonrespondent	5	2.0		—	—		5	2.0		3	1.2	

Note. *Birth-related MSK complaints; **Postpartum-related non-MSK care

5.4.4.4 Family Members Concurrently Under Care

A significant proportion (59.40%, *SD* = 23.49, range: 1–100%) of family members were indicated (*n* = 245; 99.2%) as concurrently under care as the pregnant women. The family members were identified by the respondents as 'spouse/partner, children and other relatives' by 207 (83.8%) respondents and 37 (15.0%) respondents identified 'a child or children only' and 3 (1.2%) indicating a 'spouse or partner only.'

5.5 Discussion

To date, this is the most comprehensive characterisation of chiropractic pregnancy care from the perspective of chiropractors with a focus on pregnancy care. Our findings confirm previous data on practitioner and pregnant patient characteristics and provide new insights into the chiropractic of pregnant women.

5.5.1 Response Rate

As described, 542 of 2076 invited chiropractors accessed the study hyperlink. Three hundred ninety-nine initiated the survey with 247 respondents completing the survey. This provided a response rate of 19.2% and a completion rate of 61.9%. [596, 600] This was a poor response rate relative to the online response rate of 44.1% calculated by Wu et al. [601] in a meta-analysis of 1071 online survey response rates reported in education-related research. The survey for this study was initiated in June of 2021 during the Covid-19 pandemic. [600, 602] The adverse impact of the Covid-19 pandemic on healthcare practices cannot be denied and has dramatically changed how outpatient care is delivered and has negatively impacted clinical research. [603] Krieger et al. [604] compared the change in response rates between 2020 and 2019 in 6 national surveys conducted by the US Census, the US Department of Health and Human Service and agencies under its aegis (i.e., US National Center for Health Statistics, US Centers for

Disease Control and Prevention), as well as the US Department of Labor. Krieger et al. [604] found a 29% lower response rate during the pandemic. The Covid-19 pandemic has also taken a great amount of toll on the health and wellbeing of healthcare workers. [605] In chiropractic, Neff et al. [606] found that of 750 US chiropractor respondents, 51.2% and 30.4% reported moderate and severe levels of psychological stress, respectively. The low response rate by our chiropractors may be attributed, in part, to the psychological distress and financial and business concerns/stress associated with the Covid-19 pandemic. A high percentage (n = 153; 61.9%) of respondents in this study indicated that their practices (i.e., patient volume) were not affected by the Covid-19 pandemic and thus a selection bias may have ensued in participating in this study.

5.5.2 Practitioner Characteristics

The mean age of our respondents was 39.0 years (n = 236, SD = 9.08) with the majority having over 15 years of practice experience and is consistent with practicing chiropractors in the US [607] and Canada. [262, 608-611]

The respondents in this study were predominantly female (i.e., 79.4% females and 20.6% males; see Table 5.1). The preponderance of female practitioners in our study is inconsistent with the dominance of male chiropractors in the United States [606] and Canada [610] but consistent with studies utilising the ICPA practice-based research network (PBRN) and/or studies examining specialty practices such as pregnancy care [53, 113-114, 612-613] or paediatric care. [399, 614]

The high percentage of respondents completing (80.6%) or currently pursuing (i.e., 19.4%) a postgraduate program in pregnancy care in inconsistent with the poor attendance in postgraduate courses (i.e., 21.2% have completed and 16.2% were working towards a diplomate or master's qualification in a clinical specialty) by a representative sample of chiropractor respondents from the US 2020 Practice Analysis of Chiropractic [615]. In a

study to examine chiropractors' knowledge on exercise guidelines for pregnant patients, respondents indicated as having received no formal postgraduate training in exercise and pregnancy care with almost half describing themselves as self-taught and another 40% as learning from conferences and seminars. [262]

Yuen et al. [261] found that only 20.3% (n = 29) of their respondents had postgraduate training of any type with 11 respondents (i.e., 7.7%) receiving training from the ICPA. [616] The ICPA also provided postgraduate training in pregnancy care to the majority (96.8%) of this study's respondents. Additionally, the study respondents in this study were specifically required to be actively engaged in the care of pregnant and non-pregnant women. The chiropractic care of pregnant women requires specialised knowledge and skills. Knowledge and skills not typically taught in the chiropractic school setting but are addressed in postgraduate courses. [616] Given the lack of postgraduate training and/or clinical expertise in pregnancy care such as those of the Weis et al. respondents [262] or Yuen et al. [261], the findings of these studies may not be an accurate reflection of the practice activities of chiropractors in pregnancy care. Ultimately, the findings from such research may have limited applicability to real-world practice, the gap between research and practice widens and chiropractors are hesitant to implement or adopt the research findings and hinder evidence-based practice. The majority of respondents in this study completed a postgraduate course in pregnancy care and focused on the care of pregnant women in their daily practice. As such, the findings from this study may more reflect chiropractic pregnancy care and inform chiropractic training, education and research that adequately reflects the practice characteristics and techniques/methods applied by chiropractors in day-to-day pregnancy care.

5.5.3 Practice Characteristics

The majority of our study respondents (*n* = 141; 57.0%) practiced with other chiropractor(s) or other practitioners is consistent with studies indicating the practice environment among chiropractors. [612, 617-618] In addition to sharing the cost of doing business, multiple practitioner clinics allows for the sharing of administrative tasks associated with running a practice, provide for patient coverage, allow for more flexibility in scheduling, and facilitates opportunities for case discussions and learning opportunities relative to a solo practice. [619-620] Disadvantages of multiple practitioner clinics are the risk for personal and professional conflicts, and greater bureaucracy. [619-620]

5.5.3.1 Practice Patient Volume

Patient volume represents a measurable variable with an impact on a number of quality-of-care domains (i.e., safety and effectiveness) [621] and has been of research interest in medicine since Luft et al. [622] identified that the type of surgical procedures performed was important to the relationship between surgical/patient volume and mortality. To the best of our knowledge, this is the first examination of practice patient volume in the chiropractic care of pregnant women. As such, no direct comparative data is available. The respondents in this study attended to pregnant women at a mean of 25.8 patient visits per week. A survey of a representative sample of US chiropractors [623] indicated a mean frequency of clinical encounter with pregnant women of 1.7 (0 = *never*, 1 = *1-6 times per year*, 2 = *about once per month*, 3 = *about once per year*, 4 = *about once per day*, 5 *several times per day*) with most respondents (70.8%) indicating a co-management strategy. A study by Stuber [260] to examine the perceived safety, treatments employed and referral patterns of chiropractors in the care of pregnant women found only 14 of 18 respondents as caring for 0-5 pregnant women per month. Given the high volume of pregnant patients attended to by this study's respondents, the findings of this study may

more accurately reflect the practice activities and attitudes of chiropractors pertaining to pregnancy care. The study by Stuber [260] must be eyed with caution given the lack of clinical experience of the Stuber respondents in the care of pregnant women. This lack of pregnancy care experience among the Stuber respondents places into question the veracity of their findings with respect to perceived safety, treatments employed and referral patterns of chiropractors in the care of pregnant women. As previously discussed, an inaccurate reflection of the practice activities of chiropractors in pregnancy care may have limited applicability and relevance to real-world practice, hinder evidence-based practice including the needs and preferences of pregnant patients and adversely affect patient care.

A comparative analysis of the respondents overall PVperW and pregnant PVperW based on years of practice or between female and male chiropractors (see Tables 5.3 and 5.4) found no statistically significant differences. The exception was that male chiropractors attended to, on average, 64.9 visits per week greater than female chiropractors. Based on a 48-workweek year, a difference of 64.9 visits per week translates to over 3113 patient visits per year. At a mean charge of $50 per visits, the difference of 3113 patient visits per year in overall patients among male and female chiropractors translates to a difference of $155 650 per year of income. The difference in overall PVperW between female and male chiropractors are statistically and economically significantly different. A comparison of the PVperW between Canadian and American chiropractors found no statistically significant difference between overall PVperW and pregnant PVperW. However, based on a 48-workweek year, this translates to a difference of approximately 1001 overall patient visits per year and 604 pregnant patient visits per year between American and Canadian chiropractors. At a mean charge of $50 (i.e., based on Canadian and American respondent fees for regular visits), this translates to a

difference in income of $50 000 per year from overall patient visits or $30 150 from pregnant patient visits. These amounts are economically significant.

The overall mean PVperW of 140.3 reported by our respondents was relatively high when compared to a survey of a representative sample of US chiropractors that found that only 17.4% of practitioners treat 140-149 patients per week. [624] In paediatric chiropractic, Alcantara et al. [399] reported their respondents as attending to 133 PVperW (median = 100 visits, mode = 100 visits) while Pohlman et al. [614] reported that 21% of their respondents of paediatric chiropractic diplomates attended to 100-149 PVperW. The greater PVperW attended to by our respondents and those of Alcantara et al. [613] may be due in part to the majority (n = 212; 85.8%) of our respondents working from the clinical framework of wellness or salutogenic care, which is characterised with regular scheduled patient visits motivated by enhancement of health beyond mere resolution of symptoms.

As previously mentioned, the adverse impact of the Covid-19 pandemic on chiropractic [625-627], medical [628-629] and other healthcare practices [630-631] cannot be denied. However, the majority of our respondents (61.9%) indicated that their practices were unaffected by the Covid-19 pandemic. An informal survey of chiropractors [632] found that 82% of respondents indicated a loss of income due to the pandemic. The impact of the Covid-19 pandemic on chiropractic pregnancy care requires further investigation in terms of its impact on chiropractic practices, the quality of life of chiropractors and their pregnant patients.

5.5.3.2 Fee Structure

There is a belief that the method of payment to healthcare providers may affect their clinical and practice behaviour. [633] In medicine, fee-for-service results in more patient visits, greater continuity of care, higher compliance with a recommended number of visits, but patients were less satisfied with access to their physician compared with

salaried payment. [634] In chiropractic, the predominant method of reimbursement is fee-for-service and in certain circumstance (i.e., chiropractor as an employee), a salary. However, the evidence is virtually nonexistent on the topic of chiropractors' mode of reimbursement or for that matter, how this may affect their clinical behaviour. To date, this is the first and most comprehensive study to examine the fee structures of chiropractors in the care of women in the perinatal period (see Tables 5.6–5.14). As with other healthcare providers, the fees charged by chiropractors must take into account a number of factors that include (but not limited to) the cost of doing business (i.e., rent and utilities, office supplies, equipment, staff hires, etc.) in a particular geographic locale, business related matters (i.e., staff benefits and insurance), work hours (care provision and follow-up, complexity of cases, etc.), chiropractor training (i.e., postgraduate specialty such as pregnancy or paediatric), and out-of-pocket versus insurance reimbursement. [635] The fees charged by chiropractors in this study to pregnant and postpartum women were very similar (see Table 5.6). The mean fees charged by female and male chiropractors were not statistically significant except for the fees charged on the re-examination for a postpartum patient (see Table 5.7). Male chiropractors, on average, charged a greater fee in the amount of $16.68. Examination of the mean fees charged based on the respondents' years of clinical practice, significant differences were found for mean fees associated with the initial and re-examination of postpartum patients (see Table 5.8). In terms of country of practice, the differences in mean fees charged by American and Canadian chiropractors were not statistically significant (see Table 5.9). Whether the differences in fees paid are economically significant deserves further investigation.

In terms of the fees reimbursed by out-of-pocket or insurance among the respondents' general patient population, the fees reimbursed by insurance were greater than fees paid out-of-pocket with the difference as statistically significant. However,

among the pregnant women and non-pregnant women, the difference in fees with insurance and out-of-pocket were not statistically significant (see Table 5.10).

Respondents were asked if they had a differential fee schedule for out-of-pocket or insurance reimbursement. Almost 80% (n = 194) of respondents indicated no differential fee structures for out-of-pocket versus insurance paying patients. In the United States where 88% of our respondents practiced, cash discounts are allowed in certain states. For example, in California, the California Business and Professions Code 657(b) allows for health care providers to 'grant discounts for health or medical care provided to any patient the health care provider has reasonable cause to believe is not eligible for, or is not entitled to, insurance reimbursement.' [636] However, in other states such as New York, the subject is not so clear cut. It is noted that in this study, the largest number of respondents (n = 200) indicated that 70.84% (SD = 32.26) of their pregnant patients paid out-of-pocket for chiropractic services. In contrast, the US Practice Analysis of Chiropractic 2020 [637] found, on average, that only 36.3% of its respondents indicated as being reimbursed out-of-pocket for the care of patients. Whether out-of-pocket reimbursement is a unique characteristic of pregnancy care requires further investigation as it may present a barrier to chiropractic access by women in the perinatal period.

Despite differing healthcare systems between Canada and the United States (i.e., Canada has universal healthcare insurance while the United States has healthcare insurance offered by private, for-profit companies) [638], our findings indicate that the chiropractic care of pregnant women are very similar in both countries, particularly the cost of care. First, regardless of the country of practice, the majority of pregnant women pay for their chiropractic visits out-of-pocket. Second, there is very little difference (mean difference = $1.44) in the cost of regular visits to American and Canadian chiropractors while the examination fees are in this PhD candidate's opinion were not financially significant.

The poor response rate to the questions pertaining to fee schedules in this study may be attributed to survey fatigue as the questions pertaining to fees were at the end of the 84-item survey. However, the lack of transparency on fee schedules on the part of chiropractors requires further investigation and is not unique to chiropractic. In the United States, there is a national movement towards 'price transparency in healthcare.' Shortly after *Time Magazine* published the article on health care costs by Stephen Brill, entitled, 'Bitter Pill: Why Medical Bills Are Killing Us.' [639], the then-Secretary of the Department of Health and Human Services, Kathleen Sebelius, made available online the 2011 chargemaster prices of the 100 most common inpatient treatment services of all hospitals that treated Medicare patients. The information showed great variation in the prices of tests and procedures and allowed Medicare patients to compare prices in hospitals across their geographic locale. [640] In Canada, various provincial governments publish physician payment information. For example, in Alberta, its payments for all physician specialties are publicly available. [641] Future studies should examine the reproducibility of our findings and the motivations for and reasons for the chiropractic fee structures specific to pregnancy care.

5.5.3.3 Chiropractic Technique, Adjunctive Therapies, and Technique Modification

A number of anatomic, physiological, biochemical, and psychological changes occur during pregnancy to ensure foetal growth and development. [642-643] The questions in this survey were designed to reflect this dynamic process during the trimesters and addressed pregnant women as a heterogenous population.

The Webster Technique was the most commonly applied primary technique in pregnancy care (see Table 5.13). This differs from Diversified technique, defined as a HVLA thrust SMT or a combination of techniques, and has reportedly been used by over

85% of practicing chiropractors. [642-644] Among our respondents, Diversified Technique (e.g., utilising a combination of techniques) was also commonly used.

In terms of adjunctive therapies, our findings are consistent with the existing literature on the common use of soft-tissue therapy (i.e., massage, myofascial release), exercise, diet, and nutrition. [256, 261-262, 346] The popularity of exercise and active rehabilitation throughout the trimesters and the increasing use of soft-tissue therapies like massage and myofascial release as the pregnancies progressed was notable (see Table 5.14).

In terms of technique modification (see Table 5.15), the use of pregnancy pillows or a table drop piece to accommodate the growing foetus, avoiding rotation at the lumbopelvic region or performing SMT with the patient in the seated or knee-chest positions, mitigating the applied manual force during SMT or using low-force techniques (i.e., Thompson Technique, Logan Technique, Sacro Occipital Technique (SOT), and Activator Methods) is consistent with the existing literature on the technique approach to pregnancy care. [334-335, 341, 357, 645] The popularity of low force techniques such as the Thompson Technique was also observed in correcting sacral malposition to restore neuro-biomechanical function of the pelvis (see Table 5.16).

5.5.3.4 Collaborative Care Efforts

The data on chiropractors' collaborative efforts in pregnancy care confirms the findings that for a majority of US chiropractors, pregnancy care was a co-management approach. [623] The respondents indicated as receiving referrals from other providers to care for pregnant women complaining of LBP and/or PGP. Chiropractic referrals to other providers depend on their area of specialty and focus of care. For example, chiropractors and massage therapists commonly refer to each other to address MSK conditions associated with pregnancy. The chiropractors in this study identified as having a

professional relationship most commonly with massage therapists and confirms this long-standing collaboration in pregnancy care. [256, 260, 261] Despite differences in training and scope of practice, both professions have a hands-on approach and a focus on patients with MSK conditions. After massage therapists, chiropractors commonly collaborate with midwives. In the last 25 years, there has been an effort on the part of chiropractors for increased collaboration between chiropractors and midwives in pregnancy care. According to Ohm [344], both professions acknowledge and trust in the body's inner wisdom, offer care that is individualised and personalised, and support the use of noninvasive birthing procedures. The use of the Webster Technique [358] to maintain the neurobiomechanical integrity of the pelvis during pregnancy and facilitate correction of foetal malposition and malpresentation is offered in this regard. This study found that midwives refer to chiropractors to address patients with foetal malposition/malpresentation and complaints of LBP and/or PGP. Mullin et al. [646] found that referring midwives had a positive personal and professional experience with chiropractic and were of the opinion that chiropractic was safe for pregnant patients. The findings of a strong collaboration between chiropractors and midwives are consistent with the literature. [43, 647] In terms of collaboration with obstetricians, Weis et al. [648] surveyed Canadian obstetricians (n = 91) on their attitudes toward chiropractic and found that 30% held a positive view of chiropractic, 36.7% were neutral and 33.3% held negative views. The majority of obstetricians indicated chiropractic was effective in addressing certain MSK conditions and a useful supplement to conventional medical care but questioned chiropractic's effectiveness in address non-MSK conditions. Interestingly in this study, the respondents indicated as receiving referrals from obstetricians to facilitate correction of foetal malposition/malpresentation and address LBP and/or PGP. Although the collaborative

efforts of chiropractors with acupuncturists, naturopaths and mental health professionals was characterised, the literature is lacking in this regard and deserves further investigation.

5.5.3.5 Safety Attitudes of Chiropractors

In terms of safety attitudes (see Table 5.20), the chiropractor respondents provided high ratings of safety (with a mean score of 9.91 (0 = *not very safe* to 10 = *very safe*) with pregnancy care overall and the use of the Webster Technique. The use of HVLA SMT received the lowest safety rating (mean score = 8.7/10) relative to the use of manually assisted instruments (Activator Methods) or drop table techniques (Thompson Technique) with mean scores of 9.9/10 and 9.5/10, respectively. Stuber [260] surveyed chiropractors (n = 18) to assess their perceptions of safety of pregnancy care and 90% indicated that SMT was an appropriate treatment for pregnant women suffering from LBP, midback pain, neck pain and headache pain while 74% indicated that SMT was appropriate for those with vertigo. The percentage of the Stuber respondents employing SMT on pregnant patients with a variety of comorbidities of pregnancy were multiple pregnancies (83%), gestational diabetes (56%), hypertension (39%), pre-eclampsia (22%), ectopic pregnancy or blood clotting disorder (11%) and none would provide SMT in women with excessive, unexplained spotting. In contrast, 72.9% of our respondents indicated that they would provide care (i.e., spinal adjustment/SMT) prior to referring to a specialist, 40.9% would provide care to a woman with pre-eclampsia and eclampsia while only 10.5% would provide care to a pregnant woman with vaginal bleeding (spotting due to ectopic pregnancy). The differences in responses may be due in part to the lack of clinical experience and advanced training of the Stuber respondents in pregnancy care (i.e., the majority had less than 4 years clinical experience and cared for 0-5 pregnant women per month).

5.5.4 Patient Characteristics

5.5.4.1 Clinical Presentations

This study examined the MSK and non-MSK clinical presentations of pregnant women attending chiropractic care. With respect to their MSK clinical presentations, the most common presenting complaint by pregnant women was LBP (with or without radiculopathy) and PGP involving the pubic symphysis or sacro-iliac joint, other spinal regions (i.e., neck pain and thoracic spine pain), and hip pain, regardless of the trimester of pregnancy. These study findings are consistent with those of others characterising the presenting MSK complaints of pregnant women for chiropractic care. Alcantara et al. [114] found that LBP and/or PGP was the most common primary, secondary, and tertiary complaint among pregnant women. Among their pregnant respondents, Skaggs et al. [649] reported that two thirds suffered from back pain at three sites: at the low back, pelvis, and mid-back. In addition to presenting with breech presentations and headaches, Rubin [257] also found LBP as a common clinical presentation. In contrast, for women in the postpartum period, the most common presenting complaints were associated with thoracic and cervical spine pain followed by LBP and/or PGP.

This is the first examination of the non-MSK clinical presentations of pregnant women. In the first trimester, hyperemesis gravidarum followed by fatigue and headaches were the most common presenting complaints. In the second trimester, acid reflux, fatigue and symptoms associated with hyperemesis gravidarum were the most common. In the third trimester, abnormal foetal position or breech followed with complaints associated with heartburn/acid reflux, abdominal pain and constipation were common presenting complaints. These findings resonate with the common morbidities associated within each trimester of pregnancy. It's estimated that hyperemesis gravidarum has a prevalence of 50%-80% in pregnant women with an onset in the 5th week after a woman's last menstrual

period and peaks at 8-12 weeks and resolve by weeks 16-18 for most women. [650] Gastroesophageal reflux or its severe form, gastroesophageal reflux disease (GERD) has been reported to occur in up to 80% of pregnancies. [651-652] Estimates on the prevalence of constipation during pregnancy ranges from 11% to 38% of pregnancies. [653-654] According to Hickok [655], approximately 25-30% of all foetuses will present as breech before the 28 weeks of gestation. However, by the 34th week, the majority will have corrected to the cephalic presentation except for 3-4% of singleton pregnancies that reach term. Future research should continue to document both MSK and non-MSK conditions addressed in pregnancy. This reflects the grass roots efforts of chiropractors in pregnancy care, inform the development of appropriate chiropractic interventions, inform referrals to the appropriate specialist, and serve to guide the training and education of chiropractors in pregnancy care.

5.5.4.2 Motivation for Care and Theoretical Framework for Chiropractic Care

Given the prevalence of MSK complaints in the second and third trimester of pregnancy, there is no doubt that women use chiropractic services for symptom relief. However, Mitchell [36] also found that CAM use by women transformed their beliefs in the normality of birth, taught them practical strategies to use as a defence against unnecessary medical intervention, but more importantly put them in control over their birth experiences. Mitchell [36] also found that CAM use in pregnant was for general wellness and to treat LBP. This is consistent with this study's findings that 85.8% of the respondents characterised their practices as functioning for wellness or salutogenic care. Furthermore, the respondents indicated that their pregnant patients attended care to enhance functioning and wellbeing (see Table 5.22–5.23). Wellness and symptom care during pregnancy is consistent with the published literature. [33, 36, 113-114]

5.5.4.3 Family Members Concurrently Under Chiropractic Care

The high proportion of family members concurrently under chiropractic care comes as no surprise. The respondents were members of the ICPA, an organization that supports family wellness care that begins in pregnancy. [540] It acknowledges that women more than men are responsible for the uptake of alternative and conventional therapies for their families due to a woman's traditional/caregiving role, their employment status, and higher use of healthcare services in general. [656-659]

5.6 Conclusion

This study characterised the practice of chiropractic pregnancy care. Practitioners involved in pregnancy care are characterised as female, relatively young, have less than 15 years of clinical experience and have attended a postgraduate course in pregnancy care. They attend to a mean of 140.3 PVperW with 18.4% of these visits devoted to the care of pregnant women. The majority of respondents indicated that pregnancy care was reimbursed mostly by out-of-pocket. In the mechanics of providing care, chiropractors indicated the necessity of modifying their chiropractic technique (i.e., use of relatively lower forces during SMT) and identified the Webster Technique as their primary chiropractic technique and the use of adjunctive therapies (i.e., massage, exercise, dietary and nutritional interventions). Pregnancy referrals from other practitioners involve caring for women with LBP and/or PGP or to address foetal malposition/malpresentation as referred by midwives and medical doctors. Referrals to other practitioners depends on the practitioner's specialty of care. For example, referrals to medical doctors involve out-of-scope issues. In the care of pregnant women with comorbidities, clinical management involved the provision of chiropractic care (i.e., SMT and adjunctive therapies) and referral to a specialist, no provision of chiropractic care and immediate referral to a specialist and with certain comorbidities, an absolute contraindication to chiropractic care.

Not surprisingly, the respondents indicated that chiropractic care was safe for pregnant women.

The respondents characterised their pregnant patients as motivated to seek care to address a symptom or complaint (i.e., LBP and/or PGP) and for wellness care (i.e., increase functioning and adaptation). Pregnant women presented with non-MSK complaints, dependent on their trimester of pregnancy. They presented commonly with hyperemesis gravidarum in the first trimester, problems associated with gastrointestinal system (i.e., acid reflux, constipation) in the second trimester and foetal malposition/malpresentation in the third trimester. With MSK complaints, pregnant women presented with LBP and/or PGP, regardless of their trimester of pregnancy.

Based on the study findings, the care of pregnant women is dissimilar to the care of the general adult population and requires specialised knowledge, skills, and clinical experience on the part of the attending chiropractor. Notable in this regard is the unique aspects associated with the provision of the chiropractic SMT to pregnant women. The application of SMT requires technique modification such as the use of pregnancy pillows or the use of a chiropractic table with a drop piece to accommodate the growing foetus and the avoidance of positioning the patient in a side-posture position to avoid over-rotation ('torquing') of the pregnant woman's lumbopelvic region. In terms of the force applied, the use of low-force techniques such as that applied manually or instrument-assisted such as Activator Methods and Thompson Technique are required due to the effects of relaxin on joint hypermobility. The Webster Technique was identified as the primary technique in pregnancy care. The use of this technique in pregnancy care requires specialised training.

Overall, the findings on the chiropractic care of pregnant women in this study points to the care of pregnant women as a specialty practice in chiropractic that requires specialised knowledge and skills.

Chapter 6. Results of Study 2: Sense of Coherence and Associated Factors in Pregnant and Non-Pregnant Women Attending Care in a Practice-Based Research Network

6.1 Introduction

This chapter presents the results of a survey of pregnant and non-pregnant respondents under chiropractic care. The survey examined their sociodemographic and clinical information and assessment of Antonovsky's sense of coherence (SOC) [660], Bandura's self-efficacy [661], Rotter's locus of control (LOC) [662], domains quality of life (QoL), and the interpersonal process of care (IPC) experience with chiropractic.

Among pregnant women, the use of complementary, alternative, and integrative medicine (CAIM) [29] varies widely between 1% and 87% [663] but occurs commonly worldwide. [664] Research on the safety and effectiveness of CAIM during pregnancy is important but so is understanding the health behaviour of pregnant women. Health behaviours have been defined as behavioural patterns, actions and habits that relate to the maintenance, restoration, and improvement of health. [665] While investigating the motivation of pregnant women's use of moxibustion for breech presentations, Guittier et al. [666] found that 60% of pregnant women intended to use moxibustion in subsequent breech pregnancies despite having read the results of a randomised clinical trial that failed to demonstrate the efficacy of moxibustion to correct a breech foetus. The principal motivation for using moxibustion was their desire to try anything that could turn their breeched foetuses to vertex so as to increase their chances of delivering vaginally. Understanding health behaviour allows for the identification of factors that influence an individual's choices and actions related to their health, assist in identifying the barriers and facilitators for an individual to adopt and maintain a healthy behaviour and enhance doctor–patient communication with due to consideration to an individual's beliefs, culture,

and social determinants of health. Health behaviour theories provide the framework for understanding health behaviour and how it can be influenced. [667] Inquiries on the nature of health behaviour requires measuring its basic constructs. [668] Such information provides insights into an individual's overall health, their patient experience, and effectiveness of the care they receive.

A systematic review of the literature on measures of SOC and in pregnancy (see Chapter 2. Sense of coherence in pregnancy: a systematic review of the literature) found that among pregnant women, SOC as measured by the SOC-29 [222] has never been measured concurrently with the 29-item Patient-Reported Outcomes Measurement Information System (PROMIS-29) profile instrument. PROMIS-29 measures pain intensity along with the QoL domains of Physical Function, Anxiety, Depression, Fatigue, Sleep Disturbance, Ability to Participate in Social Roles and Activities, and Pain Interference. [495] SOC-29 has also never been measured concurrently with the GSE scale [511], the health LOC (HLOC) Form C [525] and the IPC-18 [534] in the pregnant population. To address this deficit in the scientific literature, the second aim of this thesis was to assess the SOC, general self-efficacy (GSE), and health HLOC, QoL and IPC experience of pregnant and non-pregnant women under chiropractic care.

6.2 Methods

The details of the methods (i.e., data collection, data preparation and analysis) of this study are provided in Chapter 3 Methods. A brief review of the study methods is presented here to augment the presentation of the results.

Non-pregnant women were utilised as a comparative group in this study given the physiological, biomechanical and health behaviour differences between pregnant and non-pregnant women. Physiologically, pregnant women have significantly higher levels of glucose, total cholesterol, triglycerides, and low-density lipoprotein cholesterol relative to

non-pregnant women. [669] Biomechanically, the gait speed of pregnant women in their second and third trimester is significantly reduced when compared to nonpregnant women. [670] With health concerns for their unborn child, a pregnant woman's lifestyle choices and health behaviours are healthier and differ from those of non-pregnant women. [552-554] These differentiating factors suggest that pregnant and non-pregnant women may respond to chiropractic care differently but more importantly, respond differently in measures of SOC and its associated health constructs.

6.2.1 Data Collection

Professional members of the International Chiropractic Pediatric Association (ICPA) [540] were asked to recruit pregnant and non-pregnant women under their care to participate in this study to examine their SOC and related health constructs.

Upon study entrance, the respondents accessed the study hyperlink based on their pregnancy status to complete a baseline or time one (T1) survey. The survey inquired from the respondents their sociodemographic information (i.e., age, family income, educational levels), clinical information (i.e., presenting complaints, weeks of gestation), and measures of SOC [222], QoL [495], GSE [511], HLOC [523] and IPC experience. [534] Following a course of chiropractic care, a follow-up or time two (T2) survey was implemented. SOC and its related health constructs were measured again (see Figure 6.1). The T1 and T2 responses were linked for each respondent using a unique participant identifier (i.e., the first three letters of the participants' mother's first name and the last three digits of the participants' phone number: DOL0893). The surveys were implemented online using Research Electronic Data Capture or RedCap. [541]

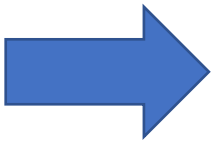
T1	Chiropractic care	T2
• Sociodemographic information • Clinical information • SOC • QoL • GSE • MHLOC • IPC experience		• SOC • QoL • GSE • MHLOC • IPC experience

Figure 6.1. Summary of Data Collection at T1 and T2

Note. SOC = sense of coherence; QoL = quality of life; GSE = General Self-Efficacy; MHLOC = Multiple Health Locus of Control; IPC = interpersonal process of care.

6.2.2 Data Preparation and Analysis

ReCap [541] outputs the data in Excel [557] for ease of analysis. A total of 36 pregnant and 60 non-pregnant women completed the T1 survey. After data cleaning, three non-pregnant respondents at T1 had missing data for calculating the primary outcomes (i.e., SOC-29, GSE or MHLOC). In such instances, these respondents were excluded from the analysis. Among the pregnant respondents, one respondent was a duplicate at T1 and removed. Overall, a total of 92 respondents (i.e., 35 pregnant 57 non-pregnant) contributed data for analysis. At T2, only 11 non-pregnant and 4 pregnant women completed the survey. Portions of the T1 and T2 surveys also contained items with open-ended questions. The responses were categorised as appropriate. Given the paucity of data from the T2 survey, the focus of the analysis undertaken was on the T1 data.

Statistical analysis utilised descriptive statistics (i.e., frequencies, percentages, mean and standard deviation [*SD*]). [546] Differences in means involving two levels were assessed with the independent *t*-test [547] or the Mann-Whitney *U* test. [671] The chi-square (χ^2) test of independence assessed the relationship between two variables. [555] Differences in means involving ≥3 levels were assessed with the analysis of variance (ANOVA). [545]

Since age [561-562, 590] and the number of patient visits [564-565] may impact the patient-reported outcomes (PROs), the SOC and its related constructs were analysed with the raw data as well as data restricted to respondents with similar age range (i.e., reproductive age of 15-45 years) and similar patient visits (i.e., patient visits 2-110). To determine whether mean values between two outcomes were clinically significantly different, the minimal clinically important difference (MCID) was calculated using the standard error of the mean (SEM) or ½ the standard deviation (½ *SD*). [300] To analyse the relationship of SOC and its related constructs (i.e., QoL, GSE, HLOC), multiple regression analysis was performed using Excel. [557] Pearson's *r* determined the linear relationships between two continuous variables. [35] Cronbach's alpha (α) measured the reliability of the survey instrument. [556-557] Statistical significance was set a $p < .05$.

6.3 Results

6.3.1 Age

At T1, a total of 92 respondents (i.e., 35 pregnant and 57 non-pregnant) comprised the study population. Their age information is provided in Table 6.1. A significant difference ($t_{86} = 3.3462$, $p = .001$) was found in the mean age of pregnant and non-pregnant respondents.

Table 6.1. Age of Pregnant and Non-Pregnant Respondents

Respondent	*n*	Mean (years) (*SD*)	Range (years)
Pregnant	35	31.4 (4.67)	23-41
Non-pregnant	51	39.3 (12.14)	21-74
Overall	86	36.1 (10.53)	21-74

6.3.2 Educational Attainment

The educational attainment of the respondents is shown in Table 6.2. Both pregnant and non-pregnant respondents were highly educated with the majority having a baccalaureate degree or higher.

Table 6.2. Educational Attainment of Respondents ($N = 92$)

	Non-pregnant women		Pregnant women	
Educational level	*n*	%	*n*	%
PhD/doctorate	12	13.0%	4	4.4%
Master's degree	9	9.8%	7	7.8%
4-year degree	23	25.0%	18	20.0%
2-year associate degree	5	5.4%	1	1.1%
Some college	5	5.4%	4	4.4%
High school	3	3.3%	1	1.1%
Total	57	61.1%	35	38.9%

A χ^2 test of independence revealed χ^2 (5, 92) = 3.58 ($p = .61$). The $\chi^2_{Calculated}$ is less than the $\chi^2_{Critical}$ of 11.07, and therefore a failure to reject the null hypothesis and conclude that there are no differences in the educational levels of pregnant and non-pregnant women.

6.3.3 Ethnicities

The respondents' ethnicities (e.g., White, African American) [672] are summarised in Table 6.3. The majority ($n = 78$; 31 pregnant and 47 non-pregnant) of respondents were White.

Table 6.3. Ethnicity of Respondents ($N = 92$)

	Non-pregnant women		Pregnant women	
Ethnicity	*n*	%	*n*	%
White	47	51.1%	31	33.7%
Asian	5	5.4%	0	0%
Hispanic	2	2.2%	2	2.2%
Multicultural	3	3.3%	1	1.1%
African American	0	0%	1	1.1%
Total	57	61.9%	35	39.1%

A χ^2 test of independence revealed χ^2 (4, 92) = 5.33 ($p = .26$). The $\chi^2_{Calculated}$ is less than the $\chi^2_{Critical}$ of 11.07, and therefore a failure to reject the null hypothesis and there is no association between pregnancy status and ethnicity.

6.3.4 Number of Patient Visits

The number of patient visits attended by the respondents is summarised in Table 6.4. The non-pregnant respondents attended a greater mean number of visits compared to the pregnant respondents and the difference was statistically significantly different ($U = 453$, z-score = 3.73, $p = .0002$).

Table 6.4. Patient Visits of Pregnant and Non-Pregnant Respondents

Respondent	*n*	Mean visits (*SD*)	Range of visits
Pregnant	33	26.0 (28.40)	2-110
Non-pregnant	53	182.8 (311.46)	1-1500
Overall	86	122.7 (255.99)	1-1500

6.3.5 Patient Status: New Patients, Established Patient, and Long-Standing Patients

In terms of patient status at T1, 65 respondents (45 non-pregnant and 20 pregnant) identified themselves as long-standing patients (i.e., attended 13+ visits), 25 (14 non-

pregnant and 11 non-pregnant) as established patients (i.e., attended 3-12 patient visits), and two (one each of pregnant and non-pregnant) identified as new patients (i.e., attended 1-2 visits).

6.3.6 Gestational Age of Pregnant Women

The 35 pregnant women initiated the survey at a mean week of gestation of 26.4 weeks (*SD* = 8.09, *n* = 35, range: 10-39, median = 29.0 weeks, mode = 33, 32 weeks). Seventeen (48.6%) indicated that they were a chiropractic patient prior to their pregnancy while another 17 (48.6%) indicated they had no chiropractic experience prior to their pregnancy with one (2.8%) nonresponder.

6.3.7 Family Income

The mean family income of the pregnant and non-pregnant respondents, regardless of country of care, was $143 985 (*n* = 67 [72.8%], *SD* = 102 176, range: $20 000 – $500 000, median = $110 000).

The pregnant women, regardless of country of origin, indicated a mean family income of $153 222 (*n* = 27, *SD* = 92 099, range: $40 000 – $400 000, median = $125 000). Among the pregnant respondents, one respondent was from Canada with a family income of Can$220,000. The remaining pregnant respondents (n=26) from the United States indicated a mean family income of US$150 653 (SD = 92 932, range: US$40 000 – US$400 000, median = US$122 500). Eight American pregnant respondents did not provide a response to the family income inquiry.

The non-pregnant women, regardless of country of origin, indicated a mean family income of $137 750 (*n* = 40, *SD* = 109 150, range: $20 000 – $500 000, median = $96 500). Three non-pregnant respondents identified as Canadian had a mean family income of Can$ 94 333 (SD = 66 002, range: Can$28 000 – Can$ 160 000, median = Can$95 000).

The remaining American non-pregnant respondents (n=37) had a mean family income of US$141 270 (SD=111 780, range: US$ 20 000 – US$500 000, media = US$ 98 000). Seventeen non-pregnant respondents did not provide a response to this inquiry on family income.

An independent *t*-test in family income between the pregnant and non-pregnant respondents, regardless of country of origin, determined no statistically significant difference ($t[65] = 0.6245$, $p = .5345$) with a mean difference of $15 470.

6.3.8 Presenting Complaints

Among the non-pregnant women, the majority presented with musculoskeletal (MSK) complaints consisting of low back pain (LBP) (without radiculopathy [$n = 19$] and with radiculopathy [$n = 2$]), followed by neck pain ($n = 7$), hip pain ($n = 3$), midback pain ($n = 2$), knee pain ($n = 1$), fatigue ($n = 1$), shoulder pain ($n = 1$), sleep dysfunction ($n = 1$), thoracolumbar spine pain ($n = 1$), and upper back pain ($n = 1$). Five women presented with migraine headaches and three with non-migraine headaches. Seven women presented for wellness care and two women to address stress. One indicated suffering from wrist pain, neck pain and rib pain.

Among the pregnant women, the majority also presented with MSK pain complaints consisting of LBP ($n = 9$) or LBP with radiculopathy ($n = 2$), followed by hip pain ($n = 6$), and pelvic girdle pain (PGP) ($n = 2$), and one each for groin pain, neck pain, upper back pain, and breech presentation. Two women presented with headaches ($n = 1$) or migraine headaches ($n = 1$). One pregnant woman was a nonresponder. Note that respondents were able to provide more than one presenting complaint.

6.3.9 Chiropractic Care (Spinal Adjustment and Adjunctive Therapies)

All respondents (n = 92; 100%) indicated having received spinal adjustments or spinal manipulative therapy (SMT) during their care. A summary of the frequencies and types of adjunctive therapies received by the respondents is shown in Table 6.5. Note that the choices were not mutually exclusive. A χ^2 test of independence revealed a χ^2 (12, 249) of 20.1014 (p = .06). The $\chi^2_{Calculated}$ is less than the $\chi^2_{Critical}$ of 21.026, and therefore a failure to reject the null hypothesis and there is no association between pregnancy status and the respondents' use of adjunctive therapies.

Among the non-pregnant women, the five most common adjunctive therapies utilised were exercise and active rehabilitation, followed by use of vitamins and minerals, dietary and nutrition counselling, postural suggestions, herbal remedies, and homeopathic remedies. Among the pregnant women, the five most common adjunctive therapies were exercise and active rehabilitation, followed by the Webster Technique, dietary and nutrition counselling, use of vitamins and minerals, and soft-tissue therapy.

Table 6.5. Use of Adjunctive Therapies among Non-Pregnant and Pregnant Women

	Non-pregnant women		Pregnant women	
Adjunctive therapy	*n*	%	*n*	%
Exercise & rehabilitation	32	34.8%	14	15.2%
Use of vitamins & minerals	27	29.3%	12	13.0%
Dietary & nutrition Counselling	24	26.1%	12	13.0%
Postural suggestions	19	20.7%	8	8.7%
Herbal remedies	11	11.9%	2	2.2%
Homeopathic remedies	13	14.1%	4	4.3%
Soft-tissue therapy	9	9.8%	11	11.9%
Myofascial release & passive rehabilitation	8	8.7%	4	4.3%
Webster Technique	6	6.5%	13	14.1%
Naturopathic remedies	3	3.3%	1	1.1%
Physiotherapy modalities	2	2.1%	2	2.2%
No adjunctive	7	7.6%	7	7.6%
Other	2	2.2%	3	3.3%

6.3.10 Concurrent Care with Other Healthcare Professionals

When asked about concurrent care with other healthcare professionals, all (n = 35) pregnant respondents indicated as having concurrent care with another healthcare professional.

Of the 57 non-pregnant women, 26 respondents indicated receiving concurrent care with another healthcare provider. Thirty respondents did not have concurrent care with another healthcare provider and one non-pregnant non-responder to the inquiry. However, in a follow-up question, this non-responder indicated concurrent care with an obstetrician/gynecologist. Of the 30 non-pregnant respondents indicating no concurrent care, 9 respondents subsequently identified at least one other healthcare provider in addition to a chiropractor in a follow-up question. These healthcare providers were identified as an obstetrician/gynecologist (n = 3), Medical Doctor or Doctor of Osteopathy (n = 3), massage therapist (n = 5), and acupuncturist (n = 1).

Among the non-pregnant respondents, concurrent healthcare providers identified as 'Other' were a dentist (n = 1), nurse practitioner (n = 3), physical therapist (n = 2), a 'Lyme/mould specialist' (n = 1), a 'Reiki Master' (n = 1), mental health specialist (n = 1), and an orthopaedic specialist (n = 1).

Among the pregnant women, concurrent healthcare providers identified as 'Other' were a craniosacral therapist (n = 1), a doula (n = 1), pelvic floor physiotherapists (n = 3), and nutritionists (n = 2). The type and frequency of concurrent care with chiropractic is summarised in Table 6.6. Note that respondents were allowed to provide more than one type of concurrent provider.

Table 6.6. Concurrent Healthcare Professionals for Non-Pregnant and Pregnant Respondents (n = 92)

	Non-pregnant women		Pregnant women	
Concurrent healthcare provider	*n*	%	*n*	%
Medical Doctor or Doctor of Osteopathy	17	29.8%	3	8.6%
Massage therapist	16	28.1%	13	37.1%
Obstetrician/gynaecologist	10	17.5%	17	48.6%
Acupuncturist	4	7.0%	7	20.0%
Naturopath	3	5.3%	3	8.6%
Homeopath	2	3.5%	—	—
Midwife	—	—	22	62.9%
Nurse midwife	—	—	1	2.9%
Another chiropractor	—	—	1	2.9%
Other	9	15.8%	7	20%
No healthcare professional	16	28.1%	—	—

A χ^2 test of independence of the frequencies of various healthcare providers among pregnant and non-pregnant women revealed χ^2 (10, 151) is 54.9554 ($p < .001$). The $\chi^2_{Calculated}$ is greater than the $\chi^2_{Critical}$ of 18.307, and the null hypothesis is rejected. Therefore, there is a significant association between pregnancy status and concurrent care with other healthcare professionals.

The stark contrast in concurrent care between pregnant and non-pregnant women was the use of specific healthcare providers during pregnancy. The pregnant women were under concurrent care with a midwife, or a nurse-midwife followed by an obstetrician/gynaecologist and the services of a massage therapist. The non-pregnant women were cared for concurrently by a Medical Doctor or Doctor of Osteopathy and a massage therapist with a large proportion (i.e., 36.8% or 21 of 57 non-pregnant respondents) receiving no concurrent care.

6.3.11 Types of Care Provided by Other Healthcare Providers

The types of care provided by other healthcare providers to the respondents is summarised in Table 6.7. Note that the choices were not mutually exclusive. Three non-pregnant women indicated 'Other' types of care and identified as craniosacral therapy, exercise, and a combination of hyperbaric oxygen therapy and 'energy medicine.' Among the three pregnant women, 'Other' types of therapy were identified as exercise, acupuncture, and a combination of exercise and acupuncture. A χ^2 test of independence revealed χ^2 (12, 219) = 27.9800 (p = .005). The $\chi^2_{Calculated}$ is greater than $\chi^2_{Critical}$ of 21.026, and the null hypothesis is rejected. Therefore, there is an association between pregnancy status and the respondents prescribed adjunctive therapies.

Table 6.7. Types and Frequencies of Advice/Care Provided by Concurrent Providers to Non-Pregnant and Pregnant Respondents (n = 92)

	Non-pregnant women		Pregnant women	
Types of care provided	*n*	%	*n*	%
Use of vitamins & minerals	15	26.3%	25	71.4%
Prescription medication	15	26.3%	8	22.9%
Dietary & nutrition counselling	12	21.0%	19	54.3%
Soft-tissue therapy such as massage	12	21.0%	9	25.7%
Herbal remedies	9	15.8%	10	28.6%
Recommended over-the-counter medication	7	12.3%	8	22.9%
Naturopathic remedies	5	8.8%	4	11.4%
Postural suggestions according to lifestyle and particular needs	4	7.0%	12	34.3%
Myofascial release & passive rehabilitation	4	7.0%	6	17.1%
Homeopathic remedies	3	5.3%	4	11.4%
Other	3	5.3%	3	8.6%
Physiotherapy modalities	2	3.5%	4	11.4%
I am not attending care with another healthcare professional	16	28.0%	—	—

In addition to the use of vitamins and minerals, the pregnant women indicated that the most prevalent type of concurrent care was prescription medication followed by soft-tissue therapy, dietary and nutrition counselling and recommended over-the-counter medication. Unlike the pregnant women, the non-pregnant women indicated the use of dietary and nutrition counselling as the most prevalent type of care followed by vitamins and minerals, postural suggestions according to lifestyle and particular needs, the use of herbal remedies, and soft-tissue therapy such as massage.

6.3.12 Primary Outcome Measures at Baseline (T1)

The descriptive statistics of the primary outcome measures at baseline (T1) are provided in Table 6.8. The pregnant women reported greater mean T-scores in Fatigue, Sleep Disturbance, Ability to Participate in Social Roles and Activities, Pain Interference, and pain numeric rating scale (NRS). The non-pregnant women reported greater *T*-scores *in Physical Function, Anxiety and Depression. The* largest difference (Δ) in mean T-scores between pregnant and non-pregnant women were in the QoL domains of Depression (Mean Δ = 3.6), followed by Physical Function (Mean Δ = 2.8), Fatigue (Mean Δ = 2.2), Ability to Participate in Social Roles and Activities (Mean Δ = 1.0), and Pain Interference (Mean Δ = 1.1). The differences in the subdomains scores of the IPC-18, in GSE scores and the subdomain scores of the HMLOC were less than one unit. A difference of 8.63 units was observed in SOC scores favouring pregnant women. The mean difference in the SOC subdomains were 1.7 (Comprehensibility), 3.3 (Meaning), and 3.9 (Manageability) in favour of the pregnant respondents.

Table 6.8. Descriptive Statistics of Primary Outcome Measures among Non-Pregnant and Pregnant Respondents at T1

	Overall		Non-pregnant		Pregnant	
Primary outcome measure	Mean	*SD*	Mean	*SD*	Mean	*SD*
Physical Function	50.6	7.01	51.6	6.76	48.8	7.17
Anxiety	52.8	9.09	53.2	9.39	52.2	8.68
Depression	47.8	7.81	49.2	8.48	45.6	6.01
Fatigue	53.4	9.00	52.6	9.46	54.8	8.14
Sleep Disturbance	51.0	7.34	50.8	8.04	51.5	6.13
Ability to Participate in Social Roles and Activities	53.1	7.80	52.7	8.11	53.7	7.34
Pain Interference	50.6	8.00	50.2	8.02	51.3	8.05
Pain NRS	2.9	2.10	2.8	2.13	3.1	2.08
Communication (Lack of clarity)	1.4	0.57	1.3	0.55	1.4	0.59
Communication (Elicited concerns, responded)	4.6	0.46	4.6	0.50	4.7	0.38
Communication (Explained results)	4.4	0.97	4.4	0.99	4.5	0.93
Decision-making (Decided together)	4.3	0.82	4.4	0.70	4.3	0.99
Interpersonal Style (Emotional support, compassion)	4.8	0.49	4.7	0.60	4.92	0.14
Interpersonal Style (Discriminated due to race/ethnicity)	1.0	0.21	1.0	0.26	1.0	0
Interpersonal Style (Disrespectful office staff)	1.0	0.16	1.0	0.15	1.04	0.19
General Self-Efficacy	32.9	4.38	32.6	4.75	33.4	3.72
Internal Locus of Control	25.6	4.84	25.4	5.31	25.9	4.01
Chance Locus of Control	13.2	4.92	13.1	5.20	13.5	4.49
Doctor Locus of Control	13.4	3.13	13.1	2.72	13.8	3.69
Other People Locus of Control	8.3	2.84	8.5	2.96	8.1	2.65
SOC	145.1	21.04	141.8	22.81	150.4	16.80
Comprehensibility	55.8	8.14	55.1	8.42	56.8	7.67
Manageability	50.5	8.45	49.1	9.03	52.9	6.87
Meaning	38.7	6.86	37.4	7.17	40.7	5.89

Note. SD = standard deviation; NRS = numeric rating scale; SOC = sense of coherence.

6.3.13 Primary Outcome Measures at Follow-Up (T2)

The descriptive statistics of the primary outcome measures at T2 is provided in Table 6.9. Note the low response rate and uneven sample size in pregnant and non-pregnant respondents at T2. Overall, the magnitude of the mean differences in T-scores

between pregnant and non-pregnant women for the various QoL domains (except for Sleep Disturbance) was greater than those at T1. The same was observed for the mean differences in GSE score and mean differences in SOC score and the SOC subdomains. Given the poor response rate at T2, further analysis involving the T2 data will not be performed.

Table 6.9. Descriptive Statistics of Primary Outcome Measures among Non-Pregnant and Pregnant Respondents at T2

	Overall		Non-pregnant		Pregnant	
Primary outcome measure	Mean	*SD*	Mean	*SD*	Mean	*SD*
Physical function	51.4	6.52	51.4	6.51	47.3	7.39
Anxiety	49.7	8.58	49.7	8.58	45.8	6.29
Depression	45.1	7.16	45.1	7.16	41.0	0
Fatigue	53.9	8.86	53.9	8.86	56.4	3.70
Sleep Disturbance	48.6	5.62	48.6	5.62	48.2	4.49
Ability to Participate in Social Roles and Activities	57.1	7.74	57.1	7.74	58.6	6.94
Pain Interference	48.5	7.22	48.5	7.22	50.3	6.08
Pain NRS	2.5	1.64	2.5	1.64	3.0	0
Communication (Elicited concerns, responded)	1.1	0.28	1.1	0.28	1.0	0
Communication (Explained results)	4.6	0.70	4.6	0.70	4.8	0.33
Decision-making (Decided together)	4.7	1.03	4.7	1.03	5.0	0
Interpersonal Style (Emotional support, compassion)	4.3	1.15	4.3	1.15	4.6	4.63
Interpersonal Style (Discriminated due to race/ethnicity)	4.7	1.03	4.7	1.03	5.0	0
Interpersonal Style (Disrespectful office staff)	1.3	1.03	1.3	1.03	1.0	0
General Self-Efficacy	33.7	4.32	33.7	4.32	35.5	3.79
Internal Locus of Control	29.0	5.42	29.0	5.42	26.8	2.36
Chance Locus of Control	12.9	5.97	12.9	5.97	11.5	4.20
Doctor Locus of Control	13.1	3.24	13.1	3.24	13.0	2.16
Other People Locus of Control	9.1	1.20	9.1	2.00	9.0	2.16
SOC	147.0	20.99	147.0	20.99	163.8	17.95
Comprehensibility	48.8	9.24	48.8	9.24	56.0	7.87
Manageability	53.1	8.59	53.0	8.59	58.5	6.66

	Overall		Non-pregnant		Pregnant	
Primary outcome measure	Mean	*SD*	Mean	*SD*	Mean	*SD*
Meaning	45.1	5.71	45.1	5.71	49.3	5.06

Note. SD = standard deviation; NRS = numeric rating scale; SOC = sense of coherence.

6.3.14 Independent t*-Test of the Primary Outcome Measures at Baseline Between Pregnant and Non-Pregnant Measures*

The independent *t*-test between pregnant and non-pregnant women with respect to the primary outcome measures as measured by PROMIS-29, IPC-18, GSE scale and MHLOC scales at T1 are shown in Table 6.10. The mean Depression *T*-scores and the mean scores for the SOC subdomains of Manageability and Meaning were statistically significantly different between non-pregnant and pregnant women.

Table 6.10. Independent *t*-Test of Primary Outcome Measures between Pregnant and Non-Pregnant Women at T1

Instrument	Domain	df	*t*-statistic	Mean Δ Non-pregnant–Pregnant	95% CI	*p*-value
PROMIS-29	Physical Function	90	1.8824	2.797	[-0.155, 5.749]	.06
	Anxiety	90	0.4740	0.929	[-2.965, 4.823]	.64
	Depression	90	2.2129	3.632	[0.371, 6.893]	.03
	Fatigue	90	1.1480	-2.215	[-6.049, 1.618]	.25
	Sleep Disturbance	90	0.4831	-0.766	[-3.914, 2.383]	.63
	Ability to Participate in Social Roles and Activities	90	0.6152	-1.034	[-4.375, 2.306]	.54
	Pain Interference	90	0.6063	-1.046	[-4.473, 2.381]	.55
	Pain NRS	90	0.5761	-0.26	[-1.16, 0.64]	.57
IPC-18	Communication (Lack of clarity)	90	0.6173	-0.075	[-0.318, 0.167]	.54
	Communication (Elicited concerns, responded)	89	1.8564	-0.1834	[-0.380, 0.013]	.07
	Communication (Explained results)	90	0.4096	-0.085	[-0.500, 0.329]	.68
	Decision-making (Decided together)	90	0.6271	0.111	[-0.241, 0.464]	.53
	Interpersonal Style (Emotional support, compassion)	90	1.7618	-0.1815	[-0.386, 0.023]	.08
	Interpersonal Style (Discriminated due to race/ethnicity)	90	0.7819	0.04	[-0.05, 0.12]	.44
	Interpersonal Style (Disrespectful office staff)	90	0.3435	-0.0122	[-0.083, 0.058]	.73
General Self-Efficacy	General Self-Efficacy	89	0.8466	-0.80	[-2.68, 1.08]	.40

Instrument	Domain	df	*t*-statistic	Mean Δ Non-pregnant–Pregnant	95% CI	*p*-value
Health Locus of Control	Internal Locus of Control	90	0.4543	-0.48	[-2.55, 1.60]	.65
	Chance Locus of Control	89	0.4160	-0.44	[-2.56, 1.67]	.68
	Doctor Locus of Control	90	0.9923	-0.67	[-2.00, 0.67]	0.32
	Other People Locus of Control	89	0.6465	0.40	[-0.82, 1.61]	.52
SOC-29	Comprehensibility	90	0.9853	-1.72	[-5.20, 1.75]	.33
	Manageability	90	2.1881	-3.89	[-7.42, -0.36]	.03
	Meaning	89	2.2583	-3.26	[-6.14, -0.39]	.03
	SOC	89	1.9314	-8.63	[-17.50, 0.25]	.06

6.3.15 Pearson's Correlation Coefficient of Various Outcome Measures

The strength and direction of the relationship between the various PRO measures among pregnant, non-pregnant and combined measures are shown in Tables 6.11, 6.12, and 6.13, respectively. Note that only moderate correlations ($|r|$ = .30–.50) and strong correlations ($|r|$ > .50) as suggested by Cohen [673] were indicated in the correlation tables. Weak correlation ($|r|$ = .10–.29) were excluded.

The direction of the correlations for the various PRO measures and their domains, regardless of data source (i.e., pregnant versus non-pregnant) demonstrated that PROs measuring increasing detrimental health were negatively correlated with PROs measuring increasing optimum health. For example, depression was negatively correlated with physical functioning or SOC was positively correlated with Ability to Participate in Social Roles and Activities.

Table 6.11. Pearson's Correlation Coefficient of Primary Outcome Measures from Pregnant Women at Baseline Measures

	**	***	A	B	C	D	E	G	&	H	I	J	K	O	P	Q
A		.53														
B		.61	.63													
C	-.48	.56	.48	.52												
D	.65	-.36	-.47	-.48	-.59											
E	-.63					-.35										
F	-.54				.4	-.35	.76									
G		.46	.53	.39	.46	-.37										
H									.5							
I									.6	.42						
J		-.31						-.31								
K				-.53	-.38	.46		-.36								
L				-.32												
M			-.37									.36				
N												.39				
O	.37	-.48		-.39	-.37	.36		-.56			.46	.48				
P		-.34	-.49	-.48	-.39			-.52	.34		.42	.7		.59		
Q		-.31	-.42		-.32			-.47				.52			.67	
R		-.47	-.47	-.55	-.44	.32		-.63			.44	.69	.34	.8	.91	.75

Note. ** = Physical Function; *** = Anxiety; A = Depression; B = Fatigue; C = Sleep Disturbance; D = Ability to Participate in Social Roles and Activities; E = Pain Interference; F = Pain NRS; G = Communication (Lack of clarity); & = Communication (Elicited concerns, responded); H = Decision-making (Decided together); I = Interpersonal Style (Emotional support, compassion); J = General Self-efficacy; K = Internal LOC; L = Chance LOC; M = Doctors LOC; N = Other People LOC; O = Comprehensibility; P = Manageability; Q = Meaning; R = SOC.

Table 6.12. Pearson's Correlation Coefficient of Primary Outcome Measures from Non-Pregnant Women at Baseline Measures

	A	B	C	D	E	F	G	H	I	***	J	K	L	O	P	Q	T	U	V
A																			
B	-.45																		
C	-.31	.66																	
D	-.31	.45	.42																
E		.39	.41	.51															
F	.38	-.47	-.51	-.58	-.57														
G	-.5	.52	.43	.44	.42	-.57													
H	-.43		.31	.39	.4	-.5	.74												
I	.04																		
J		-.34	-.34	-.3															
K									-.3	.49	.38								
L			-.32	-.32						.36	.46	.41							
M											-.47								
N					.03														
O		-.35	-.44		-.5	.4						.33	.35						
P	.37	-.38	-.34																
Q	-.41	.37								-.37		-.33		-.42	-.42				
R														.31					
S						-.32									-.45	.34			
T	.37	-.45	-.6	-.37	-.44	.46		-.35						.55		-.43			
U	.32	-.5	-.64	-.33	-.47	.48		-.37						.64		-.33	.86		
V	.33	-.43	-.63	-.31	-.43	.48		-.37		.43				.57		-.32	.76	.75	
W	.37	-.5	-.67	-.37	-.48	.51		-.39		.32				.63		-.39	.95	.94	.89

Noe. A = Physical Function; B = Anxiety; C = Depression; D = Fatigue; E = Sleep Disturbance; F = Ability to Participate in Social Roles and Activities; G = Physical Interference; H = Pain NRS; I = Communication (Lack of clarity); *** = Communication (Elicited concerns, responded); J = Communication (Explained results); K = Decision-making (Decided together); L = Interpersonal Style (Emotional support, compassion); M = Interpersonal Style (Discriminated due to race/ethnicity); N = Interpersonal Style (Disrespectful office staff); O = General Self-efficacy; P = Internal LOC; Q = Chance LOC; R = Doctors LOC; S = Other People LOC; T = Comprehensibility; U = Manageability; V = Meaning; W = SOC.

Table 6.13. Pearson's Correlation Coefficient of Primary Outcome Measures from All Respondents at Baseline Measures

	*	A	B	C	D	E	F	G	**	***	H	I	L	M	N	Q	R	S
A	-.31																	
B		.61																
C		.49	.43															
D	-.35	.44	.39	.51														
E	.47	-.43	-.48		-.57													
F	-.55	.33		.32	.36	-.48												
G	-.48			.35	.41	-.44	.75											
H									.44	.31								
I			-.32						.41	0.40	.32							
J										-.38								
K																		
L		-.34	-.39		-.38							.33						
M	.31	-.31	-.3			.31												
N	-.35												-.31	-.38				
O													.32					
P												.31		-.37				
Q	.35	-.46	-.51	-.36	-.41	.42	-.37						.53		-.32			
R		-.45	-.62	-.34	-.42	.39						.3	.66			.77		
S		-.39	-.6	-.34	-.37	.38			.41				.56			.61	.73	
T		-.49	-.64	-.39	-.45	.44	-.31	-.31	.33				.65			.89	.94	.86

Note. A = Anxiety; B = Depression; C = Fatigue; D = Sleep Disturbance; E = Ability to Participate in Social Roles and Activities; F = Pain Interference; G = Pain NRS; * = Physical Function; ** = Communication (Elicited concerns, responded; *** = Communication (Explained results); H = Decision-marking (Decided together); I = Interpersonal Style (Compassionate, respectful); J = Interpersonal Style (Discriminated due to race/ethnicity); K = (Disrespectful office staff); L = General Self-efficacy; M = Internal LOC; N = Chance LOC; O = Doctors LOC; P = Other People; Q = Comprehensibility; R = Manageability; S = Meaning; T = SOC

Among the PROMIS-29 QoL domains, the mental health domains had strong intercorrelations (r = .61 between Anxiety and Depression using overall data) as did the physical health domains (Overall r = -.55 between Pain Interference and Physical Function using overall data). Fatigue, Sleep Disturbance and Ability to Participate in Social Roles and Activities were observed to have both physical and mental health characteristics in the PROMIS-29 [674] and therefore was expected to have moderate to strong intracorrelations (r = .51 to .57 from the overall data). The correlation between Fatigue, Sleep Disturbance and Ability to Participate in Social Roles with the mental health domains (i.e., Anxiety and Depression) were greater than their correlation with the physical health domains (i.e., Pain Interference and Physical Function).

The correlations between the domains of the IPC-18 and SOC were weak among pregnant and non-pregnant respondents except for the following. Among the non-pregnant respondents, significant correlations ($p < .05$) were observed between Communication (Elicited concerns, responded) with SOC (r = .32) and with the SOC subdomain of Meaning (r = .43). Among the pregnant respondents, significant correlations were observed between Communication (Lack of clarity) and the SOC subdomains of Comprehensibility (r = -.56), Manageability, (r = -.52) and Meaning (r = -.47) and with SOC (r = -.63). Communication (Elicited concerns, responded) was significantly correlated with Manageability (r = .34). Interpersonal Style (Emotional support, compassion) was significantly correlated with SOC (r = .44) and the SOC subdomains of Comprehensibility (r = .46) and Manageability (r = .42).

The correlations between SOC and MHLOC differed between pregnant and non-pregnant respondents. Among the non-pregnant respondents, Chance LOC was moderately correlated with SOC (r = -.39) and its subdomains of Comprehensibility (r = -.43),

Manageability (r = -.33), and Meaning (r = -.32). Among the pregnant respondents, Internal LOC was moderately correlated only with SOC (r = .34).

Significant correlations were found between GSE and SOC among pregnant and non-pregnant respondents. Among the non-pregnant respondents, GSE was strongly correlated with SOC (r = .63), Comprehensibility (r = .55), Manageability (r = .64), and Meaning (0.57). Among the pregnant women, GSE was moderately correlated with Comprehensibility (r = .48) and strongly correlated with SOC (r = .69), Manageability (r = .70), Meaning (r = .52).

6.3.16 Multiple Regression Analysis: SOC as the Dependent Variable

To examine the relationship between SOC as the dependent variable and its related constructs (i.e., QoL domains, GSE, MHLOC subdomains and IPC-18 subdomains) as independent variables, separate multiple regression analysis was performed with the pregnant, non-pregnant and combined data. The regression output examining the relationship between SOC and a number of its associated variables for the pregnant responder data are shown in Table 6.14 with its associated summary of overall fit in Table 6.15 and ANOVA table in Table 6.16.

Table 6.14. Results of the Multiple Regression for Predicting SOC among Pregnant Respondents

Predictor	Estimate	*SE*	*t*-statistic	*p*-value
Constant	158.85	87.1853	1.8220	.0775
Physical Function	0.26	0.4870	0.5397	.5930
Anxiety	0.43	0.4541	0.9491	.3495
Depression	-1.29	0.3961	-3.2460	.0027
Fatigue	-0.12	0.3464	-0.3454	.7320
Sleep Disturbance	-0.07	0.4136	-0.1749	.8622
Ability to Participate in Social Roles and Activities	0.40	0.5181	0.7678	.4481
Pain Interference	-0.21	0.5053	-0.4210	.6765
Pain NRS	-0.73	1.8101	-0.4012	.6909

Predictor	Estimate	*SE*	*t*-statistic	*p*-value
Communication (Lack of clarity)	-4.86	4.4920	-1.0814	.2874
Communication (Elicited concerns, responded)	3.06	6.0410	0.5064	.6159
Communication (Explained results)	2.75	3.9905	0.6895	.4953
Decision-making (Decided together)	1.37	5.0648	0.2711	.7880
Interpersonal Style (Emotional support, compassion)	-13.53	8.6170	-1.5703	.1259
Interpersonal Style (Discriminated due to race/ethnicity)	14.76	12.0571	1.2238	.2297
Interpersonal Style (Disrespectful office staff)	0.48	15.7350	0.0308	.9756
General Self-Efficacy	1.89	0.7474	2.5225	.0167
Internal LOC	0.10	0.5978	0.1653	.8697
Chance LOC	-0.20	0.6252	-0.3253	.7470
Doctor LOC	-1.81	1.1415	-1.5858	.1223
Other People LOC	-0.17	1.1626	-0.1469	.8841

Note. NRS = numeric rating scale; LOC = locus of control.

Table 6.15. Summary of Overall Fit for Regression Analysis with Pregnant Respondent Data

Measure	Value
R^2	0.70
Adjusted R^2	0.51
Residual standard error	15.66 on 33 degrees of freedom.
Overall *F*-statistic	3.78 on 20 and 33 degrees of freedom
p-value	.0004

Table 6.16. ANOVA Table from Regression Analysis of Pregnant Respondent Data

Source	df	SS	MS	*F*-statistic	*p*-value
Regression	20	18 561.53	928.08	3.78	.0004
Residual error	33	8097.01	245.36		
Total	53	26 658.54	502.99		

Note. SS = sum of squares; MS = mean squares.

Based on data from the pregnant respondents, the regression equation predictive of SOC is:

SOC = 158.85 – 1.29 (mean Depression *T*-score) + 1.89 (mean GSE score)

The proportion of variance that can be explained by the independent variables was 70% (adjusted $R^2 = 0.5122$), indicative of good model fit. The variation around the estimates of the regression coefficient was 15.6641 on 33 degrees of freedom. The null hypothesis is rejected ($p = .0004$) and it is concluded that both Depression and GSE both likely influence SOC. Note than in the pregnant respondent data, there was a significant correlation between SOC and Depression ($r = -.47$, $p < .05$) and SOC and GSE ($r = .69$, $p < .05$). According to the regression equation, a 1.2858 decrease (± 0.3961) in mean SOC score results from one unit increase in mean Depression T-score and a 1.8854 increase (± 0.7474) in mean SOC score results from one measure increase in mean GSE score.

The regression output examining the relationship between SOC and a number of its associated variables from the non-pregnant data are shown in Table 6.17 with its associated summary of overall fit in Table 6.18 and ANOVA table in Table 6.19.

Table 6.17. Results of the Multiple Regression for Predicting SOC among Non-Pregnant Respondents

Predictor	Estimate	*SE*	*t*-statistic	*p*-value
Constant	158.85	87.19	1.82	.08
Physical Function	0.26	0.49	0.54	.59
Anxiety	0.43	0.45	0.95	.35
Depression	-1.29	0.40	-3.25	0
Fatigue	-0.12	0.35	-0.35	.73
Sleep Disturbance	-0.07	0.41	-0.17	.86
Ability to Participate in Social Roles and Activities	0.40	0.52	0.77	.45
Pain Interference	-0.21	0.51	-0.42	.68
Pain NRS	-0.73	1.81	-0.4	.69
Communication (Lack of clarity)	-4.86	4.49	-1.08	.29
Communication (Elicited concerns, responded)	3.06	6.04	0.51	.62

Predictor	Estimate	*SE*	*t*-statistic	*p*-value
Communication (Explained results)	2.75	3.99	0.69	.50
Decision-making (Decided together)	1.37	5.06	0.27	.79
Interpersonal Style (Emotional support, compassion)	-13.53	8.62	-1.57	.13
Interpersonal Style (Discriminated due to race/ethnicity)	14.76	12.06	1.22	.23
Interpersonal Style (Disrespectful office staff)	0.48	15.74	0.03	.98
General Self-Efficacy	1.89	0.75	2.52	.02
Internal LOC	0.10	0.6	0.17	.87
Chance LOC	-0.20	0.63	-0.33	.75
Doctor LOC	-1.81	1.14	-1.59	.12
Other People LOC	-0.17	1.16	-0.15	.88

Note. NRS = numeric rating scale; LOC = locus of control.

Table 6.18. Summary of Overall Fit for Regression Analysis with Non-Pregnant Respondent Data

Measure	Value
R^2	0.70
Adjusted R^2	0.51
Residual standard error	15.66 on 33 degrees of freedom.
Overall *F*-statistic	3.78 on 20 and 33 degrees of freedom.
p-value	0

Table 6.19. ANOVA Table from Regression Analysis of Non-Pregnant Respondent Data

Source	df	SS	MS	*F*-statistic	*p*-value
Regression	20	18 561.53	928.08	3.78	0
Residual error	33	8097.01	245.36		
Total	53	26 658.54	502.99		

Note. SS = sum of squares; MS = mean squares.

Based on data from the non-pregnant women respondents, the regression equation predictive of SOC is:

SOC = 158.85 – 1.29 (mean Depression T-score) + 1.89 (mean GSE score)

Note the similarities in the regression equations between non-pregnant women and pregnant women. The proportion of variance that can also be explained by the independent variables was 70%. The variation around the estimates of the regression coefficient was 15.66 on 33 degrees of freedom. The null hypothesis is rejected ($p < .05$) and it is concluded that both Depression mean *T*-scores and mean GSE scores likely influence SOC. As in the pregnant data, significant correlation between Depression and SOC ($r = -.67$, $p < .05$) and GSE and SOC ($r = .63$, $p < .05$) was found among the non-pregnant data. The regression equation indicated a 1.29-unit decrease (± 0.40) in mean SOC score results from a one T-score increase in mean Depression score and a 1.89-unit increase (± 0.75) in mean SOC score results from a one unit increase in mean GSE score.

The regression output examining the relationship between SOC and a number of its associated variables for the combined pregnant and non-pregnant women data are shown in Table 6.20 with its associated summary of overall fit in Table 6.21 and ANOVA table in Table 6.22.

Table 6.20. Results of the Multiple Regression for Predicting SOC among Pregnant and Non-Pregnant Women

Predictor	Estimate	*SE*	*t*-statistic	*p*-value
Constant	157.78	54.3651	2.9023	.0050
Physical Function	0.14	0.3052	0.4543	.6510
Anxiety	0.055	0.2357	0.2316	.8175
Depression	-1.03	0.2712	-3.8092	.0003
Fatigue	-0.18	0.2279	-0.8057	.4232
Sleep Disturbance	-0.03	0.2769	-0.1019	.9191
Ability to Participate in Social Roles and Activities	0.002	0.3034	0.0062	.9951
Pain Interference	-0.27	0.2999	-0.8904	.3764
Pain NRS	-0.47	1.1160	-0.422	.6743
Communication (Lack of clarity)	-4.95	2.7269	-1.8145	.0740
Communication (Elicited concerns, responded)	4.52	4.0058	1.1276	.2635
Communication (Explained results)	1.35	1.9489	0.6942	.4899

Predictor	Estimate	*SE*	*t*-statistic	*p*-value
Decision-making (Decided together)	-0.93	2.2450	-0.4149	.6795
Interpersonal Style (Emotional support, compassion)	-7.85	6.0339	-1.3008	.1977
Interpersonal Style (Discriminated due to race/ethnicity)	8.45	8.3578	1.0111	.3155
Interpersonal Style (Disrespectful office staff)	6.05	8.9881	0.6726	.5035
General Self-Efficacy	2.26	0.4304	5.2595	0
Internal LOC	-0.05	0.3685	-0.1331	.8945
Chance LOC	0.06	0.3769	0.1661	.8686
Doctor LOC	-0.56	0.5524	-1.0185	.3121
Other People LOC	-0.68	0.6227	-1.0915	.2789

Note. SE = standard error; NRS = numeric rating scale; LOC = locus of control.

Table 6.21. Summary of Overall Fit for Regression Analysis with Combined Respondent Data

Measure	Value
R^2	0.68
Adjusted R^2	0.58
Residual standard error	13.35 on 68 degrees of freedom.
Overall *F*-statistic	7.10 on 20 and 68 degrees of freedom.
p-value	0

Table 6.22. ANOVA Table from Regression Analysis of Combined Respondent Data

Source	df	SS	MS	*F*-statistic	*p*-value
Regression	20	25 332.56	1266.63	7.10	0
Residual error	68	12 125.82	178.32		
Total	88	37 458.38	425.66		

Note. SS = sum of squares; MS = mean squares.

The regression equation based on the combined data of pregnant and non-pregnant women is:

SOC = 157.78 – 1.03 (mean Depression T-score) + 2.26 (mean GSE score)

Note the similarities in the regression equations between non-pregnant women and pregnant women. The proportion of variance that can be explained by the independent variables was 67%. The variation around the estimates of the regression coefficient was 13.3537 on 33 degrees of freedom. The null hypothesis is rejected, and it is concluded that both mean scores in Depression and GSE likely influence SOC. Correlational analysis utilising the combined data found significant relationships between Depression and SOC (r = -.64, p < .05) and GSE and SOC scores (r = .65, p < .05). The regression equation indicated that a 1.033-unit decrease (± 0.2712) in mean SOC score results from a one unit increase in mean Depression T-score and a 2.2639-unit increase (± 0.4304) in mean SOC score results from a one unit increase in mean GSE score.

6.3.17 Cronbach's Alpha of Primary Outcomes Measures at Baseline

Cronbach's alpha (α) calculations based on the T1 measures are shown in Table 6.23. The reference alpha values for the PROMIS-29 V2 are from Hays et al [675], the IPC-18 from Stewart et al. [534], the GSE from Luszczynska et al. [511], the MHLOC from Jomeen et al. [676] and the SOC-29 from Eriksson and Lindström. [226]

Table 6.23. Calculated and Reference Cronbach's Alpha Values for the PROs

Instrument	Domain	Cronbach's α reference values	Items	Overall data		Non-pregnant data		Pregnant data	
				n	Cronbach's α	*n*	Cronbach's α	*n*	Cronbach's α
PROMIS-29	Physical Function	.91-.93	4	92	.8226	57	.8186	35	.8221
	Anxiety	.87-.90	4	92	.8803	57	.8750	35	.8912
	Depression	.93-.95	4	92	.9095	57	.9133	35	.8556
	Fatigue	.91-.95	4	92	.9207	57	.9303	35	.9020
	Sleep Disturbance	.77-.88	4	92	.8080	57	.8348	35	.7748
	Ability to Participate in Social Roles and Activities	.93-.96	4	92	.6699	57	.8914	35	.8978
	Pain Interference	.86-.94	4	92	.9463	57	.9447	35	.9498
	Pain NRS	—	1	92	—	57	—	35	—
IPC-18	Communication (Lack of clarity)	.65 (.61-.72)	2	92	.7011	57	.8123	35	.5402
	Communication (Elicited concerns responded)	.80 (.79-.82)	3	91	.6440	56	.5969	35	.7316
	Communication (Explained results)	.81 (.78-.85)	2	92	.6166	57	.6312	35	.5962
	Decision-making (Decided together)	.75 (.71-.77)	2	92	.5081	57	.2527	35	.7150
	Interpersonal Style (Emotional support, compassion)	.71 (.59-.82)	3	92	.8032	57	.8217	35	.1413

Instrument	Domain	Cronbach's α reference values	Items	Overall data		Non-pregnant data		Pregnant data	
				n	Cronbach's α	*n*	Cronbach's α	*n*	Cronbach's α
	Interpersonal Style (Discriminated due to race/ethnicity)	.79 (.73-.85)	2	92	$1.13X10^{-14}$	57	$7.88X10^{-15}$	35	—
	Interpersonal Style (Disrespectful office staff)	.90 (.89-.91)	4	92	.1266	57	.0849	35	.1807
GSE	General Self-Efficacy	.86 -.94	10	92	.9083	57	.9151	35	.8925
MHLOC	Internal Locus of Control	.78	6	92	.7771	57	.8947	35	.7029
	Chance Locus of Control	.83	6	92	.8088	56	.8346	35	.7531
	Doctors Locus of Control	.34	3	92	.6048	57	.3780	35	.8110
	Other People Locus of Control	.56	3	92	.5470	56	.2631	35	.5620
SOC-29	Comprehensibility	—	11	92	.7944	57	.7385	35	.7411
	Manageability	—	10	92	.7985	57	.8145	35	.7272
	Meaning	—	8	92	.7423	56	.7465	35	.6991
	SOC	.70 - .95	29	92	.9019	56	.9133	35	.8562

Note. NRS = numeric rating scale; SOC = sense of coherence.

Our use of SOC-29 confirmed the high reliability of the instrument with a Cronbach's α of .8562 and .9133 among pregnant and non-pregnant women, respectively and within the range of α values found by Eriksson and Lindström. [226] Although Cronbach's α was lower for Physical Function and Ability to Participate in Social Roles and Activities compared to the PROMIS-29 α values described by Hays et al. [675], the PROMIS-29 as applied in this thesis still had acceptable measures of reliability with α values ranging from .78 to .95. Similarly, we found the GSE scale had a high reliability with Cronbach's α measures ranging from .89 to .91 and consistent with the findings of Luszczynska et al. [511] According to Bland and Altman [677], Cronbach's α values of .7 to .8 are regarded as satisfactory. Jomeen and Martin [676] found the αvalue for Doctors LOC to be poor (i.e., α = .34). The use of the MHLOC scale in this thesis found the internal consistency for Doctors LOC was also poor as was Other People LOC with α values of .38 and .26, respectively. The α values of the IPC-18 were below the acceptable limit of .7 to .8 [677] and therefore, the internal consistency of the IPC-18 was found to be poor.

6.3.18 Calculation of the Minimally Clinically Important Difference (MCID)

The calculations for the SEM and ½ *SD* for each PRO are shown in Tables 6.24, 6.25, and 6.26. The SEM and *SD* were calculated using the Cronbach's α and *SD* from the combined data of non-pregnant and pregnant respondents. A comparison of the differences in mean PRO measures between pregnant and non-pregnant women based on the calculated MCIDs revealed that the mean *T*-scores for Depression (i.e., Mean Δ = 3.6 > $MCID_{Overall}$ of 2.35) and the mean scores of the SOC subdomain of Manageability (i.e., Mean Δ = 3.9 > $MCID_{Overall}$ of 3.79) were clinically significantly different in addition to their statistically significant difference. The SOC subdomain of Meaning was statistically

significantly different but not clinically significantly different (i.e., Mean Δ = 3.3 < $MCID_{Overall}$ of 3.48). The mean SOC scores, despite not being statistically significantly different, were clinically significantly different (i.e., Mean Δ = 8.6 > MCID of 6.59).

Table 6.24. PRO MCIDs at T1 Based on SEM and ½ SD with Data from All Respondents

Patient-reported outcome	Mean	*SD*	Cronbach's α	$SEM_{Overall}$	½ *SD*
Physical Function	50.6	7.01	.8226	2.95	3.505
Anxiety	52.8	9.09	.8803	3.14	4.545
Depression	47.8	7.81	.9095	2.35	3.905
Fatigue	53.4	9.00	.9207	2.53	4.5
Sleep Disturbance	51.0	7.34	.8080	3.22	3.67
Ability to Participate in Social Roles and Activities	53.1	7.80	.6699	4.48	3.9
Pain Interference	50.6	8.00	.9463	1.85	4
Pain NRS	2.9	2.10	—	1.39**	1.05
Communication (Lack of clarity)	1.4	0.57	.7011	0.31	0.285
Communication (Elicited concerns, responded)	4.6	0.46	.6440	0.27	0.23
Communication (Explained results)	4.4	0.97	.6166	0.60	0.485
Decision-making (Decided together)	4.3	0.82	.5081	0.58	0.41
Interpersonal Style (Emotional support, compassion)	4.8	0.49	.8032	0.22	0.245
Interpersonal Style (Discriminated due to race/ethnicity)	1.0	0.21	$1.13x10^{-14}$	0.21	0.105
Interpersonal Style (Disrespectful office staff)	1.0	0.16	.1266	0.15	0.08
General Self-Efficacy	32.9	4.38	.9083	1.33	2.19
Internal Locus of Control	25.6	4.84	.7771	2.29	2.42
Chance Locus of Control	13.2	4.92	.8088	2.15	2.46
Doctor Locus of Control	13.4	3.13	.6048	1.97	1.565
Other People Locus of Control	8.3	2.84	.5470	1.91	1.42
SOC	145.1	21.04	.9019	6.59	10.52
Comprehensibility	55.8	8.14	.7944	3.69	4.07
Manageability	50.5	8.45	.7985	3.79	4.225
Meaning	38.7	6.86	.7423	3.48	3.43

Note. PRO = patient-reported outcome; MCID = minimally clinically important difference; SEM = standard error of measurement; NRS = numeric rating scale; SOC = sense of coherence.
** Based on Kendrick et al. [569]

Table 6.25. PRO MCIDs at T1 Based on SEM and ½ SD with Data from Non-Pregnant Women

Domain	Mean	*SD*	Cronbach's α	$SEM_{Non\text{-}Pregnant}$	½ *SD*
Physical Function	51.6	6.76	.8186	2.88	3.38
Anxiety	53.2	9.39	.875	3.32	4.70
Depression	49.2	8.48	.9133	2.5	4.24
Fatigue	52.6	9.46	.9303	2.5	4.73
Sleep Disturbance	50.8	8.04	.8348	3.27	4.02
Ability to Participate in Social Roles and Activities	52.7	8.11	.8914	2.67	4.06
Pain Interference	50.2	8.02	.9447	1.89	4.01
Pain NRS	2.8	2.13	—	1.39**	1.07
Communication (Lack of clarity)	1.3	0.55	.8123	0.24	0.28
Communication (Elicited concerns, responded)	4.6	0.50	.5969	0.32	0.25
Communication (Explained results)	4.4	0.99	.6312	0.6	0.50
Decision-making (Decided together)	4.4	0.70	.2527	0.61	0.35
Interpersonal Style (Emotional support, compassion)	4.7	0.60	.8217	0.25	0.30
Interpersonal Style (Discriminated due to race/ethnicity)	1.0	0.26	$7.88x10^{-15}$	—	0.13
Interpersonal Style (Disrespectful office staff)	1.0	0.15	.0849	0.14	0.08
General Self-Efficacy	32.6	4.75	.9151	1.38	2.38
Internal Locus of Control	25.4	5.31	.8947	1.72	2.66
Chance Locus of Control	13.1	5.20	.8346	2.11	2.60
Doctor Locus of Control	13.1	2.72	.378	2.15	1.36
Other People Locus of Control	8.5	2.96	.2631	2.54	1.48
SOC	141.8	22.81	.9133	6.72	11.41
Comprehensibility	55.1	8.42	.7385	4.31	4.21
Manageability	49.1	9.03	.8145	3.89	4.52
Meaning	37.4	7.17	.7465	3.61	3.59

Note. PRO = patient-reported outcome; MCID = minimally clinically important difference; SEM = standard error of measurement; NRS = numeric rating scale; SOC = sense of coherence.
** Based on Kendrick et al. [569]

Table 6.26. PRO MCIDs at T1 Based on SEM and ½ SD with Data from Pregnant Women

Patient-reported outcome	Mean	*SD*	Cronbach's α	$SEM_{Pregnant}$	½ *SD*
Physical Function	48.8	7.17	.8221	3.02	3.585
Anxiety	52.2	8.68	.8912	2.86	4.34
Depression	45.6	6.01	.8556	2.28	3.01
Fatigue	54.8	8.14	.902	2.55	4.07
Sleep Disturbance	51.5	6.13	.7748	2.91	3.07
Ability to Participate in Social Roles and Activities	53.7	7.34	.8978	2.35	3.67
Pain Interference	51.3	8.05	.9498	1.8	4.03
Pain NRS	3.1	2.08	—	1.39*	1.04
Communication (Lack of clarity)	1.4	0.59	.5402	0.4	0.30
Communication (Elicited concerns, responded)	4.7	0.38	.7316	0.2	0.19
Communication (Explained results)	4.5	0.93	.5962	0.59	0.47
Decision-making (Decided together)	4.3	0.99	.715	0.53	0.50
Interpersonal Style (Emotional support, compassion)	4.9	0.14	.1413	0.13	0.07
Interpersonal Style (Discriminated due to race/ethnicity)	1.0	0		—	0
Interpersonal Style (Disrespectful office staff)	1.0	0.19	.1807	0.17	0.10
General Self-Efficacy	33.4	3.72	.8925	1.22	1.86
Internal Locus of Control	25.9	4.01	.7029	2.19	2.01
Chance Locus of Control	13.5	4.49	.7531	2.23	2.25
Doctor Locus of Control	13.8	3.69	.811	1.6	1.85
Other People Locus of Control	8.1	2.65	.562	1.75	1.33
SOC	150.4	16.8	.8562	6.37	8.40
Comprehensibility	56.8	7.67	.7411	3.90	3.84
Manageability	52.9	6.87	.7272	3.59	3.44
Meaning	40.7	5.89	.6991	3.23	2.95

Note. PRO = patient-reported outcome; MCID = minimally clinically important difference; SEM = standard error of measurement; NRS = numeric rating scale; SOC = sense of coherence.
** Based on Kendrick et al. [569]

6.3.19 Comparison of Mean Values of Primary Outcome Measures Based on Reproductive Age

The mean age of the pregnant women was 31.37 years (n = 35, SD = 4.67, age range: 21–41). Removal of 14 respondents with age ranging from 45-74 years in the non-pregnant group, reduced the non-pregnant mean age to 32.97 years (SD = 5.13, age range: 21–43 years). Not surprisingly, a t-test of independence between the mean age of the pregnant and non-pregnant found no statistically significant differences (t_{70} = 1.3827, p = .1712).

A t-test of independence of the primary outcome measures at baseline based on pregnant and non-pregnant respondents with similar age are shown in Table 6.27. In the PROMIS-29 outcomes, the mean scores for the QoL domains and pain NRS are no longer statistically significantly different between pregnant and non-pregnant women. The QoL domain of Depression was statistically significantly different among pregnant and non-pregnant women when age was not accounted for as a contributing factor. Among the other outcome measures, the SOC subdomains of Manageability and Meaning remains as statistically significantly different. In terms of differences that are clinically significant, the PROMIS-29 domains of Physical Function, Depression, and Pain Interference are now clinically significantly different. The IPC-18 subdomain of Communication (Lack of clarity) and SOC and its subdomain of Manageability are clinically significantly different based on the new calculated SEMs as MCID based on respondent groups with statistically similar age.

Table 6.27. *t*-Test of Independence of the PROs at Baseline Based on Reproductive Age

	Non-pregnant (A)		Pregnant (B)							
Patient-reported outcome	*n*	Mean (*SD*)	*n*	Mean (*SD*)	ΔA-B	95% CI of difference	df	*t*-statistic	*p*-value	SEM
Physical Function	40	52.0 (6.14)	34	49.0 (7.22)	3.0	[-0.109, 6.081]	72	1.9230	.0584	2.95
Anxiety	40	52.8 (9.98)	34	51.9 (8.59)	0.9	[-3.423, 5.289]	72	0.4269	.6708	3.14
Depression	40	49.0 (8.53)	34	45.7 (6.04)	3.3	[-0.18, 6.79]	72	1.8921	.0625	2.35
Fatigue	40	54.1 (8.99	34	55.0 (8.12)	-0.9	[-4.92, 3.11]	72	0.4483	.6553	2.53
Sleep Disturbance	40	50.3 (8.51)	34	51.3 (6.05)	-1.0	[-4.44, 2.52]	72	0.5508	.5834	3.22
Ability to Participate in Social Roles and Activities	40	52.2 (8.24)	34	53.9 (7.39)	-1.7	[-5.31, 2.01]	72	0.9004	.3709	4.48
Pain Interference	40	49.6 (7.76)	34	51.6 (7.99)	-2.0	[-5.63, 1.69]	72	1.0741	.2864	1.85
Pain NRS	40	2.6 (2.07)	34	3.1 (2.11)	-0.5	[-1.46, 0.48]	72	1.0017	.3198	1.39*
Communication (Lack of clarity)	40	1.3 (0.56)	34	1.4 (0.60)	-0.7	[-0.34, 0.20]	72	0.5332	.5955	0.31
Communication (Elicited concerns, responded)	39	4.6 (0.52	34	4.7 (0.38)	-0.1	[-0.40, 0.03]	71	1.7485	.0847	0.27
Communication (Explained results)	40	4.2 (1.13)	34	4.5 (0.91)	-0.3	[-0.78, 0.18]	72	1.2513	.2149	0.60
Decision-making (Decided together)	40	4.3 (0.76)	34	4.2 (1.00)	0.1	[-0., 0.4636]	72	0.2548	.7996	0.58
Interpersonal Style (Emotional support, compassion)	40	4.7 (0.69	34	4.9 (0.14)	-0.2	[-0.45, 0.03]	72	1.7732	.0804	0.22
Interpersonal Style (Discriminated due to race/ethnicity)	40	1.1 (0.32)	34	1.0 (0.00)	0.1	[-0.06, 0.16]	72	0.9210	.3601	0.21
Interpersonal Style (Disrespectful office staff)	40	1.0 (0.18)	34	1.0 (0.19)	0.0	[-0.091, 0.078]	72	0.1561	.8764	0.15
General Self-Efficacy	40	32.7 (4.83)	34	33.2 (3.69)	-0.5	[-2.57, 1.49]	71	0.5334	.5954	1.33
Internal Locus of Control	40	26.6 (5.39)	34	26.0 (4.06)	0.6	[-1.66, 2.82]	72	0.5147	.6083	2.29

Patient-reported outcome	Non-pregnant (A)		Pregnant (B)		ΔA-B	95% CI of difference	df	*t*-statistic	*p*-value	SEM
	n	Mean (*SD*)	*n*	Mean (*SD*)						
Chance Locus of Control	39	12.2 (5.30)	34	13.2 (4.24)	-1.0	[-3.32, 1.20]	71	0.9312	.3549	2.15
Doctor Locus of Control	40	13.2 (2.49)	34	13.7 (3.71)	-0.5	[-1.92, 0.97]	72	0.6571	.5132	1.97
Other People Locus of Control	39	8.7 (3.28)	34	8.1 (2.68)	0.6	[-0.78, 2.04]	71	0.8949	.3738	1.91
Comprehensibility	40	54.8 (7.55)	34	56.8 (7.77	-2.0	[-5.50, 1.62]	72	1.0862	.2810	3.69
Manageability	40	48.8 (9.51)	34	52.7 (6.79)	-3.9	[-7.82, -0.03]	72	2.0105	.0481	3.79
Meaning	39	37.3 (7.45)	34	40.7 (5.97)	-3.4	[-6.52 5, -0.16]	71	2.0927	.0400	3.48
SOC	39	141.2 (22.82)	34	150.1 (16.93)	-8.9	[-18.35, 0.64]	71	1.8596	.0671	6.59

Note. SEM = standard error of measurement; SOC = sense of coherence.
* Based on Kendrick et al. [569]

6.3.20 Comparison of Mean Values of Primary Outcome Measures in Pregnant and Non-Pregnant Women Based on Quartiles of Age

The age quartiles of pregnant and non-pregnant women are provided in Table 6.28. The mean (*SD*) values of the primary outcome measures based on quartiles of age are shown in Table 6.29. To compare the median values of the primary outcome measures at each quartile of age between pregnant and non-pregnant women, the Mann-Whitney *U* Test was performed, and the results summarised in Table 6.30.

Table 6.28. Quartiles of Non-Pregnant and Pregnant Age (in Years)

	Quartiles						Outliers	
Group	Min	Q1	Median	Q3	Max	IQR Q3 - Q1	Low Q1-(1.5*IQR)	High Q3+(1.5*IQR)
Non-pregnant	19	31.3	34.2	44.5	74	13.3	⩽ 11.4	⩾ 64.4
Pregnant	23	28	31.5	34	41	6	⩽ 19	⩾ 43

The median values between pregnant and non-pregnant women for Ability to Participate in Social Roles and Activities at quartile 2 was found to be statistically significantly different as were Pain Interference, Pain NRS and Doctors Locus of Control quartile 3. These findings confirm that intrinsic differences exist with respect to the primary outcome measures in pregnant and non-pregnant cohorts as measured by the PROMIS-29, SOC-29, and IPC-18.

Table 6.29. Descriptive Statistics of PROs Based on Quartiles of Age

	$Q1_{Non\text{-}Pregnant}$	$Q1_{Pregnant}$	$Q2_{Non\text{-}Pregnant}$	$Q2_{Pregnant}$	$Q3_{Non\text{-}Pregnant}$	$Q3_{Pregnant}$	$Q4_{Non\text{-}Pregnant}$	$Q4_{Pregnant}$
	Mean (*SD*)	Mean (*SD*)	Mean (*SD*)	Mean (*SD*)	Mean (*SD*)	Mean (*SD*)	Mean (*SD*)	Mean (*SD*)
PRO *n*	11	8	14	8	15	7	14	11
Physical Function	52.2 (6.56)	50.66(8.80)	51.49 (5.89)	51.20 (6.22)	52.94 (6.05)	46.24 (7.89)	49.49 (8.48)	47.876.28)
Anxiety	53.9 (10.22)	54.26 (7.62)	53.19 (9.71)	51.68 (7.89)	51.73 (10.63)	53.76 (9.68)	54.38 (7.91)	49.21 (9.38)
Depression	51.6 (8.19)	45.00 (7.91)	47.39 (9.06)	44.61 (5.21)	48.65 (8.40)	46.93 (5.98)	49.89 (9.09)	46.26 (5.79)
Fatigue	58.0 (6.71)	54.01 (7.59)	52.60 (10.72)	56.51 (5.54)	52.57 (8.33)	57.81 (9.32)	50.24 (10.02)	52.78 (9.69)
Sleep Disturbance	49.3 (10.86)	52.04 (4.11)	53.12 (6.97)	50.00 (5.81)	48.46 (7.74)	51.43 (10.22)	53.62 (5.87)	51.55 (4.57)
Ability to Participate in Social Roles and Activities	51.9 (6.82)	55.27	48.35 (8.99)	57.15	56.10 (7.05)	50.70	51.51 (6.85)	52.55
Pain Interference	51.4 (8.06)	49.14 (8.93)	49.56 (7.81)	53.10 (3.28)	48.29 (7.78)	56.09 (7.73)	52.90 (8.60)	49.30 (9.21)
Pain NRS	3.4 (2.01)	2.63 (2.45)	2.64 (2.10)	3.88 (1.13)	2.00 (2.04)	4.43 (2.07)	3.71 (2.30)	2.00 (1.95)
Communication (Lack of clarity)	1.4 (0.63)	1.56 (0.90)	1.29 (0.47)	1.38 (0.58)	1.33 (0.62)	1.43 (0.45)	1.39 (0.59)	1.27 (0.47)
Communication (Elicited concerns, responded)	4.6 (0.50)	4.75 (0.30)	4.51 (0.53)*	4.75 (0.39)	4.58 (0.54)	4.57 (0.57)	4.50 (0.48)	4.82 (0.31)
Communication (Explained results)	3.6 (1.50)	4.50 (0.71)	4.39 (0.92)	4.75 (0.46)	4.47 (0.90)	4.29 (1.07)	4.75 (0.33)	4.50 (1.20)
Decision-making (Decided together)	4.1 (0.74)	4.38 (0.69)	4.21 (0.89)	4.56 (0.50)	4.47 (0.64)	3.29 (1.38)	4.46 (0.54)	4.50 (0.92)
Interpersonal Style (Emotional support, compassion)	4.4 (1.18)	4.92 (0.15)	4.79 (0.31)	4.96 (0.12)	4.84 (0.38)	4.86 (0.18)	4.79 (0.31)	4.94 (0.13)

PRO		$Q1_{Non\text{-}Pregnant}$ Mean (*SD*)	$Q1_{Pregnant}$ Mean (*SD*)	$Q2_{Non\text{-}Pregnant}$ Mean (*SD*)	$Q2_{Pregnant}$ Mean (*SD*)	$Q3_{Non\text{-}Pregnant}$ Mean (*SD*)	$Q3_{Pregnant}$ Mean (*SD*)	$Q4_{Non\text{-}Pregnant}$ Mean (*SD*)	$Q4_{Pregnant}$ Mean (*SD*)
	n	11	8	14	8	15	7	14	11
Interpersonal Style (Discriminated due to race/ethnicity)		1.2 (0.63)	1.0 (0.00)	1.00 (0.00)	1.0 (0.00)	1.00 (0.00)	1.0 (0.00)	1.00 (0.00)	1.0 (0.00)
Interpersonal Style (Disrespectful office staff)		1.1 (0.15)	1.2 (0.37)	1.0 (0.00)	1.0 (0.00)	1.1 (0.26)	1.0 (0.00)	1.0 (0.07)	1.0 (0.00)
General Self-Efficacy		32.5 (4.72)	30.9 (3.09)	31.5 (5.77)*	34.1 (3.04)	33.9 (3.99)	33.7 (4.54)	31.7 (4.79)	34.0(3.66)
Internal Locus of Control		27.4 (5.50)	27.3 (2.96)	25.9 (5.65)	25.4 (4.17)	26.5 (5.37)	25.6 (4.54)	23.3 (4.36)	25.73 (4.67)
Chance Locus of Control		12.0 (5.68)*	13.3 (3.20)	12.9 (6.07)	12.9 (3.94)	11.7 (4.51)	13.4 (5.16)	14.7 (4.39)	13.4 (5.00)
Doctor Locus of Control		14.2 (1.99)	12.9 (4.39)	13.4 (2.92)	15.6 (1.30)	12.3 (2.22)	14.56 (1.99)	12.3 (3.27)	12.3 (4.69)
Other People Locus of Control		8.8 (4.26)*	6.9 (3.27)	9.3 (2.87)	8.6 (1.99)	8.1 (3.01)	8.0 (2.58)	7.9 (2.21)	8.6 (2.81)
Comprehensibility		53.7 (---)	53.5 (12.02)	53.5 (---)	58.1 (5.72)	56.9 (---)	56.4 (8.36)	53.9 (---)	58.4 (4.52)
Manageability		48.0 (8.27)	51.4 (8.18)	47.0 (9.24)	52.9 (5.06)	52.2 (9.19)	51.3 (7.52)	48.9 (8.56)	54.4 (6.90)
Meaning		34.9 (8.42)	40.5 (7.65)	36.1 (6.47)*	38.3 (4.59)	40.1 (7.03)	40.9 (4.22)	36.7 (7.05)	42.4 (6.59)
SOC		134.9 (24.66)	145.4 (22.02)	137.4 (21.73)*	149.3 (13.93)	149.2 (21.49)	148.6 (16.54)	139.5 (24.30)	155.1 (16.10)

Note. PRO = patient-reported outcome; SD = standard deviation; NRS = numeric rating scale; SOC = sense of coherence.
* $n = 13$.

Table 6.30. Mann-Whitney *U* Test of Patient-Reported Outcome Measures Based on Quartiles of Age

	Q1			Q2			Q3			Q4		
Patient-reported outcome	*U*-value	z-test	*p*-value	*U*-value	*z*-test	*p*-value	*U*-value	*z*-test	*p*-value	*U*-value	*z*-test	*p*-value
Physical function	44.5	0	1	53.5	0.1365	.8887	26.5	1.7975	.0719	67	0.5201	.6031
Anxiety	44.5	0	1	49.5	0.4095	.6818	50	-0.1410	.8887	49	1.5055	.1310
Depression	23.5	1.6515	.0989	49	0.4436	.6599	47.5	0.3172	.7490	59	0.9580	.3371
Fatigue	29	1.1973	.2301	45.5	-0.6825	.4965	36.5	-1.0926	.2757	68.5	-0.4380	.6599
Sleep Disturbance	39	-0.3716	.7114	47	0.5802	.5619	38	-0.9869	.3222	64	0.6843	.4965
Ability to Participate in Social Roles and Activities	30	-1.1147	.267	19.5	-2.4571	.0139	29	1.6213	.1052	69	-0.4006	.6818
Pain Interference	38.5	0.4129	.6818	43.5	-0.8190	.4122	22	-2.1147	.0349	58.5	0.9854	.3222
Pain NRS	34	0.7844	.4354	34.5	-1.4333	.1527	20	-2.2557	.0238	42	1.8887	.0588
Communication (Lack of clarity)	40.5	-0.2478	.8026	53	-0.1706	.8650	41	-0.7754	.4354	69.5	0.3832	.7039
Communication (Elicited concerns, responded)	35	-0.7019	.4839	38	-0.9777	.3270	50.5	-0.1057	.9124	46	-1.6697	.0949
Communication (Explained results)	32.5	-0.9083	.3628	45	-0.7167	.4715	47	0.3525	.7263	70	-0.3558	.7188
Decision-making (Decided together)	36	-0.6193	.5353	45	-0.7167	.4715	26.5	1.7975	.0719	61	-0.8486	.3953
Interpersonal Style (Emotional support, compassion)	36	-0.6193	.5353	38	-1.1944	.2340	44	0.5639	.5755	55	-1.1770	.2380
Interpersonal Style (Discriminated due to race/ethnicity)	40	0.2890	.7718	56	0.0341	.9761	52.5	0.0353	.9681	77	0.0274	.9761
Interpersonal Style (Disrespectful office staff)	36.5	-0.5780	.5619	56	0.0341	.9761	49	0.2115	.8337	71.5	0.2737	.7872
General Self-Efficacy	28	1.2799	.2005	35	-1.1949	.2340	52	0	1	46.5	-1.6424	.1010
Internal Locus of Control	41.5	-0.1651	.8650	53	0.1706	.8650	50	0.1410	.8887	49.5	-1.4781	.1389

	Q1			Q2			Q3			Q4		
Patient-reported outcome	*U*-value	z-test	*p*-value	*U*-value	*z*-test	*p*-value	*U*-value	*z*-test	*p*-value	*U*-value	*z*-test	*p*-value
Chance Locus of Control	26.5	-1.1551	.2460	54	-0.1024	.9203	39	-0.9164	.3576	63	0.7391	.4593
Doctor Locus of Control	38	0.4542	.6527	31.5	-1.6381	.1010	23.5	-2.0090	.0444	68	-0.4653	.6383
Other People Locus of Control	31	0.7552	.4473	45.5	0.6825	.4965	47.5	0.3172	.7490	64.5	-0.6595	.5093
Comprehensibility	41	-0.2072	.8359	36	-1.3309	.1835	52	0	1	56	-1.1223	.2627
Manageability	33.5	-0.8275	.4079	32	-1.6039	.1096	47	0.3524	.7263	43	-1.8340	.0672
Meaning	27	-1.3654	.1721	39.5	-0.8691	.3843	50.5	-0.1974	.9124	43	-0.8340	.0672
SOC	32	-0.9504	.3419	34	-1.2674	.2041	52	0	1	47	-1.6150	.1074

Note. NRS = numeric rating scale; SOC = sense of coherence.

6.3.21 Examination of Primary Outcome Measures of Pregnant and Non-Pregnant Women Based on Patient Visits

As noted in Section 4.4, a statistically significant difference was found in the median values of patient visits between non-pregnant and pregnant women (z-score = 3.7342, $U = 453$, $p = .0002$). The maximum number of patient visits attended by a pregnant woman was 110 visits. This more than likely was the lifetime number of patient visits attended by the respondents as the respondent was pregnant at 20 WOG and indicated as having received chiropractic care prior to being pregnant. This was applied as the cutoff for the maximum number of visits for the non-pregnant women for comparison purposes. After the removal of respondents in the non-pregnant cohort with visits greater than 110 ($n = 16$), the mean number of visits from the non-pregnant women was 37.08 visits ($n = 37$, $SD = 31.04$, range:1–100 visits). An independent t-test of the visit numbers between pregnant and non-pregnant women was not statistically different ($t_{df=68} = 1.5472$, $p = .1264$).

The removed data from the non-pregnant population consisted of 20 respondents with patient visits ranging from 132 visits to 1500 visits. The mean number of visits from 16 of these 20 respondents was 520 ($n = 16$, $SD = 400.51$, range: 132–1500 visits). There were 4 non-pregnant and 2 pregnant respondents who did not indicate their number of visits. The results of a new independent t-test between pregnant and non-pregnant respondents are shown in Table 6.31.

For the PROMIS-29, the differences in pregnant and non-pregnant mean Depression T-scores were found to be statistically and clinically significantly different. Anxiety was found to be clinically significantly different but not statistically significantly different. For the IPC-18, Communication (Elicited concerns, responded) was found to be statistical significantly different but not clinically significantly different. SOC and its

subdomains of Manageability and Meaning were statistically and clinically significantly different.

Table 6.31. *t*-Test of Independence of Patient-Reported Outcome Measures between Pregnant and Non-Pregnant Women Patient Visits

	Pregnant Women (A)		Non-pregnant women (B)							
Patient-reported outcome	*n*	Mean (*SD*)	*n*	Mean (*SD*)	Δ_{A-B}	95% CI of difference	df	*t*-statistic	*p*-value	SEM
Physical Function	33	48.3 (7.09)	37	50.9 (7.19)	2.6	[-0.855, 5.974]	68	1.4957	.1394	2.95
Anxiety	33	52.1 (8.92)	37	56.2 (8.57)	4.1	[-0.071, 8.279]	68	1.9614	.0539	3.14
Depression	33	45.9 (6.08)	37	50.9 (8.37)	5.0	[1.554, 8.607]	68	2.8748	.0054	2.35
Fatigue	33	54.7 (825)	37	54.4 (9.07)	-0.3	[-4.458, 3.846]	68	0.1470	.8836	2.53
Sleep Disturbance	33	51.7 (6.30)	37	51.7 (8.61)	0.0	[-3.623, 3.645]	68	0.0062	.9951	3.22
Ability to Participate in Social Roles and Activities	33	53.3 (7.28)	37	51.3 (8.59)	-2.0	[-5.777, 1.865]	68	1.0215	.3106	4.48
Pain Interference	33	51.5 (8.10)	37	51.8 (8.48)	0.3	[-3.692, 4.242]	68	0.1383	.8904	1.85
Pain NRS	33	3.2 (2.11)	37	3.3 (2.24)	0.1	[-0.92, 1.16]	68	0.2274	.8208	1.39*
Communication (Lack of clarity)	33	1.4 (0.60)	37	1.2 (0.51)	-0.2	[-0.459, 0.070]	68	1.4668	.1470	0.31
Communication (Elicited concerns, responded)	33	4.7 (0.39)	36	4.5 (0.52)	-0.2	[-0.4500, -0.000]	67	2.0494	.0443	0.27
Communication (Explained results)	33	4.4 (0.95)	37	4.2 (1.14)	-0.2	[-0.754, 0.253]	68	0.9914	.3250	0.60
Decision-making (Decided together)	33	4.2 (1.01)	37	4.4 (0.79)	0.2	[-0.276, 0.582]	68	0.7104	.4799	0.58
Interpersonal Style (Emotional support, compassion)	33	4.9 (0.14)	37	4.7 (0.69)	-0.2	[-0.4525, 0.0425]	68	1.6942	.0948	0.22
Interpersonal Style (Discriminated due to race/ethnicity)	33	1.0 (0.00)	37	1.1 (0.33)	0.0	[-0.06, 0.17]	68	0.9437	.3487	0.21
Interpersonal Style (Disrespectful office staff)	33	1.1 (0.19)	37	1.1 (0.18)	0.0	[-0.0881, 0.0918]	68	0.0409	.9675	0.15
General Self-Efficacy	33	33.5 (3.82)	36	32.2 (4.75)	-1.3	[-3.37, 0.79]	67	1.2346	.2213	1.33
Internal Locus of Control	33	26.1 (3.99)	37	24.4 (5.02)	-1.7	[-3.84, 0.53]	68	1.5145	.1345	2.29

Patient-reported outcome	Pregnant Women (A)		Non-pregnant women (B)		Δ_{A-B}	95% CI of difference	df	*t*-statistic	*p*-value	SEM
	n	Mean (*SD*)	*n*	Mean (*SD*)						
Chance Locus of Control	33	13.7 (4.56)	36	14.1 (5.47)	0.4	[-2.07, 2.79]	67	0.2944	.7693	2.15
Doctor Locus of Control	33	13.6 (3.68)	37	13.5 (2.77)	-0.1	[-1.60, 1.48]	68	0.0762	.9394	1.97
Other People Locus of Control	33	8.0 (2.58)	36	9.2 (3.08)	1.2	[-0.15, 2.60]	67	1.7825	.0792	1.91
Comprehensibility	33	56.6 (7.82)	37	53.9 (8.12	-2.7	[-6.55, 1.07]	68	1.4343	.1562	3.69
Manageability	33	52.9 (7.07)	37	46.9 (8.50)	-6.0	[-9.80, -2.28]	68	3.2086	.0020	3.79
Meaning	33	40.9 (6.00)	36	35.9 (6.66)	-5.0	[-7.99, -1.88]	67	3.2207	.0020	3.48
SOC	33	150.3 (17.30)	36	136.9 (21.47)	-13.4	[-222.84, -3.99]	67	2.8416	.0059	6.59

Note. SD = standard deviation; SEM = standard error of measurement; NRS = numeric rating scale; SOC = sense of coherence.
* Based on Kendrick et al. [569]

6.3.22 Comparison of Mean Values of Primary Outcome Measures Based on Quartiles of Patient Visits

The quartiles data based on patient visits is provided in Table 6.32. The descriptive statistics of primary outcome measures based on quartiles of age are shown in Table 6.33 below. Mann-Whitney *U* Test comparing the primary outcome measures of pregnant and non-pregnant women based on quartiles of age of are shown in Table 6.34.

Table 6.32. Quartiles of Non-Pregnant and Pregnant Respondents Based on Patient Visits

	Quartiles						Outliers	
Group	Min	Q1	Median	Q3	Max	IQR Q3 - Q1	Low Q1-(1.5*IQR)	High Q3+(1.5*IQR)
Non-pregnant	1	10	30	50	100	40	-50	110
Pregnant	2	9	14	40	110	31	-37.5	86.5

In quartile 1, the PROMIS-29 domain of Depression and the SOC subdomain of Meaning were statistically significantly different. In quartile 2, the PROMIS-29 domains of Anxiety and Depression were statistically significantly different. In quartile 3, the MHLOC domain of Internal Locus of Control was statistically significantly different. In quartile 4, the SOC subdomain of Manageability was statistically significantly different.

These findings confirm that intrinsic differences exist with respect to the primary outcome measures in pregnant and non-pregnant cohorts.

Table 6.33. Descriptive Statistics of Patient-Reported Outcome Measures Based on Quartiles of Patient Visits

	$Q1_{Non\text{-}Pregnant}$	$Q1_{Pregnant}$	$Q2_{Non\text{-}Pregnant}$	$Q2_{Pregnant}$	$Q3_{Non\text{-}Pregnant}$	$Q3_{Pregnant}$	$Q4_{Non\text{-}Pregnant}$	$Q4_{Pregnant}$
	Mean (*SD*)	Mean (*SD*)	Mean (*SD*)	Mean (*SD*)	Mean (*SD*)	Mean (*SD*)	Mean (*SD*)	Mean (*SD*)
PRO *n*	5	7	13	8	7	9	12	9
Physical Function	46.0 (8.04)	45.1 (5.84)	53.7 (5.25)	48.4 (7.26)	50.0 (8.92)	48.2 (7.65)	50.4 (7.16)	50.9 (7.40)
Anxiety	59.2 (4.97)	53.2 (10.09)	55.6 (9.38)	46.3 (7.27)	60.0 (6.13)	51.7 (9.76)	53.4 (9.63)	56.7 (6.45)
Depression	56.8 (6.21)	46.3 (5.23)	50.9 (7.41)	43.0 (3.70)	52.9 (8.41)	45.9 (8.03)	47.34 (9.20)	48.1 (6.10)
Fatigue	52.9 (4.65)	57.9 (7.82)	54.9 (10.58)	49.8 (5.86)	55.5 (7.54)	55.1 (11.07)	53.8 (10.26)	56.1 (6.19)
Sleep Disturbance	48.6 (10.24)	52.9 (4.03)	51.2 (10.21)	52.1 (2.93)	51.6 (8.93)	50.0 (9.10)	53.5 (6.23)	52.1 (7.21)
Ability to Participate in Social Roles and Activities	49.6 (3.44)	51.9 (8.43)	51.0 (7.84)	54.5 (5.36)	53.6 (8.93)	54.9 (6.10)	51.1 (11.02)	51.6 (9.32)
Pain Interference	47.9 (9.34)	53.6 (6.90)	52.2 (8.01)	51.5 (8.66)	54.3 (9.83)	54.4 (7.31)	51.4 (8.35)	47.0 (8.46)
Pain NRS	2.6 (3.21)	3.7 (1.38)	3.1 (1.38)	3.1 (2.03)	3.7 (3.30)	3.8 (2.54)	3.5 (2.07)	2.1 (2.09)
Communication (Lack of clarity)	1.0 (0.00)	1.6 (0.61)	1.4 (0.67)	1.2 (0.37)	1.4 (0.63)	1.6 (0.85)	1.0 (0.14)	1.4 (0.49)
Communication (Elicited concerns, responded)	4.5 (0.51)	4.7 (0.36)	4.6 (0.44)	4.8 (0.31)	4.3 (0.58)	4.7 (0.42)	4.6 (0.62)	4.7 (0.48)
Communication (Explained results)	3.8 (1.04)	4.5 (0.76)	4.1 (1.43)	4.1 (1.46)	4.4 (1.13)	4.4 (0.81)	4.3 (0.89)	4.7 (0.71)
Decision-making (Decided together)	4.6 (0.42)	4.2 (0.91)	4.4 (0.66)	4.8 (0.46)	4.4 (0.79)	3.9 (1.01)	4.3 (1.06)	4.0 (1.35)
Interpersonal Style (Emotional support, compassion)	44.9 (0.18)	4.9 (0.16)	4.5 (1.02)	5.0 (0.12)	4.7 (0.75)	4.9 (0.17)	4.9 (0.22)	4.9 (0.15)

PRO	*n*	$Q1_{Non\text{-}Pregnant}$ Mean (*SD*) 5	$Q1_{Pregnant}$ Mean (*SD*) 7	$Q2_{Non\text{-}Pregnant}$ Mean (*SD*) 13	$Q2_{Pregnant}$ Mean (*SD*) 8	$Q3_{Non\text{-}Pregnant}$ Mean (*SD*) 7	$Q3_{Pregnant}$ Mean (*SD*) 9	$Q4_{Non\text{-}Pregnant}$ Mean (*SD*) 12	$Q4_{Pregnant}$ Mean (*SD*) 9
Interpersonal Style (Discriminated due to race/ethnicity)		1.0 (0.00)	1.0 (0.00)	1.2 (0.55)	1.0 (0.00)	1.0 (0.00)	1.0 (0.00)	1.0 (0.00)	1.0 (0.00)
Interpersonal Style (Disrespectful office staff)		1.0 (0.00)	1.0 (0.00)	1.1 (0.28)	1.1 (0.18)	1.1 (0.19)	1.0 (0.00)	1.0 (0.07)	1.1 (0.33)
General Self-Efficacy		31.8 (3.96)	34.0 (3.65)	32.5 (3.69)	32.8 (4.20)	31.6 (4.58)	33.6 (4.50)	32.3 (6.57)*	33.6 (3.49)
Internal Locus of Control		26.8 (6.72)	24.1 (4.63)	25.5 (4.10)	26.6 (3.34)	21.3 (3.35)	26.9 (3.33)	24.1 (5.60)	26.2 (4.74)
Chance Locus of Control		10.8 (2.95)	15.6 (4.28)	11.5 (3.00)**	14.1 (3.94)	18.1 (6.09)	13.9 (4.29)	15.6 (6.13)	11.7 (5.43)
Doctor Locus of Control		11.8 (3.27)	15.6 (1.40)	13.2 (2.09)	13.9 (2.85)	13.4 (2.76)	12.8 (3.38)	14.5 (3.12)	12.4 (5.34)
Other People Locus of Control		7.8 (2.39)	9.1 (1.86)	9.2 (2.79)**	7.8 (3.77)	10.1 (3.71)	7.6 (2.30)	9.3 (3.36)	7.7 (2.18)
Comprehensibility		53.8 (5.36)	55.0 (7.53)	54.0 (8.30)	60.8 (2.55)	54.9 (6.26)	52.9 (11.49)	53.2 (10.38)	57.9 (5.25)
Manageability		46.2 (8.79)	51.7 (5.99)	47.2 (8.61)	52.3 (5.60)	49.0 (7.96)	55.0 (5.77)	45.5 (9.38)	55.0 (5.77)
Meaning		33.0 (3.16)	40.9 (3.44)	36.2 (7.37)	41.6 (4.27)	36.4 (8.62)	40.8 (8.90)	36.6 (6.04)*	40.2 (6.24)
SOC		133.0 (15.28)	147.6 (14.19)	137.3 (22.43)	154.6 (10.11)	140.3 (22.34)	145.9 (26.30)	136.1 (24.51)*	153.3 (14.45)

Note. PRO = patient-reported outcome; SD = standard deviation; NRS = numeric rating scale; SOC = sense of coherence.
*n = 11. ** n = 12

Table 6.34. Mann-Whitney *U* Test of Patient-Reported Outcome Measures Based on Quartiles of Patient Visits

	Q1			Q2			Q3			Q4		
Patient-reported outcome	*U*-value	*z*-test	*p*-value	*U*-value	*z*-test	*p*-value	*U*-value	*z*-test	*p*-value	*U*-value	*z*-test	*p*-value
Physical Function	13.5	-0.5684	.5687	29	1.6295	.1031	28	-0.3176	.7490	52.5	-0.0711	.9442
Anxiety	12.5	-0.7308	.4654	22.5	2.1002	.0357	18	-1.3761	.1676	43	-0.7462	.4533
Depression	3.5	-2.1924	.0285	20	2.2813	.0226	15.5	-1.6407	.1010	47	-0.4619	.6455
Fatigue	10.5	1.0556	.2891	31.5	1.4484	.1471	31	0	1	47.5	-0.4264	.6672
Sleep Disturbance	13.5	0.5684	.5687	49.5	-0.1448	.8887	27	-0.4234	.6745	51	0.1777	.8572
Ability to Participate in Social Roles and Activities	14	0.4871	.6241	39.5	-0.8691	.3843	28.5	0.2646	.7949	51.5	0.1421	.8887
Pain Interference	10.5	1.0556	.2891	51	0.0362	.9681	29.5	-0.1588	.8729	37.5	1.1371	.2543
Pain NRS	13.5	0.5684	.5687	52	0.0362	.9681	30	0.1059	.9124	33.5	1.4213	.1556
Communication (Lack of clarity)	7.5	1.5428	.1236	43.5	0.5794	.5619	27.5	0.3705	.7114	28	-1.8122	.0703
Communication (Elicited concerns, responded)	13	0.6496	.5157	32	-1.4122	.1585	19	1.2702	.2041	43	-0.4558	.6455
Communication (Explained results)	9.5	1.2180	.2225	49.5	-0.1448	.8887	26.5	-0.4763	.6312	43	-0.7462	.4533
Decision-making (Decided together)	13.5	-0.5684	.5687	31	-1.4846	.1389	22	-0.9527	.3421	47.5	0.4264	.6672
Interpersonal Style (Emotional support, compassion)	14.5	0.4060	.6818	37	-1.0501	.2937	31	0	1	47	-0.4619	.6455
Interpersonal Style (Discriminated due to race/ethnicity)	17.5	0.0812	.9362	48	0.2535	.8026	31.5	0.0529	.9601	54	0.0355	.9681
Interpersonal Style (Disrespectful office staff)	17.5	0.0812	.9362	50	-0.1086	.9124	27	-0.4234	.6745	52	-0.1066	.9124
General Self-Efficacy	10	1.1368	.2543	50.5	-0.0724	.9442	24	0.7410	.4593	44.5	-0.3419	.7279
Internal Locus of Control	14.5	-0.406	.6818	42	-0.6880	.4902	7.5	2.4875	.0128	36.5	-1.2081	.2263

	Q1			Q2			Q3			Q4		
Patient-reported outcome	*U*-value	*z*-test	*p*-value	*U*-value	*z*-test	*p*-value	*U*-value	*z*-test	*p*-value	*U*-value	*z*-test	*p*-value
Chance Locus of Control	7	1.6240	.1052	28.5	-1.4659	.1416	18.5	-1.3231	.1868	33	1.4569	.1443
Doctor Locus of Control	3.5	2.1924	.0285	42.5	-0.6518	.5157	28	-0.3176	.7490	41.5	0.8528	.3953
Other People Locus of Control	11	0.9744	.3320	37.5	0.7715	.4413	16	-1.5878	.1118	36.5	1.2081	.2263
Comprehensibility	16.5	0.0812	.9362	26	-1.8467	.0643	30.5	0.0529	.9601	39	-1.0305	.3030
Manageability	10	1.1368	.2543	35.5	-1.1587	.2460	27	0.4234	.6745	18.5	-2.4873	.0128
Meaning	1.5	2.5172	.0117	26.5	-1.8105	.0703	25	0.6351	.5221	35	-1.0636	.2991
SOC	10	1.1368	.2543	27.5	-1.7381	.0819	26.5	0.4763	.6312	28.5	-1.5575	.1188

Note. PRO = patient-reported outcome; NRS = numeric rating scale; SOC = sense of coherence.

6.4 Discussion

This study examined the sociodemographic information (i.e., age, educational attainment, family income), clinical covariates (patient status, number of patient visits, gestation age, presenting complaints, concurrent care), and measures of SOC, QoL, GSE, MHLOC, and IPC experience in pregnant and non-pregnant women under chiropractic care.

As discussed in Chapter 5 Section 5.5.1 Response Rate, the poor response rate among chiropractor respondents due to the Covid-19 pandemic may have also played a role in the lack of recruitment by chiropractors for pregnant and non-pregnant patient participants in this study.

Overall, the average age of respondents was 36.08 years with non-pregnant women being significantly older that the pregnant women. Both groups of respondents were highly educated with the majority in both groups attaining a baccalaureate degree of higher. The majority (84%) of respondents were White with Asians, Hispanics, African American and Multicultural comprising less than 5% as a group of respondents. At the time of the study, the respondents had attended a mean of 122.7 visits, with the pregnant women attaining a significantly lower mean number of visits (i.e., mean visits = 26.0) compared to the non-pregnant women (mean visits = 182.8). With respect to their patient status, the majority of patients identified themselves as long-standing patients (n = 65), followed by established patients (n = 25) and new patients (n = 2). The mean family income of the respondents was $143 985, with the pregnant women having a significantly greater mean family income of $153 222 compared to the non-pregnant women's mean family income of $137 750.

Pregnant respondents initiated the survey at a mean week of gestation of 26.4 weeks. Seventeen (48.6%) of the 35 pregnant women indicated that they were a chiropractic patient prior to their pregnancy, while a similar proportion (n = 17; 48.6%)

indicated they had no chiropractic experience prior to their pregnancy. Both groups of respondents indicated presenting for chiropractic care with complaints associated with the MSK system and headaches.

All the respondents indicated receiving some form of spinal adjustment or SMT and the use of adjunctive therapies and commonly identified as exercise and active rehabilitation, use of vitamins and minerals, dietary and nutrition counselling, and postural education.

Concurrent care among the pregnant and non-pregnant women differed significantly. Pregnant women were under the care of midwives followed by an obstetrician/gynaecologist, and massage therapists, while the non-pregnant women were under the care with Medical Doctors or Doctors of Osteopathy followed by a massage therapist and obstetrician/gynecologist. Not surprisingly, the type of care provided by the other healthcare providers also differed in a significant way. Among the non-pregnant women, the use of medication was notable while the pregnant women were cared for with the use of vitamins and minerals, diet and nutrition, and herbal remedies.

Pregnant and non-pregnant respondents of similar age differed in their SOC scores and in the SOC subdomain scores of Manageability and Meaning in a statistically significant manner. Clinically, Physical Functioning, Pain Interference, and Depression differed in a significant manner. Pregnant and non-pregnant women with similar patient visits differed in Depression, scores in Communication (Elicited concerns, responded), in SOC scores and its subdomain scores of Manageability and Meaning in a statistically significant manner. Clinically, Anxiety, Depression, SOC and its subdomain of Manageability, and Meaning were significantly different.

With the PROMIS-29 *T*-scores, strong intercorrelations were observed in the physical health domains (i.e., Physical Function, Pain Interference and Pain NRS) and

mental health domains (i.e., Anxiety and Depression) in both pregnant and non-pregnant respondents. Fatigue, Sleep Disturbance, and Ability to Participate in Social Roles and Activities had moderate to strong intercorrelations and moderate to strong intracorrelations with the mental and physical health domains. Among all the respondents, the IPC-18 correlations demonstrated that in both pregnant and non-pregnant women, there was moderate correlation between Decision-making (Decided together) with the domain of Interpersonal style (Compassionate, respectful). Overall, Communication (Elicited concerns, responded) had a moderate correlation with Decision-making (Decided together) and Interpersonal Style (Emotional support, compassion) while Communication (Explained results) moderately correlated with Decision-making (Decided together), Interpersonal Style (Emotional support, compassion), and Interpersonal Style (Discriminated due to race/ethnicity). With MHLOC subdomains, overall, Internal LOC was moderately correlated with Chance and Other People LOC. The SOC subdomains (i.e., Comprehensibility, Manageability, Meaning) had strong intercorrelations and strong correlations with SOC.

Overall, GSE was moderately correlated with the PROMIS-29 QoL domains of Anxiety, Depression, and Sleep Disturbance; moderately correlated with the MHLOC domains of Chance LOC and Doctors LOC; and strongly correlated with the SOC and its subdomains of Comprehensibility, Manageability, Meaning.

SOC had moderate to strong correlations with the subdomains of the PROMIS-29 except with Physical Function among pregnant women. SOC was also moderately correlated with Communication (Elicited concerns, responded) among non-pregnant women and strongly correlated with Communication (Lack of clarity) and moderately correlated with Interpersonal Style (Emotional support, compassion). Correlation between

SOC and the subdomains of MHLOC was moderate, with the Chance LOC among non-pregnant women and strongly correlated with Internal LOC among pregnant women.

Multivariate regression analysis with SOC as the independent variable found that Depression and GSE scores were predictive of SOC, regardless of the data source (i.e., pregnant respondents, non-pregnant respondents, or combined data).

To date this is the most comprehensive characterisation of the practice of chiropractic specific to pregnancy care. While the handful of previous studies have provided important insights into the practitioners involved in pregnancy care [53, 114], their management protocols [114, 256, 260-264] and patient characteristics [113, 254, 258, 260, 262, 267, 332, 678], the information provided often lacked rich, in-depth examination of these core aspects of chiropractic pregnancy care or lacked coherence. Among the studies found, samples were at times drawn from small samples and in those studies involving chiropractor respondents, the practitioners did not have focus on pregnancy care and therefore poorly reflect the day-to-day practice of pregnancy care. The information provided in this study were from pregnant and non-pregnant patients under the care of chiropractors experienced in the care of women, including pregnancy care.

6.4.1 Sociodemographic Information

The sociodemographic information provided by the pregnant respondents in this study are consistent with the literature on chiropractic pregnancy care. The mean age of our pregnant respondents was 31.4 years which is consistent with the age of women in Canada and the United States having children and those of pregnant women involved in studies on the chiropractic care of pregnant women. [408, 679] In Chapter 2 of this thesis, the quantitative systematic review of the literature on chiropractic pregnancy care found the average age of pregnant women at 30.6 years from 12 studies involving 1455 subjects. The mean age (39.3 years) of the non-pregnant respondents in this study is consistent with

patients attending chiropractic care in the United States [679], where the majority of the study respondents resided. In terms of race or ethnicity, the majority of the study respondents were White and consistent with findings of the US Practice of Analysis of Chiropractic 2020 where 90.8% of chiropractic patients were identified as White. [680] In a scoping review of chiropractic utilisation based on sociodemographic factors including income level, Gliedt et al. [681] found that chiropractic utilisation was most common in individuals with individual or household/family annual income between $40 000 and $60 000 and from individuals with a high school diploma or completion of a general educational development (GED) certificate. The chiropractic respondents in this study were relatively more educated (i.e., baccalaureate degree or higher) and more affluent with a mean household income of $143 985. The mean week of gestation (i.e., 26.0 weeks) of the pregnant respondents in this study is consistent with the mean weeks of gestation of 25.86 weeks documented among respondents in 11 studies involving 1177 pregnant women (see Chapter 2. Chiropractic Care During Pregnancy: A Quantitative Systematic Review of the Literature).

6.4.2 Presenting Complaints of Pregnant Women

The majority of pregnant and non-pregnant women in this study presented with complaints associated with the MSK system. This is consistent with chiropractic patients in general [11] and among pregnant women in particular (see Chapter 2. The Chiropractic Care of Pregnant Women: A Scoping Review of the Literature). In addition to MSK complaints, the non-pregnant women also presented with complaints of headaches (n = 7), particularly migraine headaches (n = 4), for wellness care (n = 5) along with food sensitivities, fatigue, insomnia, depression, low energy and to address stress. Among the pregnant women, additional motivations for care involved wellness care (n = 8), migraine headaches (n = 1), and preparation for birth (n = 1). This confirms the findings that

pregnant and non-pregnant women attend chiropractic care motivated by the need to address a pain complaint of both MSK and non-MSK origin as well as wellness care. [54, 113, 258, 258]

6.4.3 Chiropractic Care (Spinal Adjustments and Adjunctive Therapies)

Although the scope of practice of chiropractors varies from one jurisdiction to another, chiropractors apply a number of chiropractic techniques (i.e., defined a system of analysis and in the application of the spinal adjustment or SMT), as their primary mode of care approach in conjunction with a variety of adjunctive therapies. [682] All the study respondents indicated that they received SMT and adjunctive therapies during their care. Although no association was found between pregnancy status and the respondents' use of adjunctive therapies, the pregnant respondents indicated the Webster Technique as an adjunctive therapy with less reported use of herbal remedies (botanical therapies to treat/prevent disease conditions) and homeopathic remedies (ingesting small amounts of a drug which simulates or causes a disease may actually stimulate the body to cure itself – 'like cures like') compared to their non-pregnant counterparts. [683] The use of over-the-counter or prescribed medication by the pregnant respondents was noted and deserved further investigation given the stated concern among pregnant women on its use during pregnancy. [32-36] The use of adjunctive therapies (i.e., exercise, diet and nutrition, massage) reported by the study respondents is consistent with the literature [113, 256, 260, 261, 335]. The extent to which these adjunctive therapies are referred or performed in-house by the chiropractor remains to be fully investigated.

6.4.4 Concurrent Care

For the vast majority of chiropractors, pregnancy care is a co-management approach. [679] The pregnant respondents in this study were concurrently under the care

most commonly with a midwife, an obstetrician/gynaecologist, or a massage therapist. Among the non-pregnant respondents, approximately 28% reported no concurrent care, while the remaining reported receiving care most commonly from a Medical Doctor or Doctor of Osteopathy and massage therapists. These are consistent with the findings of Alcantara et al. [113] who also reported concurrent care received by pregnant women. In that study, three quarters (n = 258) of pregnant respondents indicated receiving care from a primary pregnancy provider (i.e., an obstetrician/gynaecologist or a midwife) along with chiropractic. Interestingly, 14% (n = 48) of these pregnant respondents reported that their primary pregnancy provider referred them for chiropractic care. The referrals came from midwives (n = 39; 11%) followed by obstetrician/gynaecologists (n = 7; 2%), and medical physicians (n = 2; < 1%). Other studies have also documented the referrals by other healthcare professions for the chiropractic care of pregnant women. In characterising 100 consecutive pregnant women presenting for chiropractic care, Aas-Jakobsen et al. [258] found that 44% of women were referred to the clinic by friends or family and 48% by healthcare professionals that included midwives (23%), medical doctors (15%), and physiotherapists (10%). In terms of chiropractors making referrals to other healthcare providers in the care of pregnant women, Yuen et al. [261] found that chiropractors (i.e., 94% of respondents) commonly refer to massage therapists and to a small extent (i.e., < 1% of respondents) to Maya abdominal therapists, cranio-sacral therapists, Traditional Chinese Medicine practitioners, naturopathic physicians, and nutritionists. Based on referral patterns by chiropractors, Stuber et al. [260] documented that pregnant women concurrently utilised massage therapy, care from family physicians, midwives, obstetrician/gynaecologists, naturopathic physicians, and physical therapists or podiatrists with chiropractic care.

6.4.5 SOC in Chiropractic Pregnancy Care

To date, this is the first reporting of measures of SOC in pregnant women under chiropractic care in the literature. In this study, a mean SOC difference of 8.63 was found between pregnant and non-pregnant women with the differences assessed as statistically and clinically significantly different. Jamison applied the Distress and Risk Assessment Method (DRAM) and SOC-29 questionnaires to categorise patients requiring a referral to a specialist [86] and to characterise patients with fibromyalgia. [85] Unfortunately, the SOC-29 scores were not provided in sufficient detail by the author to make further inferences. Another study by Alcantara et al. [83] assessed the QoL (as measured by the PROMIS-29 and PROMIS Global Health) and SOC of 1980 chiropractic patients attending care in a practice-based research network. The authors found that the most important variables to changes in SOC were scores in Global Mental Health, Depression, Anxiety, Fatigue and Sleep Disturbance and age. In the present study, the mean SOC scores of pregnant and non-pregnant women were found to be clinically significantly different despite no differences (statistically and clinically) in their GSE and MHLOC scores. As will be discussed further below, SOC shares very similar characteristics with GSE and SOC. The expectation would be that measures of GSE and MHLOC would at least differ in some way or parallel the measures of SOC.

6.4.6 Quality of Life and the Use of PROMIS-29

In the present study, the QoL of pregnant and non-pregnant women with similar age and similar patient visits was assessed with the PROMIS-29. Overall, the study found that non-pregnant respondents had more optimum physical health than their pregnant counterparts due to clinically significantly greater measures of physical functioning and less measures of pain interference. However, in terms of mental health, the non-pregnant respondents were more compromised due to higher levels of Depression. The mean

difference in the Depression *T*-scores between pregnant and non-pregnant respondents differed in a statistically and clinically significant manner. The mean difference in *T-score*s of physical functioning and pain interference differed in a clinically significant manner. Although PROMIS instruments have been applied in studies involving pregnant women [684-690], this is the second application of the PROMIS-29 instrument in pregnant women under chiropractic care. Alcantara et al. [113] found that with a course of chiropractic care (i.e., median number of visits at follow-up = 3.30 (*SD* = 22.71), the QoL of pregnant women improved from baseline to comparative measurement while holding constant for visit number and time lapse, trimester of pregnancy, and care provider type. Unfortunately, the PROMIS-29 does not have established scoring interpretations for psychopathologic symptoms and maladaptive personality traits particular to chiropractic patients. The differences in Depression T-scores in pregnant and non-pregnant women may be attributed, in part, to respondents' attitude towards their presenting complaints and its duration. Although the dominant clinical presentations for care in both groups of respondents involved chronic MSK complaints (i.e., duration lasting > 3 months [691]); among the pregnant women, their MSK complaints may have been an accepted part of the normal, healthy process of pregnancy. [692] The non-pregnant women may not have similar attitudes towards their MSK complaints as their MSK complaints may be of longer duration than 10 months, the timeline for pregnancy. Consider, for example, the study by Alcantara et al. [116] that found that 59.3% (*n* = 841) of patients under chiropractic care indicated their complaints were 'years' in duration. In another study, Alcantara et al. [693] found male and non-pregnant female chiropractic patients (82% of study population) presented with MSK complaints with a mean duration of 1.19 years. The impact of chronic pain on depression in adults is well established. [694-695] Alhalal et al. [696] found that pain disability was a significant predictor for depression. However, in this present study,

no statistically and clinically significant differences in Pain Interference and Physical Function *T*-scores were observed.

6.4.7 General Self-Efficacy

A number of studies have examined general self-efficacy in pregnancy [517, 697-698]. However, this is the first application of the GSE questionnaire by Schwarzer and Jerusalem [511] in pregnant and non-pregnant chiropractic patients. The mean GSE scores of pregnant and non-pregnant women at T1 did not differ in a statistically and clinically significant manner. Ceteris paribus ('all other things being equal'), a comparison of the mean GSE scores of this study's pregnant respondents (i.e., mean GSE = 32.88, *SD* = 4.38) and those of Chunmei et al. [517] involving pregnant women with LBP and PGP (25.2, *SD* = 12.8) in their 12th week of pregnancy found a statistically significant difference (Mean $\Delta = 8.17$, $t_{145} = 4.386$, $p < .0001$). The calculated MCID from this study's pregnant respondents was 1.22, while among the Chunmei et al. [517] respondents, the MCID was 6.4 based on ½ *SD*. Since the mean difference of 8.17 exceeds the calculated MCIDs, the difference in GSE scores is said to be clinically significant. Although the two populations differ in many respects, one differentiating factor between these two populations may be that the respondents in this study were receiving chiropractic care. Theoretically, a higher self-efficacy may lead to a greater propensity for health-seeking behaviour and specifically for alternative therapies such as chiropractic care. However, the evidence is mixed in this regard. Among cancer patients, higher self-efficacy was associated with a healthy diet and sports activities, but not with alternative therapy use. [699]

6.4.8 Health Locus of Control

In the present study, pregnant and non-pregnant women had similar control expectancies for their health. This was quite surprising given the expectation that individuals would have great variability in their perceived control over their health based on genetic and environmental factors [700], culture [701] and overall life experience. [702] In both groups of respondents, Doctors LOC was relatively high (i.e., relative to their maximum scoring), followed by Internal LOC, Other People LOC, and Chance LOC. This indicates that with a high Internal LOC and Doctor LOC, the pregnant and non-pregnant women were more likely to have the belief that their health and the health of their unborn child is directly influenced by their own actions and behaviours [703] as well as from the care they received from their chiropractor. Interestingly, a strong Internal LOC has been found to be significantly associated with CAIM use [704-705] or a high appraisal of CAIM. [706]

Although the MHLOC has been examined in pregnant women [531-532, 707-709], the MHLOC Form C has not been assessed as commonly in the pregnant population. Based on a confirmatory factor analysis, Jomeen and Martin [676] found the MHLC-C to be comprised of three distinct and correlated factors of Internal, Chance, and Powerful Others LOC. Similar to the findings in the present study, Jomeen and Martin [676] found the Doctors LOC scale lacked acceptable internal reliability. Pomeranz et al. [709] found that pregnant women who chose trial of labour after Caesarean (TOLAC) were more religious, wanted more children, were not influenced by Other People LOC and had a higher Internal and Chance HLOC while women choosing elective repeat Caesarean delivery (ERCD) were more likely to be secular and had a higher Doctors LOC. In two other studies involving the use of the MHLOC in pregnant women, Stevens et al. [710] found that pregnant women may not be able to distinguish their Doctors LOC expectancies

from Other People LOC expectancies. This was not the case in the present study as pregnant and non-pregnant respondents were able to assign different expectancies to Doctors LOC or Other People LOC.

6.4.9 Interpersonal Process of Care Experience

This is the first use of the IPC-18 scale to examine the IPC experience of pregnant and non-pregnant women under chiropractic care. The findings are that the IPC-18 scoring among pregnant and non-pregnant women did not differ in a statistically and clinically significant manner. Both groups of respondents indicated having good IPC experience with chiropractic care in terms of communication, decision-making, and in their interaction with their chiropractor. The findings in the present study resonate with the findings of Alcantara et al. [113] on the high patient satisfaction of pregnant women with chiropractic care.

6.4.10 Correlational Analysis

The concurrent assessment of SOC with related constructs such as GSE and MHLOC along with QoL and IPC Experience provided a unique opportunity to examine the relationship between SOC and these constructs.

6.4.10.1 SOC and QoL

The present study's obtained measures of SOC and QoL confirmed the established relationship between SOC and QoL, that is, that a strong SOC is correlated with optimum QoL. [83] The results of the correlational analysis between SOC and the various QoL domains of the PROMIS-29 are shown in Tables 6.9, 6.10 and 6.11. The hypothesis that SOC is positively correlated with the PROMIS-29 domains of physical functioning and satisfaction with participation in social roles and activities and negatively correlated with anxiety, depression, fatigue, pain interference and pain intensity has been confirmed.

Consistent with the findings of Alcantara et al. [83], the mental health domains and physical health domains demonstrated strong correlations within but weak correlations between. This present study also confirms that Fatigue, Sleep Disturbance and Ability to Participate in Social Roles and Activities have both physical and mental health characteristics \ given their moderate to strong correlations with both mental health and physical health QoL domains. The relatively stronger correlation between the mental health domains and SOC compared to the physical health domains and SOC is consistent with the findings of Flensborg-Madsen [220, 711-712] that the SOC scale in a good predictor for mental health (i.e., Depression and Anxiety) but not physical health. Interestingly, among the pregnant respondents, the strongest correlation was between SOC and Fatigue (r = -.55) while among the non-pregnant women, SOC and Fatigue (r = -.37) had the weakest correlation. Future studies should confirm these observations. Among the pregnant respondents, Fatigue may be more characteristic of a mental health domain whereas among non-pregnant respondents, Fatigue had more physical health characteristics.

6.4.10.2 SOC and GSE

Although SOC and GSE have been examined in the general population [713-719], this is the first reporting of the association between SOC-29 and GSE in pregnant and non-pregnant women under chiropractic care. A strong positive correlation between SOC and GSE was found among the pregnant (r = .69, p < .0001) and non-pregnant (r = .63, p < .0001) respondents. This strong correlation may reflect very similar aspects of behaviour being measured by SOC and GSE in the two groups. [153, 435] To date, four studies have measured SOC concurrently with self-efficacy among pregnant women. Although Yu et al. [153] did not report a correlation between SOC-13 and GSE, they found that pregnant women with pre-pregnancy exercise habit and high GSE predicted a

stable and then increased health behaviour trajectory. Einav et al. [157] found that maternal efficacy significantly predicted maternal satisfaction but found no link (i.e., r = .08) between maternal efficacy and SOC-13. Carlsson et al. [97] found that women with relatively high childbirth self-efficacy also had higher SOC-13 scores. Linden et al. [168] found a moderate correlation of .33 between SOC-13 and the Swedish Diabetes Empowerment Scale or SWE-DES-10, a proxy but not a direct measure of self-efficacy. In the present study, SOC-29 was significantly, positively, and strongly correlated with GSE in pregnant women and non-pregnant women.

6.4.10.3 SOC and LOC

The pattern, direction, and strength of the correlation between SOC and MHLOC among the pregnant and non-pregnant respondents was found to differ. Among the pregnant respondents, Chance LOC was significantly negatively moderately correlated with SOC (r = -.39, p = .00033) and its subdomains of Comprehensibility (r = -.43, p = .0011), Manageability (r = -.33, p = .0137), and Meaning (r = -.32, p = .0171). Among the pregnant respondents, SOC was significantly positively moderately correlated with Internal LOC (r = .34, p = .04296). These differences may reflect different health LOC functioning in these two groups of respondents, at least insofar as it relates to their SOC. Although both SOC and LOC have been examined previously [434, 720-722], a systematic review of the literature on measures of SOC in pregnancy (see Chapter 2 Sense of coherence in pregnancy: a systematic review of the literature) found no studies examining SOC in relation to LOC in pregnant women. This study is the first to assess SOC concurrently with MHLOC in pregnant women.

6.4.10.4 SOC and IPC-18

The present study is the first to assess SOC concurrently with the IPC-18 instrument.

Among the pregnant respondents, significant correlations were found between SOC and its subdomains with the IPC-18 domains of Communication and Interpersonal Style. Communication (Lack of clarity) was negatively strongly correlated with SOC (r = -.63, p = .00004), Comprehensibility (r = -.56, p = .0004), Manageability (r = -.52, p = .0015), and Meaning (r = -.47, p = .0047). Communication (Elicited concerns, responded) was positively moderately correlated with Manageability (r = .34, p = .0461). Interpersonal Style (Emotional support, compassion) was positively moderately correlated with Comprehensibility (r = .46, p = .0052), Manageability (r = .42, p = .0126), and SOC (r = .44, p = .0080). Among the non-pregnant women, the subdomain of Communication (Elicited concerns, responded) was significantly and moderately positively correlated with SOC (r = .32, p = .0175) and SOC subdomain of Meaning (r = .43, p = .0012). The differences in correlation between pregnant and non-pregnant women reflect differences in the role that the IPC-18 subdomains play in contributing to the SOC in these two groups of patients.

To date, very few studies have examined patient satisfaction with SOC. In a prospective study, Bergman et al. [723] assessed the SOC-13 and the Seattle Angina Questionnaire (SAQ) [724] in patients following a myocardial infarction (MI). The investigators found that all the subdomains of SOC-13 were significantly correlated with patient satisfaction, a subdomain measured by the SAQ. In a cross-sectional survey, Drageset et al. [725] examined nurse–patient interaction (i.e., using the Nurse–Patient Interaction Scale or NPIS) and SOC-13 among cognitively intact nursing home residents. Multiple regression analysis found statistically significant associations between SOC-13

total score and NPIS (b = 0.05, p = .04) and SOC with 3 of the NPIS items (i.e., 'The nurses take me seriously,' 'The nurses make all possible efforts to relieve my ailments,' and 'The nurses are listening interestingly to me'). According to the authors, nurse–patient interaction is a vital resource in strengthening nursing home residents' SOC, particularly in terms of the three NPIS items mentioned previously.

6.5 Conclusion

The principal aim of this study was to examine the SOC, QoL, GSE, MHLOC, and IPC experience of pregnant and non-pregnant women under chiropractic care. Relative to non-pregnant women of similar age and number of patient visits, this study found that pregnant women have higher levels of SOC, less depression but more compromised physical health in terms of physical functioning and pain interference. No clinically or statistically significant differences were noted in both groups of respondents with respect to their measures of GSE and MHLOC. Interestingly, the internal and external domains of the MHLOC were not mutually exclusive with respondents indicating high levels of both internal LOC and external (i.e., Doctors) LOC. This implies that the respondents attribute their health outcomes to their own health behaviours but also simultaneously acknowledge the role of their chiropractor (or other healthcare providers) in their health. Both group of respondents also indicated high interpersonal process of care experience with chiropractic care in terms of their communication (i.e., chiropractor elicited and responded to their patient's concerns) with their chiropractor, their participation in clinical decision-making and in their interactive exchange (i.e., the chiropractor was compassionate and respectful) with their chiropractor).

This study found that among pregnant and non-pregnant respondents, there was moderate to strong correlations between SOC and the mental health domains of anxiety and depression but weak correlations with the physical health domains (i.e., physical

function, pain interference), and strong correlation with GSE. This may be due to items on the SOC-29 scale as more aligned with mental health constructs than physical health constructs. [220, 711-712] SOC reflects an individual's ability to make sense and cope with stressors. Such stressors may orient more towards social and psychological aspects of life whereas physical health may be more influenced by biological factors that are not as closely tied to SOC. The strong correlation between SOC and GSE suggests convergent validity and measurement of the same constructs or concepts. As high levels of SOC and GSE are associated with good patient outcomes, interventions to increase SOC, GSE or both could be implemented. Overall, SOC had weak correlations with the domains of the MHLOC and the IPC-18. However, the pattern of correlation between SOC and the domains of MHLOC or IPC-18 differ between pregnant and non-pregnant women. Among the pregnant respondents, SOC was significantly positively correlated with Internal LOC and the IPC-18 domains of Communication (Lack of clarity) and Interpersonal Style (Emotional support, compassion). Among the non-pregnant respondents, SOC was significantly negatively correlated with Chance LOC and the IPC-18 domain of Communication (Elicited concerns, responded). These different patterns of correlation suggest that the pregnant and non-pregnant respondents have different motivations and coping mechanisms. Among pregnant women, their SOC has developed based on reliance of their own capabilities and decision-making and a higher Internal LOC while among non-pregnant women, their SOC developed by accepting and adapting to the unpredictability of life resulting in higher Chance LOC. The findings of this study also suggest that different aspects of the doctor–patient relationship are important in developing the respondents' SOC and that healthcare providers such as chiropractors must provide patient-centred care that is individualised to meet the unique needs of each patient and ultimately enhance the patient interpersonal experience. Among pregnant women, good

communication and a compassionate and respectful chiropractor are important while among non-pregnant women, the chiropractor's show of concern is most important.

Chapter 7. Results of Study 3: The Lived Experience of Pregnant Women Under Chiropractic Care: A Phenomenological Analysis

7.1 Introduction

This chapter presents the results of the qualitative study with the aim to acquire a deeper understanding of the pregnant patient experience and the nature of their therapeutic encounter with their chiropractor. To achieve this aim, the lived experience of pregnant women under chiropractic was assessed.

Details of the methodological approach of this qualitative study from its theoretical framework of transcendental phenomenology, participant selection and recruitment, data collection and analysis are provided in detail in Chapter 4. The trustworthiness of the qualitative approach is addressed in Chapter 3. A brief review of the methods is presented here prior to the presentation of the findings of this qualitative study.

7.2 Methods

This study was approved by the Ethics Review Board of Southern Cross University (Approval #2021/112) (Lismore, NSW, Australia) and Life University (Marietta, GA, USA).

7.2.1Theoretical Framework

This study was informed by transcendental phenomenology, which focuses on the essential meanings of the individual experience. In this study, the question asked was, 'What is the essence of the lived experience of pregnant women under chiropractic care?' Edmund Husserl [1859-1938] believed that by achieving a transcendental state, a researcher could identify both their conscious and unconscious a priori beliefs and biases and set them aside in a process called epoche or bracketing. With intentionality (i.e., the act of being present in a situation and creating intersubjectivity with the participants to step

into or relate to their experiential shoes), the essence or central theme of an experience are revealed. The analysis followed that prescribed by Moustakas. [587, 726] This involves the researcher reflecting on their own prejudices and biases and set them aside during bracketing or epoche followed by a deep immersion in the data (e.g. by reading and re-reading transcripts) to identify meaningful statements. These statements are then clustered into themes and with imaginative variation, structural descriptions are created from the textural descriptions. The textural-structural descriptions are then examined to construct a composite description of the meanings and essences of the responders' lived experience. [582, 727]

7.2.2 Participant Selection and Recruitment

This qualitative study utilised criterion sampling where participants were required to meet predefined criteria. Inclusion criteria for study participation were: (a) currently pregnant, regardless of weeks of gestation, (b) currently receiving chiropractic care for musculoskeletal and/or non-musculoskeletal conditions, or for general wellness care (c) able to read and speak English, and (d) had access to the internet and possessed a video conferencing service (i.e., Zoom). [577] The principal investigator, a chiropractor, contacted six professional colleagues (from the United States) known to care for pregnant women and requested their assistance in recruiting their pregnant patients for semistructured interviews about their experience with chiropractic care. These chiropractors were provided with copies of the Study Information Sheet and Informed Consent Forms for potential participants. Ultimately, four participating chiropractic clinics located in urban cities in Pennsylvania, Massachusetts, Atlanta, and Florida provided participants for this study.

7.2.3 Data Collection

Interested individuals meeting the inclusion criteria (as screened by the participating clinic) contacted the principal investigator by text messaging or email. Upon study entrance, the women were scheduled for interviews via Zoom [577-578]. Prior to the interviews, participants provided a signed Informed Consent document (see Appendix AB). Individual in-depth interviews were performed by the principal investigator via Zoom in the privacy of the participants' and primary investigator's place of residence and lasted approximately 30-45 minutes. Verbal consent was also obtained prior to conducting each interview.

A semistructured interview guide (see Table 7.1) containing open-ended questions allowed participants to provide authentic responses. Follow-up questions were designed to encourage participant to provide rich and in-depth descriptions of their experiences. Note that the interview guide was paraphrased for everyday conversation and is only a partial list of the questions asked given the iterative process of the interview with ongoing revisions of questions as required. Prior to each interview, the interviewer (PhD candidate) took time to reflect on and set aside any preconceived biases about pregnant women and chiropractic pregnancy care that may affect the interview.

Table 7.1. Semistructured interview guide

Question #	Leading question(s)	Follow-up question(s)
1	How did you become a chiropractic patient?	e. Did you do any research on chiropractic before you decided on chiropractic care during your pregnancy? f. Is chiropractic something that resonates with your view of health and healthcare? • How does chiropractic fit in with other types of care you may be receiving? g. Did you experience any barriers (or facilitators) to becoming a chiropractic patient? If so: • How did the facilitators help you to become a chiropractic patient? • What barriers or challenges did you experience to becoming a chiropractic patient?

Question #	Leading question(s)	Follow-up question(s)
		• How did you overcome these barriers? • Did you feel that these barriers were out of your control? • Without identifying your chiropractor, did your chiropractor or their staff help you in any way to overcome these barriers? If so, how did they do that?
2	What has been your experience with chiropractic care so far?	a. How has chiropractic addressed the complaints/symptoms you were experiencing? b. What other types of benefits have you experienced with chiropractic care? c. Now that you have experienced chiropractic care, do you feel that chiropractic care is safe? • Have you ever experienced any symptoms that didn't feel good with the chiropractic adjustment? d. Are there things that stand out to you in the way your chiropractor or their staff treated you? If so, please tell me about them. • Did you feel that you were part of the decision-making process with your care plan? Why or why not?

All interviews were recorded as video and audio recordings via the Zoom function. Each interview was labelled using the participants initials and the last 4 digits of their phone number (i.e., JA0893). Sociodemographic data (e.g., age) and clinical covariates (i.e., weeks of gestation at the time of interview and weeks of gestation at initiation of chiropractic care) were collected from participants at the start of the interview. Interviews were performed until data sufficiency (i.e., qualitative data has sufficient depth and breadth) [569] was obtained.

7.2.4 Data Analysis

Audio recordings were transcribed using Microsoft 365 software [Microsoft, Redmond, Washington, 2017]. Each interview was read or listened to carefully prior to the next interview to inform potential new lines of questioning in subsequent interviews. A transcendental phenomenological approach to data analysis followed the principles of Moustakas. [582, 587, 727] The transcripts for each interview were imported to NVivo

[591] for coding and analysis. For each transcript, significant nonoverlapping, nonrepetitive and meaningful statements (i.e., invariant horizons) were identified to highlight each participant's experience with chiropractic care (i.e., horizontalisation). A dimension of each participant's experience is the texture or the 'thickness' of the experience and is the qualitative feature of the experience. Another dimension of the participant's experience is structure and deals with the development of themes (i.e., clustering) that describe the essential aspects of the participant's experience. Such themes are grasped through reflection and the process of imaginative variation (i.e., the participants experience is viewed from varying perspectives). The themes were then analysed to create textural descriptions to underscore the essence of the lived experience of pregnant women under chiropractic care.

7.2.5 Trustworthiness

Four criteria have been suggested as the 'gold standard' for establishing trustworthiness of qualitative data: credibility, dependability, confirmability and transferability. [536-537] To achieve credibility, there was prolonged engagement with the data by the principal investigator and regularly scheduled peer-debriefing with the co-authors who are clinicians and versed in either pregnancy care, chiropractic care, qualitative research (and phenomenology in particular) or combinations thereof. Confirmability was achieved with written details of each step of the data analysis as well as peer-debriefing to demonstrate that the findings were not coloured by conscious or unconscious bias. Transferability was enhanced by including women unrelated to one another and residing in different parts of the United States. The findings and interpretations were supported by inclusion of verbatim quotes to allow the reader to evaluate the transferability of the findings to other contexts. The Consolidated Criteria for Reporting Qualitative Research or COREQ [593], a 32-item checklist for interviews and

focus groups, was applied in the reporting of this qualitative study. This is provided in Table 7.2.

Table 7.2. The 32-Item Consolidated Criteria for Reporting Qualitative Studies (COREQ) Checklist

Domain	Subdomain	Item #	Item	Guide question	Description
Domain 1: Research team and reflexivity	Personal characteristics	1	Interviewer / facilitator	Which author/s conducted the interview or focus group?	JA
		2	Credentials	What were the researcher's credentials? e.g., PhD, MD	DC, DO, ND, MN, MMed, PhD
		3	Occupation	What was their occupation at the time of the study?	At the time of the study, Joel Alcantara was the research director for the ICPA. Stephen Myers was Emeritus Professor at Southern Cross University. Elizabeth Emmanuel was Senior Lecturer, Southern Cross University. Sandra Grace was Professor at Southern Cross University.
		4	Gender	Was the researcher male or female?	Two of the researchers are male and two are female.
		5	Experience and training	What experience or training did the researcher have?	All the researchers have a professional degree in chiropractic, osteopathy, nursing and medicine with 35+ years of clinical experience. Three of the researchers have PhDs and have extensive experience in academia and clinical research.
	Relationship with participants	6	Relationship established	Was a relationship established prior to study commencement?	No relationship was established with the participants prior to the commencement of the study.
		7	Participant knowledge of the interviewer	What did the participants know about the researcher? e.g., personal goals, reasons for doing the research	The participants were made aware the purpose of the study.
		8	Interviewer characteristics	What characteristics were reported about the interviewer/facilitator? e.g., Bias, assumptions, reasons, and interests in the research topic	The interview was characterized as a chiropractor in pursuit of his PhD and was performing the interviews for this purpose.

Domain	Subdomain	Item #	Item	Guide question	Description
Domain 2: Study design	Theoretical framework	9	Methodological orientation and theory.	What methodological orientation was stated to underpin the study?	The methodological orientation stated was descriptive or transcendental phenomenology.
	Participant selection	10	Sampling	How were participants selected? e.g., purposive, convenience, consecutive, snowball	Participants were selected with purposive sampling.
		11	Method of approach	How were participants approached? e.g., face-to-face, telephone, mail, email	Participants were approached face-to-face initially.
		12	Sample size	How many participants were in the study?	10 participants
		13	Nonparticipation	How many people refused to participate or dropped out? Reasons?	We did not collect data on refusals. No participant dropped out.
	Setting	14	Setting of data collection	Where was the data collected? e.g., home, clinic, workplace	Data was collected via Zoom with participants in their homes
		15	Presence of non-participants	Was anyone else present besides the participants and researchers?	No others were present during the interviews.
		16	Description of sample	What are the important characteristics of the sample? e.g., demographic data, date	Age, weeks of gestation at time of interview, weeks of gestation at initiation of chiropractic care, geographic locale.
	Data collection	17	Interview guide	Were questions, prompts, guides provided by the authors? Was it pilot tested?	The interviews were semistructured with the use of questions.
		18	Repeat interviews	Were repeat interviews carried out? If yes, how many?	No repeat interviews were performed.
		19	Audio/visual recording	Did the research use audio or visual recording to collect the data?	Both audio and visual recording were used to collect data.

Domain	Subdomain	Item #	Item	Guide question	Description
		20	Field notes	Were field notes made during and/or after the interview or focus group?	Field noted were made prior to and after the interviews.
		21	Duration	What was the duration of the interviews or focus group?	The duration of the interviews ranged from 30-45 minutes
		22	Data saturation	Was data saturation discussed?	Data saturation and data sufficiency were discussed.
		23	Transcripts returned	Were transcripts returned to participants for comment and/or correction?	The transcripts were not returned to the participants for comments and/or correction.
Domain 3: Analysis and findings	Data analysis	24	Number of data coders	How many data coders coded the data?	One person coded the data and discussed with co-authors.
		25	Description of the coding tree	Did authors provide a description of the coding tree?	No description of the coding tree was provided.
		26	Derivation of themes	Were themes identified in advance or derived from the data?	No prior identification of themes was performed.
		27	Software	What software, if applicable, was used to manage the data?	NVivo was used to manage the data.
		28	Participant checking	Did participants provide feedback on the findings?	Participants did not provide feedback on the findings.
	Reporting	29	Quotations presented	Were participant quotations presented to illustrate the themes / findings? Was each quotation identified? e.g., participant number	Quotations were presented to illustrate the subthemes. The quotations were identified by the use of participant label.
		30	Data and findings consistent	Was there consistency between the data presented and the findings?	There was consistency between the data presented and the findings.
		31	Clarity of major themes	Were major themes clearly presented in the findings?	Major themes were clearly presented in the findings augmented with the use of a figure

Domain	Subdomain	Item #	Item	Guide question	Description
		32	Clarity of minor themes	Is there a description of diverse cases or discussion of minor themes?	No description of diverse cases or discussion of minor themes was presented

7.3 Findings

7.3.1 Participant Characteristics

A total of 10 pregnant women participated in the study. The participants' sociodemographics and clinical characteristics are summarised in Table 7.3. At the time of the interview, the participants were at a mean week of gestation (WoG) of 34.3 weeks (*SD* = 4.4). For the majority of participants (*n* = 8), initiation of chiropractic care occurred in the second trimester at a mean WoG of 15.44 weeks (*SD* = 14.31). Two participants indicated presenting for care in the first and third trimester respectively. The majority of participants (*n* = 9) were under chiropractic care at a mean of 18.78 weeks (*SD* = 10.47) at the time of the interviews.

Table 7.3. Summary of Participant Sociodemographic and Clinical Characteristics

ID	Age (years)	Weeks of gestation at time of interview	Weeks of gestation at initial care	Weeks of care under chiropractic
DN1752	30	29	14	15
SD6227	25	40	35.5	4.5
KC9617	37	39	28-39*	1-11*
CR9846	30	31	8	23
RF0084	41	27	1	26
HN6510	31	36	7	29
SM5717	25	35	20	15
AW0497	30	33	1	32
LB1123	30	39	37	2
KO9840	30	34	1-12*	22.5
Mean	30.9	34.3	15.4	18.8
SD	4.86	4.40	14.31	10.47
Range	30-41	27-40	1-37	2-32

* Not included in descriptive statistics

7.3.2 Themes

Analysis of the transcripts revealed three main themes emerging as the essence of the lived experience of pregnant women under chiropractic care:

1. Self-determination: the participants were provided an avenue to assert control and the means of achieving their pregnancy preference.
2. Enhanced pregnancy experience: With chiropractic care, participants were provided a means of maintaining physical, mental, and social normality, and a sense of safety for themselves and their unborn child.
3. A transformative experience: as a result of their chiropractic experience and newfound knowledge about the clinical framework of chiropractic pregnancy care, participants underwent a cognitive shift towards a new mindset about chiropractic and pregnancy care in particular, a new outlook of positivity and competence about their pregnancies, and towards their labour and childbirth.

These themes and their subthemes are summarised in Figure 7.1.

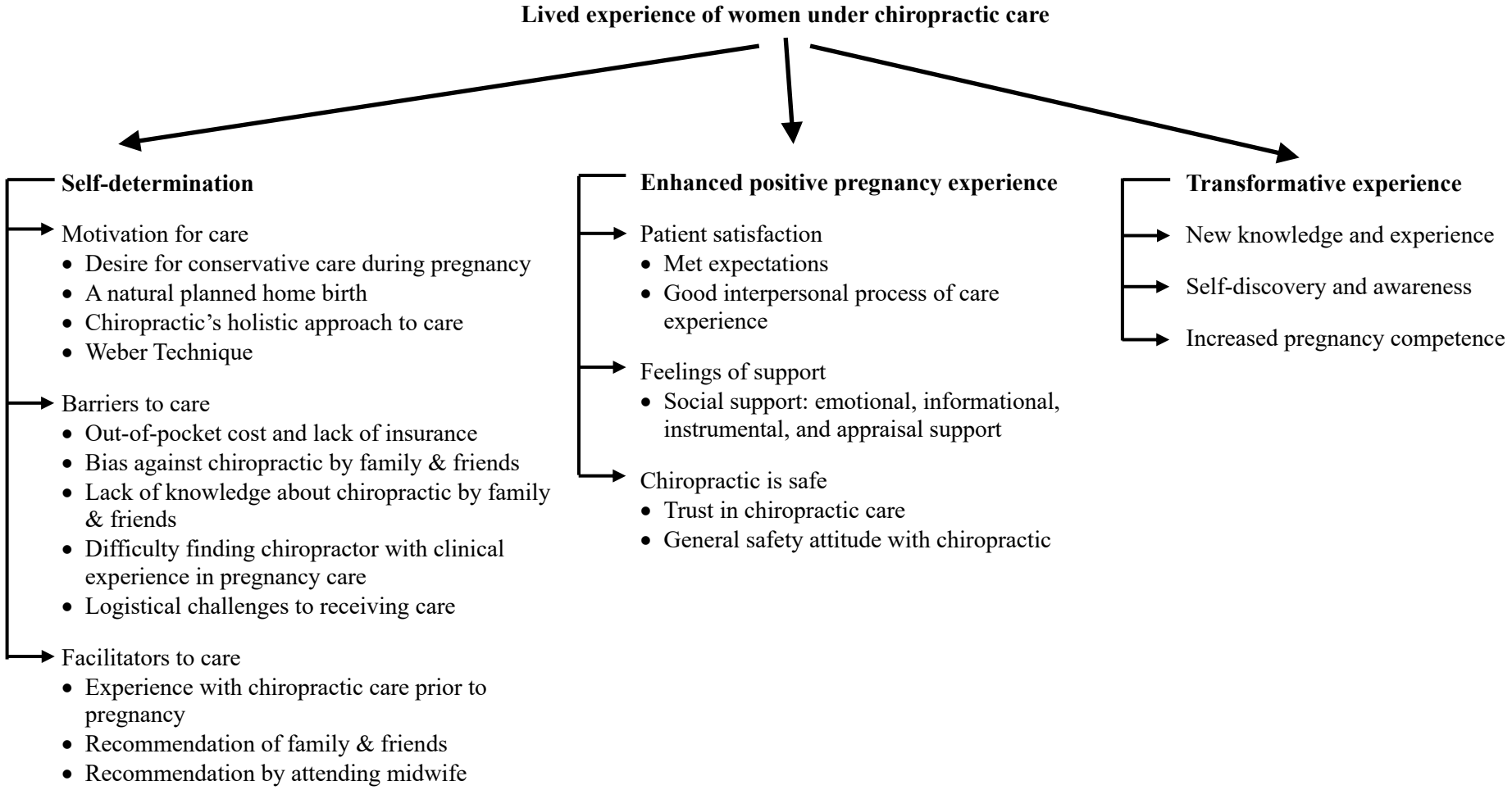


Figure 7.1. Summary of Themes and Subthemes on the Lived Experience of Pregnant Women under Chiropractic Care

7.3.2.1 Theme 1: Self-Determination

The first theme to emerge from the interviews of the participants under chiropractic care was one of self-determination. This became immediately evident in terms of participants' strong desire for a certain pregnancy experience and in the type of care they received while pregnant.

> *I would say that I feel like I'm in the driver seat of the situation and I feel like I've made a lot of decisions that have made me feel better both physically and emotionally about how this pregnancy is going … but I think that I've made choices that support what I want or what I'm looking for out of this. (DN1752)*

The theme of self-determination emerged from the subthemes of: (1) participants' motivations for chiropractic care, (2) barriers participants faced in receiving chiropractic care, and (3) facilitators participants experienced in their pursuit of chiropractic care.

7.3.2.1.1 Participants' Motivation for Chiropractic Care

Participants' motivation for seeking chiropractic care was grounded in their general health-related choices. In general, participants indicated a conservative approach to health care characterised as minimal or without the use of medication or invasive medical procedures, and reliance on the innate curative powers of the human body.

> *I like the idea of using less medical intervention or medications because of just the effects that they can have on your body during and after and that actually gives me more anxiety than just going for it the old-fashioned way.* (KC9617)

This conservative approach to care naturally translated to their choice of pregnancy care due to concerns of possible negative side effects of medications for their unborn child. Furthermore, participants were adamant about their desire to avoid a Caesarean birth and experience a physiological childbirth without the use of pharmacology for pain (i.e.,

epidural, opioid analgesia) or the use of induction (i.e., Pitocin) if possible, with birth being powered only by the innate capacity of themselves and their foetus.

> *I very much do not want to have a C-section so that's kind of first, and I also did not want to be induced and … I didn't want any sort of medical induction … which I feel like almost everybody that I know who's had babies in hospitals recently has been induced at 39 weeks.* (DN1752)

The majority of participants chose a midwife as their pregnancy provider as they believed this would support their strong desire for a home birth. Some of the participants were of the opinion that giving birth in a hospital environment would result in their loss of control of their birth experience due to the hospital's focus on liability, policy, and mitigating risk rather than a focus on the baby or the mother.

> *I don't necessarily consider myself to be a huge control freak, but I just feel like there is a lot of things in hospitals that are kind of like standard practice that aren't necessarily better for the baby or the mother and they're just kind of like protecting sometimes – I guess liability sometimes in a hospital setting and I don't want those to be the motivators. You and I understand there's … a degree of risk in any birth, regardless of your setting, but it's like I don't want the way it goes down to be dictated by a policy just because insurance says so, you know, so that is more my problem with it. I feel like if they weren't so rigid on policy type things or if it was truly always an evidence-based thing, then I wouldn't necessarily want to fight with all of it. I just don't think that it always leads to better outcomes.* (DN1752)

With a holistic and drugless approach to patient care, participants saw chiropractic care as resonating with their conservative approach to pregnancy care.

> *I think the chiropractic care made a lot of sense to me when I had looked into … the prenatal practice around it.* (DN1752)

Specifically, participants wanted care from chiropractors trained in the Webster Technique in preparation for birth (i.e., to facilitate a natural childbirth and minimise birth trauma) based on the recommendation of friends and their Internet search.

> *Yeah, I'm … in planning a home birth and my midwife told me, ah, what would be really important is to get a chiropractor that was familiar with Webster Technique.* (SD6227)

For participants, chiropractic care was also a natural segue to address their pregnancy related MSK complaints, most commonly LBP and/or PGP. Participants indicated that as their pain complaints intensified, it was affecting their QoL and functionality, and they were willing to try anything, including alternative therapies such as chiropractic. Participants wanted their pain complaints addressed to increase their functionality in their activities of daily living and as a preventative measure to avoid further disability. Participants were also concerned that their pain complaints may be related to more serious consequences for their unborn child that they were not aware of or beyond their admitted limited knowledge.

> *Once I felt that bones were shifting and popping and clicking, I was a little out of my comfort zone; that's out of my range and that's where I felt like I needed to be dependent on someone else and someone else's knowledge and that was, I guess, a really important thing for me to realize because as much as I fought it in a way, I also wanted to self-help it or self-fix it. I just realised that I didn't have the knowledge. I didn't have the understanding of what was going on in the body, what was moving and shifting everything apart and I needed someone else outside of me to help me understand.* (SD7227)

7.3.2.1.2 Barriers the Participants Faced in Receiving Chiropractic Care

Participants experienced a number of barriers to accessing chiropractic care. For the majority, lack of insurance coverage and out-of-pocket cost was a major barrier to chiropractic care.

> *Insurance is a big one. Money. For my last chiropractor I was paying a copay, and they did go through insurance up until I hit a certain amount and then I had to pay out of pocket. Then, with this office that I'm in now, there was no option to have them do any insurance paperwork and I had to pay up front for a certain number of visits out of pocket. .... I felt that was the right decision for me and I decided to go ahead and pay out of pocket. But it took a while to think about that and make that decision and I can imagine people in other financial circumstances that that would just be a complete barrier to [chiropractic care].* (KO9840)

In some instances, the negative perception of chiropractic by people within participants' social and family circle was also identified as a barrier to chiropractic care. This bias against chiropractic was attributed to what they may have seen on social media, their own negative experiences with chiropractic and safety concerns about adverse risks associated with cervical spinal manipulation, as popularised on social media with anti-chiropractic sentiments.

> *When I did tell relatives, they would tell me, 'I've gone to chiropractors before, and I've tried to do all these things and it just didn't help. It didn't do anything. I just think it's a made-up thing, I don't even know if they could actually really fix you.'* (SD6227)

In addition to the negative perception of chiropractic by friends and family, there was also the lack of familiarity or knowledge about the services provided by chiropractors (i.e., chiropractic pregnancy care) or their legitimacy as healthcare practitioners.

Someone even asked me, 'Are chiropractors even considered legit in a way? Are they even real or do they even do anything?' I had to fight back those things because it was the path that I was taking. (SD6227)

Finding a chiropractor with expertise in pregnancy care also proved to be a challenging issue for some of the women.

I didn't know the difference between a chiropractor who couldn't specialise with pregnant women as opposed to just going to a regular chiropractor; my friend actually helped me. She knew you have to look for their certification, actually talk to them and find out. For example, have they worked with pregnant women before, because obviously our bodies are … (KC9617)

Logistical challenges were also faced by participants such as finding a chiropractor with pregnancy-care expertise with a practice located in close proximity to their home. The amount of time for regularly scheduled chiropractic appointments, particularly when the visits were scheduled at three times per week, was also identified by participants as a possible barrier to their chiropractic care.

I don't really have any prior experience of chiropractic care. This is my first chiropractor. The only chiropractor I've seen. When I think about how much the pregnant body is changing and preparing for labour and delivery, and obviously the recovery afterwards, it sort of made sense. Especially as an elderly primipara and I'm 39 weeks pregnant. So, it made sense to me to go more frequently to kind of keep everything sort of in tune. (KC9617)

7.3.2.1.3 Facilitators that Participants Experienced in Their Pursuit of Chiropractic Care

A number of facilitators also emerged from the interviews to support their use of chiropractic services. Just as there were family members who had negative opinions about going to a chiropractor, there were also family members or friends who strongly

recommended participants attend chiropractic care. Based on their personal and professional experience with chiropractic, participants' midwives also played a large role in recommending participants seek chiropractic care, particularly from a chiropractor certified in the Webster Technique.

> *My midwife suggested this particular chiropractor. … She was the one who referred me there and she personally had experience with seeing her [the chiropractor] through her pregnancy. So just knowing someone who had gone, and experienced relief was the biggest thing for me.* (KO9840)

Another factor in facilitating participants having chiropractic care was the participants' previous experience with chiropractic. Participants indicated their positive experience with chiropractic care was a motivating factor to seek care in pregnancy. Some participants indicated that they were current chiropractic patients before they became pregnant and chiropractic care was a natural progression into their pregnancy.

> *I had this issue come up when I was about 14 weeks pregnant, and it got so bad that I could barely walk in the span of a week. I thought that if this continues then I'm going to be in a bad way. I talked to one of my friends about having this pain and she recommended going to a chiropractor as she had chiropractic pregnancy care. It made a huge difference for her. So that's kind of how I got connected.* (DN1752)

7.3.2.2 Theme 2: Enhanced Pregnancy Experience

The second theme to emerge from interviews of pregnant women under chiropractic care was that they had an enhanced pregnancy experience. With chiropractic care, participants felt they were able to maintain a level of normality in terms of their physical, mental, and social functioning, a sense of safety for themselves and their unborn child, and a positive attitude towards their imminent labour and childbirth. This theme

emerged from three subthemes: (1) experience of high sense of patient satisfaction with their chiropractic care, (2) feelings of support during their pregnancy care, and (3) feelings of safety with chiropractic care.

7.3.2.2.1 Experience of High Sense of Patient Satisfaction with Their Chiropractic Care

Participants conveyed a great deal of satisfaction with their chiropractor and the care that they received. They used phrases such as, 'I feel pretty lucky,' (DN1752) 'It's also been really nice,' (DN1752), 'I'm really thankful that I've found this practice' (KO9840), and 'I've been really happy with my experience overall' (LB1123) to convey their satisfaction.

The participants presented for chiropractic care to address mainly LBP and/or PGP. The expectation of relief from their presenting complaints were met with a course of chiropractic care.

> *As far as my back pain is, it's definitely improved from going to chiropractic care.* (CR9846)

With chiropractic care, the participants also conveyed an improvement in their QoL, such as improvements in physical functioning, increased quality and quantity of sleep, less anxiety, and the prevention of further pain and disability.

> *I think it definitely positively impacted my wellness while pregnant just because … I had such issues getting around with standing up, sitting down, walking – and this was before I was really bearing any weight related to the pregnancy. So, it's definitely improved my quality of life there, but also I feel like I've got a lot of other lifestyle solutions too.* (DN1752)

Beyond the provision of spinal adjustments or spinal manipulation, participants described experiencing good interactions with their chiropractor. Participants indicated that their chiropractor was warm and friendly, was attentive and listened to them,

addressed their needs, and explained what was being performed as part of their care. Furthermore, they felt that they were part of the decision-making process.

> *I think that she's very warm and friendly. I don't know if I've said this to her directly, but on reflection it feels like a very therapeutic session for me to go into her office. There are massage chairs to sit in, which is really soothing. And just hearing from her. I think too, it's a lot to do with how she has set up her practice, and how she is as a person in addition to the chiropractic care itself. So, a little bit of the interpersonal relationship, the context or the environment, and the actual treatment.* (AW0497)

7.3.2.2.2 Feelings of Support During Their Pregnancy Care

Another subtheme contributing to the women's enhanced pregnancy experience is the social support the women experienced outside of chiropractic (i.e., family and friends) and within chiropractic. This involved participants, their chiropractor, and other patients as well as their midwife. Contributing much to this social support that they experienced is their sense of belonging to a community within chiropractic. The women indicated that they felt a sense of belonging. The participants' social interactions with their chiropractor and his or her office staff and particularly other patients gave them the venue to share and discuss their experiences with pregnancy and with their chiropractic care, allowed for the exchange of information and facilitate discussion involving individual or mutual concerns.

> *The community spirit that has been fostered at the chiropractor's office, directly with the chiropractor, office manager, and then with the other people who are coming in and out of the office … that has been a real positive that I didn't know existed until I got started with chiropractic care.* (AW0497)

Participants experienced social support in terms of emotional or esteem social support (i.e., from family and friends, the attending chiropractor, their midwife) and

informational and tangible support related to their pregnancy care (i.e., the role of proper posture, diet, and exercise from the attending chiropractor). Social support from family and friends also came in the form of instrumental support such as a spouse paying for a participant's chiropractic visit or the provision of babysitting services by a participant's parent so the participant can attend chiropractic care. They also described appraisal support (i.e., confidence building and encouragement) from other patients and from their chiropractor.

> *Each time when I get there … she's always asking how I'm feeling … if there's anything new. … [I] feel like she's given me a lot of good advice outside of pregnancy. Some of it's related to alignment, and some not. It's just addressing … wellness while pregnant, so I feel it's been a really nice addition to my prenatal care beyond just the adjustment itself.* (DN1752)

7.3.2.2.3 Feelings of Safety with Chiropractic Care

Another subtheme contributing participants' enhanced pregnancy experience was the perceived safety of chiropractic care for pregnant women. This was derived from the participants' (1) trust in their chiropractor's experience and expertise in pregnancy care, (2) general attitude of safety towards chiropractic and (3) lack of cause for alarm despite experiencing a minor adverse event (i.e., self-limiting and not requiring medical care). The latter two factors may have stemmed from their previous and current experience as chiropractic patients.

> *I think it's safe. A lot of people that do it … so I think for me surrounding myself with people that are kind of … are open to that … because I am open to that. I think is helpful because they're my pregnancy care doctors.* (KC9617)

7.3.2.3 Theme 3: A Transformative Experience

The third theme emerging from participant interviews was one of a transformative experience. This theme was illustrated: (1) new knowledge and experience, (2) self-discovery and awareness, and (3) increased pregnancy competence that resulted in the acculturation of the participants in the paradigm of chiropractic pregnancy care, each of which has been classified as a subtheme.

7.3.2.3.1 New Knowledge and Experience

Patient education was a large part of chiropractic care. Participants were educated on the role of posture, diet and stretching exercises in pregnancy.

> *It's been, like, really understanding the body and the nervous system. It wasn't clear in the very beginning, and I definitely had to do some of my own research, but … just talking to other people who've had experiences or had similar symptoms to what I was experiencing. Also, the chiropractor that I work with is very knowledgeable and always has little tips for me.* (KC9617)

7.3.2.3.2 Self-Discovery and Awareness

As a result of being chiropractic patients, participants experienced a sense of self-discovery and increased awareness. For example, the participants became more aware of their bodies, their posture and those of others and the activities of daily living to mitigate or exacerbate the effects of micro- and macro-trauma to their bodies.

> *Obviously visible at first there were definitely some things that were out of place and I could not function right. Now I'm just extremely conscious about how I sit. How I'm walking. I don't like to put too much weight on one side. I like to stand up straight and try to evenly distribute my weight. No crossing legs when I'm sitting down. I just try to do a lot more things that I'm really conscious of and then when*

… I do those things, I can feel my mind say 'OK, don't do that 'cause you're just going to reverse whatever the chiropractor is trying to do. (SD6227)

What became apparent was that participants experienced more than pain relief with chiropractic care. Beyond their reported improved functionality and improved QoL, participants also experienced other benefits such as relief of their headaches, heartburn, restless leg syndrome, urinary incontinence and general support in their pregnancy.

One of the first visits that I had with this chiropractor I had mentioned … that I was experiencing some urinary incontinence, and she was like, 'Oh, we can fix that with XYZ and make that better.' And I really just had no sense that those things were connected, that that could be solved by a chiropractor. And so I have definitely learned a lot more about how balance within your body can … affect the things. In my mind I was like, 'Oh, it has to be managed by a urology doctor or whatever.' … So, I've learned a lot through my time. (AW0497)

7.3.2.3.3 Increased Pregnancy Competence

As a result of their experience with chiropractic care and certainly as a result of an increase in new knowledge, participants' abilities to manage the demands of being pregnant and maintain their mental health (i.e., decreased anxiety and stress) reflect an increase in their pregnancy competence or ability to course through their pregnancy and an easier and shorter labour and delivery.

I hope it'll be similar to my past experiences and again, I realise I'm … a lucky duck. … I don't have the whole day of labour so I'm hoping for a relatively quick labour and delivery. And hopefully the chiropractic piece will help with the baby positioning and the round ligament stuff. … I don't know … I'm not a medical professional, but just positioning and preparing my body for labour, just hoping it'll make it a little bit easier. (RF0084)

With chiropractic care, their belief and confidence in their capabilities to self-care during their pregnancy increased. Educational support and verbal encouragement from their chiropractor enhanced their competency to self-care.

> *I suppose there's some mental reassurance that goes along with that, you know, knowing that you're doing everything that you can, and, you know, things that I suppose helped more from a mental well-being standpoint.* (LB1123)

7.4 Discussion

In this transcendental phenomenological study, the lived experience of pregnant women under chiropractic care was explored. Three key themes emerged from the interviews of pregnant women receiving chiropractic pregnancy care: self-determination, enhanced positive pregnancy experience, and transformative experience (see Figure 7.1).

The first theme of the lived experience of pregnant women under chiropractic care was on of self-determination, Participants' self-determination was marked by the motivation to achieve a pregnancy experience based on conservative care (i.e., minimal use of medication and invasive intervention) and a desire for natural childbirth. The participants overcame barriers such as the out-of-pocket cost to chiropractic care, the bias against chiropractic by family and friends, difficulties in finding a competent pregnancy chiropractor and logistical challenges (i.e., the amount of time requirement and the distance travelled for patient visits). The recommendation to see a chiropractor by their midwife, family, and friends as well as previous positive experience with chiropractic acted as facilitators to chiropractic care. The second key theme, an enhanced pregnancy experience, emerged from the participants' high patient satisfaction, feelings of social support and confidence of the safety of the care they received. The third key theme was one of personal and epistemic transformative experience. As a result of their experience with chiropractic care during pregnancy, the participants were acculturated in

chiropractic's doctrine of health and pregnancy care. That is, a properly functioning spine and nervous system are vital for overall health and wellbeing. This requires a properly aligned spine and a nervous system free from nerve interference. [728] Specific to pregnancy care, chiropractic adjustments (also referred to as spinal manipulative therapy) were applied to pregnant women to restore and maintain the neurobiomechanical integrity of their pelvis. Participants were also offered lifestyle suggestions and adjunctive therapies (i.e., diet and nutrition counselling) to improve their posture and biomechanical function and overall health. As a result of acculturation to the chiropractic lifestyle, participants engaged in self-discovery, increasing their awareness about themselves, their bodies, and other people. As one participant related, they became aware of how other people make lifestyle choices, not be aware of its consequences. As a result of their experience with chiropractic care, participants became more confident and competent in dealing with their pregnancy and pending labour and delivery.

7.4.1 Self-Determination

Self-determination, defined as the psychological needs for competence (i.e., feeling effective in meeting the demands of pregnancy), autonomy (i.e., having input into a pregnant woman's values, preferences, and needs) and relatedness (i.e., feeling connected with and cared for by significant others during pregnancy) – the fulfillment of which are essential components for effective functioning and wellness [729-730] – emerged from participant interviews. Central to this theme of self-determination was the participants' intrinsic motivation (i.e., engaging in behaviours for their own sake rather than due to rewards, social norms or to avoid punishment [729]) for conservative care (i.e., the minimal or without use of medication and minimal use of invasive procedures) and a strong desire to experience a physiological labour and birth (i.e., labour and birth powered by the innate capacity of the birthing person and foetus [731], preferably at home.

Although studies have documented the use of complementary, alternative and integrative medicine (CAIM) [29] by pregnant women in preparation for labour and specifically the desire for a natural childbirth [33, 732] this is the first paper in the scientific literature documenting the use of chiropractic services by pregnant women due to its conservative approach to patient care (i.e., minimal use of medication for pain or to induce labour), increase the chance of a pregnant woman to avoid a Caesarean and experience a physiological labour and delivery in addition to relief of LBP and/or PGP. The pregnant participants of Sadr et al. [332] and Bernard-Giglio et al. [678] were motivated to attend chiropractic care for relief of LBP and/or PGP based on their previous experience with chiropractic as pregnant and/or non-pregnant patient experience. Previous use of chiropractic services has been demonstrated to be associated with its use during pregnancy. [733-734]. In a systematic review of the literature to assess the effectiveness of chiropractic care commonly used for pregnancy-related LBP and/or PGP, Weis et al. [49] found many of the interventions applied by chiropractors to have moderate or unclear but favorable evidence.

In the present study, some study participants specifically sought chiropractors certified in the Webster Technique. [358] This was based on their own research on chiropractic care for pregnancy and the strong recommendation by their midwives and recommendations by family and friends with previous experience with chiropractic while pregnant. The theoretical conceptual practice framework of the Webster Technique is to restore and maintain neuro-biomechanical function in the sacrum and pelvic region. Maintaining the neuro-biomechanical function in the pelvis is thought to facilitate an effective transition towards a natural childbirth and towards a positive labour and birth experience (i.e., less obstetric intervention such as use of Pitocin). In an analysis of the Australian Longitudinal Study on Women's Health involving 1885 pregnant or recently

given birth respondents, Steel et al. [735] found that women receiving chiropractic care during pregnancy were less likely to require a Caesarean section after onset of labour or to have a premature birth, but more likely to have an instrumental childbirth. These reported findings based on an analysis of a large cohort of pregnant women is the first of its kind beyond anecdotes.

In addition to case reports [273, 315], two other studies are noteworthy for their investigation on the benefits of chiropractic care to improve labour and delivery. In a case control study, Phillips and Meyer [253] compared 35 pregnant women receiving chiropractic care in addition to usual obstetrics care with a matched comparison group of 35 non-chiropractic women receiving no chiropractic care. Phillips and Meyer [253] found no statistically significant differences in the level of intervention for labour (i.e., Pitocin induction or stimulation) and delivery (i.e., Caesarean or vaginal) between the two groups. In another longitudinal study, Alcantara et al. [53] examined the effects of the Webster Technique on the rates of auto correction of foetal malposition or malpresentation prior to birth. Based on data from 63 pregnant women, 70% of the foetal malposition/malpresentation reverted to vertex with the Webster Technique. However, the authors commented that the results must be examined with caution since a number of the subjects were receiving other forms of care (i.e., slant board, moxibustion, homeopathy) that confounded their findings.

Also contributing to the theme of self-determination were the subthemes of barriers (i.e., cost of care and bias against chiropractic by friends and family) and facilitators (advice of midwife or friends and family) to chiropractic care and the safety of chiropractic care. These additional subthemes presented challenges to be overcome or factors that must be taken into consideration in the participants' pursuit of self-determination.

Six barriers to chiropractic care, defined as factors that make access to or use of chiropractic services difficult or impossible, for pregnant women were identified by participants. Three of these were personal barriers (i.e., financial barriers, logistical issues, and discrimination and bias), another was due to a specific caregiver quality or qualities (i.e., chiropractor knowledge and expertise), and another two were service characteristics (i.e., accessing the chiropractic clinic due to distance travelled and the time devoted for patient visits). [491] These barriers are not unique to chiropractic pregnancy care and have been identified in both general prenatal care [736-737] and chiropractic. [738] Although not identified in the study by Sadr et [332], Bernard-Giglio et al. [678] identified discrimination and bias on the part of friends and family of the pregnant women as a barrier to chiropractic care. This finding was also identified in the present study.

The cost of health care is a well-recognised barrier to the use of recommended health services among those with insurance (i.e., copayments, deductibles, lack of coverage) or without. [739-740] Although participants in this study were relatively affluent and highly educated and could afford to pay out-of-pocket cost for their chiropractic visits, out-of-pocket costs, insufficient or nonexistent insurance coverage for pregnancy care or their chiropractor did not accept insurance reimbursement were identified by the participants as barriers to care by other pregnant women seeking chiropractic care. If healthcare reform is truly about making healthcare affordable for women in the perinatal period [741], investigations into the integration of CAIM practitioners like chiropractors into mainstream healthcare delivery systems are required. As in allopathic healthcare [742], physical geography (i.e., extensive distance to reach the appropriate chiropractic clinic) and healthcare-related provider factors (i.e., limited availability of chiropractors with the training, professional knowledge, skills, and clinical expertise to care for pregnant

women) have also been identified as barriers to healthcare delivery and access to chiropractic care in the present study.

As was found in this study and by Bernard-Giglio et al. [678], the decision-making process preceding the use of alternative therapy is highly influenced by an individual's social network, made up predominantly of family and friends. [743] Unlike the findings of Adams et al. [744] that found that medical professionals and allied healthcare practitioners played a relatively insignificant role in referral for complementary treatment, participants in this study indicated their midwife was a significant source of referral for chiropractic care. Midwives support the use of CAIM (and chiropractic specifically) because they believe it is philosophically congruent with midwifery. [646, 745-746] For example, both midwives and chiropractors acknowledge and trust in the body's inner wisdom, offer profound support and commitment to noninvasive birthing procedures, and offer individualised care. [344] Furthermore, as found in this study, midwives referring pregnant women for chiropractic care have experienced positive personal and professional clinical experience with chiropractic. [646] The use of CAIM supports a woman's autonomy and can enhance a midwife's professional autonomy. [745] Some participants of the study indicated accessing the Internet to gain information about (CAIM) [29] treatments and specifically, chiropractic. This is congruent with the use of the Internet to search for medical or health-related information [747-748] However, in this era of healthcare consumerism [749], consumers need to be cautious of unsubstantiated claims on the Internet. [748] As was raised by some of the participants in the present study, finding a chiropractor specifically trained and experienced in pregnancy care was challenging.

7.4.2 Enhanced Pregnancy Experience

A key consideration from the World Health Organization's guidance for antenatal care for pregnant women [750] was a positive pregnancy experience, defined as the

maintenance of physical and sociocultural normality, maintaining a healthy pregnancy for mother and baby (including preventing or treating risks, illness and death), having an effective transition to positive labour and birth, and achieving positive motherhood (including maternal self-esteem, competence and autonomy) [225, 751]. According to participants of this study, chiropractic care enhanced their pregnancy experience. The subthemes of high satisfaction with chiropractic care, feelings of support with chiropractic, and attitudes of safety with chiropractic for themselves and for their unborn child supported this enhanced pregnancy experience.

Patient satisfaction is a measure of the degree to which a patient is fulfilled or gratified with the healthcare they received from their healthcare provider and is an important measure of quality in healthcare. [752]. Patient satisfaction has been examined from a myriad of viewpoints based on the Donabedian model [753] of general expectations in accessing healthcare infrastructure, the interpersonal and technical process of care experience of the patient and expectations of a positive outcome from care. [754] Individuals presenting for care with a healthcare provider have diverse expectations ranging from accessing the appropriate provider and facilities to address their health concerns (in general) to more specific expectations related to their healthcare providers' interpersonal and clinical skills. [755] Meeting expectations has been applied as a valid measure of patient satisfaction with healthcare services. [756] To date, the prospective study by Alcantara et al. [113] remains the only study specifically examining patient satisfaction in pregnant chiropractic patients. In addition to examining the QoL of pregnant women receiving chiropractic care, the authors utilised the RAND VSQ9, a 9-item visit-specific satisfaction instrument (i.e., ratings of *poor* = 0%, *fair* = 25%, *good* = 50%, *very good* = 75%, and *excellent* = 100%) to examine the patient's access to chiropractic infrastructure (i.e., amount of time to get an appointment, convenience of location), the

technical and interpersonal process of care experience of the patient (i.e., time spent with the chiropractor, explanation of procedures performed, technical skills of the chiropractor, personal courtesy of the chiropractor) and overall rating of satisfaction with their patient visit. The women in the study indicated high patient satisfaction at baseline (i.e., overall visit rating = 95.62%) and increasing satisfaction in a statistically significant manner (i.e., ($t = 3.8409$, df = 8, $p < .005$) at comparative measures (i.e., overall visit rating = 96.14%).

Participants in this present study attended chiropractic care for the purpose of addressing their pregnancy related MSK complaints. From all accounts, participants' expectations of relief of their presenting complaints were met with chiropractic care. As was previously discussed, there is evidence that pregnant women may benefit from chiropractic care to address their pregnancy-related LBP and/or PGP. [49] There is also evidence that chiropractic care improves the QoL of pregnant women. [49,100-101, 113, 247, 249, 251]

According to Donabedian, technical process of care should be judged in comparison with best practices (i.e., clinical competence), while interpersonal process of care is the vehicle by which technical care is implemented and includes in prenatal care good communication between a patient and their health care provider, participation in the decision-making and good interpersonal style experience from their health care provider and office staff. [757] Characterisation of these processes, their measurement and their impact on patient satisfaction and quality of care have been a focus of research. [758] Ineffective communication has been identified as a barrier to prenatal care utilisation. [758-759] Perceived lack of concern and respect [736, 760], being authoritative and task focused on the part of the prenatal healthcare provider have also been found to deter use of prenatal care [760-762] and a barrier to the disclosure of health concerns by the pregnant patient. [763] The interpersonal process of care experience is therefore an important aspect

of keeping pregnant women engaged in their care and ultimately important in the outcomes of their pregnancy. Participants in this study reported experiencing good interpersonal process of care characterised as good communication with their chiropractor, being part of the decision-making process in their care and having a caring chiropractor. A strong, positive correlation ($r = .78$, $p < .001$, $R^2 = 61.46\%$) was found between caring and patient satisfaction. [764] These findings are consistent with the findings of Alcantara et al. [113] on the use of the VSQ9 to measure patient satisfaction among pregnant chiropractic patients. Sadr et al. [332] also emphasised the importance of good chiropractor–patient communication as one of their themes.

Social support is a critical protective factor for women experiencing physical and emotional changes in the perinatal period. [765] Social support is defined as fulfilling the needs of individuals who have a connection and recurring interactions with others in the form of emotional, informational, instrumental, and appraisal support. [766] Low social support has been shown to be significantly associated with risks of depression, anxiety, and self-harm during pregnancy. [767] Social support has been demonstrated to play a direct and mediating role in improving the health related QoL of pregnant women. [768]

Central to participants feelings of social support was their sense of community outside and within the context of their chiropractic care. Unlike traditional clinic environments where examination and treatment are provided in a private room, participants in this study were cared for in an open environment. No study has determined if this is type of clinic design is common among chiropractic practices. Referred to as an ‘open adjusting environment,’ participants were provided ongoing care within sight of other patients and staff. The initial consultation involving patient histories, patient examinations, or the presentation/discussion of the reports of findings were performed in a private setting. Patients are not undressed in an open adjusting room setting but may have

been asked to wear clothing that facilitated easy movement on the chiropractic table. [769] This open environment allowed for social interaction and peer support, facilitating the sharing of information and discussions of individual or mutual concerns regarding participants' experiences with pregnancy and with their care. Although most chiropractic patients cared for in an open environment indicate a high level of satisfaction, their dignity respected, their privacy maintained and being cared for in a professional manner [769], one participant in this study indicated that providing immediate feedback to their chiropractor was not so easy in an open environment but not impossible if required. Given the importance of social support in maintaining overall social well-being in pregnancy care, [770] the use of an open environment in chiropractic pregnancy care deserves further research attention.

Another subtheme contributing to participants' enhanced pregnancy experience with chiropractic care was participants' attitude about patient safety. To date, studies on patient safety in pregnancy care are limited, comprising mostly of studies reporting systematic reviews [55-56, 365], a study on the opinions of safety from a limited number of practitioners (n = 18) with minimal experience in pregnancy care [260], and a retrospective file review of the foetal heart rate monitoring of pregnant women under chiropractic care. [264]. Chiropractors' and patients' perspectives on patient safety in chiropractic deserves further investigation. Similar to the participants of Sadr et al. [332] and Bernard-Giglio et al. [678], our study participants were of the opinion that chiropractic care in pregnancy was safe. However, this is the first study to examine the perspective and meaning behind participants' safety attitudes.

Participants' attitudes about safety with their chiropractic care were based on trust in chiropractic care, despite some participants' experiencing mild adverse events with chiropractic spinal manipulative treatments. Trust is the foundation of the doctor–patient

relationship. [771] Across diverse clinical settings, patients have reported being more satisfied with treatment, showed more beneficial health behaviours, less symptoms and higher QoL when they had higher trust in their health care professional. [772] Trust has been defined as the optimistic acceptance of a vulnerable situation in which the trustor believes the trustee will care for the trustor's interests. [773] This definition highlights four key features of trust in the chiropractic setting: (1) it involves a chiropractorpatient relationship, (2) there is a set of expectations about how the chiropractor will behave in relation to the patient in the future, (3) there is a degree of vulnerability and risk assumed by the patient, and (4) there is an expectation that the chiropractor will have concern for the patient's interests. [774] Pregnant patients experienced a degree a vulnerability and risk, regardless of the type of care they received. Participants reported experiencing mental reassurance and confidence in the direction their pregnancy and care was heading. They felt heard, were part of the decision-making process, placed a high trust in their chiropractor, and felt that their chiropractor was caring. Participants' expectations were met in terms of their chiropractor's clinical experience and expertise with pregnancy care. Another contributing factor was participants general attitude of safety of chiropractic. This attitude that chiropractic is safe stemmed from their previous experience with chiropractic and observing the safe chiropractic care of friends and family. Unlike the Sadr et al. study [332] that reported no adverse events among its participants, two participants in the present study experienced muscle soreness following their initial care. The muscle soreness did not require medical attention and the participants did not regard these symptoms as a cause for concern given that they experienced soreness with previous care without consequence.

7.4.3 Transformative Experience

Although the majority of participants attended chiropractic care prior to pregnancy, the chiropractic care of pregnant women is not the same as that of non-pregnant adults.

Chiropractic pregnancy care requires a unique approach to patient care with specialised knowledge and skills. In Sadr et al.'s [332] study, their chiropractor participants were knowledgeable about caring for pregnant patients and had either some kind of formal postgraduate training or had attended seminars or workshops. The attending chiropractors in this study were all postgraduate instructors in prenatal care with the International Chiropractic Pediatric Association, a professional organisation providing postgraduate training in paediatric and perinatal chiropractic care. [775] Their appointment as instructors was based on their content and clinical expertise with pregnancy care.

Pregnancy itself is a transformative experience characterised by three trimesters, each marked by unique physiological and psychological changes. [776] In the context of pregnant patients under chiropractic care, participants in this study described a transformative experience that was specific to their care. This was characterised by their new knowledge and new experiences of chiropractic care, a sense of self-discovery and awareness, and pregnancy competence.

Patient education is a hallmark of the chiropractic clinical encounter and is defined as the process of influencing patient behavior and producing the changes in knowledge, attitudes and skills necessary to maintain or improve health. [777] Throughout their interviews, participants indicated acquiring new knowledge and skills in ways to address symptoms or complaints associated with their pregnancy. Foremost in this process was participants' education on the chiropractic paradigm of health as exemplified with the Webster Technique. The clinical and theoretical framework of the Webster Technique is to establish and maintain neurobiomechanical function of the sacral/pelvic region though chiropractic adjustments. [358] As previously discussed, this technique was observed to ease labour and delivery. Through patient education, participants described an increase in their awareness and sense of self-discovery about their pregnancy and their bodies.

The use of the term pregnancy competency was borrowed from the term maternal competency, defined as perceived maternal role competence or a mother's judgment of how well she can function in a caregiving capacity and address specific tasks or challenges related to the parenting role. [778] Therefore pregnancy competency is a pregnant woman's judgement on how well she can function during her pregnancy and address specific tasks or challenges she may encounter in her day-to-day activities. Very little is known about the influence of chiropractic care on women and maternal competency during their transition to motherhood, that is, pregnancy and following childbirth. This present study is the first to demonstrate the positive influence of chiropractic on women's pregnancy and maternal competency. Participants' experience with chiropractic care resulted in pregnancy competency by improving and maintaining their functionality, providing them with peer-support and encouragement, boosting their self-esteem and decreasing their stress and anxiety about their pregnancy.

7.4.4 Study Context

To the best of our knowledge this is the first study describing the lived experience of pregnant women under chiropractic care using a phenomenological approach. The previous studies by Sadr et al. [332] and Bernard-Giglio et al. [678] examined the chiropractic experience of pregnant women presenting specifically to address their pregnancy related LBP and/or PGP. The present study did not specify such a criterion for study inclusion.

Sadr et al. [332] and Bernard-Giglio et al. [678] utilised a grounded theory approach to explore the experiences of pregnant women under chiropractic care for LBP and/or PGP. Not surprisingly, the investigators found similarities in their thematic analysis. In both studies, the participants received chiropractic care prior to their present pregnancies with successful outcomes to address the participants' LBP and/or PGP. The

Bernard-Giglio et al. [678] participants also described chiropractic care in previous pregnancies with successful outcomes. Similar motivating factors were also identified in the majority of participants in this phenomenological study.

In terms of barriers to chiropractic care, Sadr et al. [332] and Bernard-Giglio et al. [678] acknowledged the lack of knowledge among the pregnant women about pregnancy in general and LBP care in particular. Among the Sadr et al. participants, this presented a challenge or a barrier to their care. Among the Bernard-Giglio participants, this lack of knowledge contributed to the participants' doubt about the role of chiropractors in treating pregnant. The Bernard-Giglio participants also identified negative sentiment by others, the cavitation during chiropractic SMT and the attitude that LBP and PGP are a normal consequence of pregnancy.

In terms of the type of care provided to the participants, both studies described the application of Diversified Technique, characterised as high velocity, low amplitude thrust with modified (low) force in addition to low force techniques such as Activator Methods. Adjunctive therapies were also applied, including soft-tissue modalities, postural modification and patient education and reassurance. The studies by Sadr et al. [332] and Bernard-Giglio et al. [678] also acknowledged the use of prescribed self-care as part of the care experience of the pregnant women. These include yoga, stretches and/or walking. The participants in both studies acknowledged the safety of chiropractic care during pregnancy. In terms of treatment and its effectiveness, both studies found that pregnant women found their chiropractic care as effective in alleviating their pain complaints. Beyond pain relief, both studies documented the pregnant women to experience psychosocial well-being with reduced stress and anxiety. Sadr et al. [332] attributed mental wellbeing to good doctor–patient communication while Bernard-Giglio et al. [678] attributed mental being as a positive consequence of relieving the women's pain complaints. Despite the many

similarities in findings, Sadr et al. [332] and Bernard-Giglio et al. [678] differed in some respects: Sadr et al. [332] highlighted the importance of doctor–patient communication, while Bernard-Giglio et al. [678] highlighted the barriers to pregnant women receiving chiropractic care. As has become evident in these discussions, the themes identified by Sadr et al. [332] and Bernard-Giglio et al. [678] were similar or related to the subthemes identified in the present study. However, the phenomenological approach demonstrated in this study provided a more in-depth and holistic exploration of the lived experience of pregnant women under chiropractic care and the meanings they ascribed to them.

7.4.5 Strengths and Limitations

The finding of this study emerged from the reflections of 10 pregnant women on what it was like for them to receive chiropractic care. Consequently, the findings are context-dependent and not intended to be generalised. Participants in this study were not a homogenous population and differed in many respects, most notably in terms of their age, parity, trimester of pregnancy, marital and socioeconomic status. These differences may have influenced their experiences with chiropractic care and ultimately the themes and subthemes generated from our analysis. Furthermore, participants in this study self-selected to share their stories and experiences which adds an element of selection bias. Despite these limitations, the findings of this study provide valuable insights into the essence of the lived experience of pregnant women under chiropractic care.

7.5 Conclusion

This qualitative study examined the lived experience of pregnant women under chiropractic care. Guided by transcendental phenomenology, our analysis identified three key themes to describe the essence of the lived experience of pregnant women under chiropractic care: (1) chiropractic care promoted self-determination to achieve their

desired pregnancy experience, (2) with chiropractic care women's pregnancy experience was enhanced due to met expectations, a healthy and safe pregnancy and a positive attitude towards their labour and delivery, (3) chiropractic care was a transformational experience in that participants described a cognitive and emotional shift in how they viewed themselves and their pregnancy leading to a sense of competence about their pregnancy. Our findings could inform unique strategic opportunities for chiropractic educators, practitioners, researchers, and policymakers in the chiropractic care of pregnant women.

Chapter 8. Discussion and Conclusion

This thesis is about the chiropractic care of pregnant women. It is comprised of three studies informed by a scoping review and two systematic reviews of the literature. In keeping with the aims of this thesis, Study 1 characterised chiropractors involved in chiropractic pregnancy care, including their patients and practice features. Study 2 assessed measures of sense of coherence (SOC), quality of life (QoL), general self-efficacy (GSE), multidimensional health locus of control (MHLOC), and the interpersonal process of care (IPC) experience in pregnant and non-pregnant women under chiropractic care. To provide context to these quantitative studies, Study 3 examined the lived experience of pregnant women under chiropractic care.

8.1 Study 1: Chiropractic Care During Pregnancy and the Postpartum Period: A Survey of Chiropractors

8.1.1 Practitioner Characteristics in the Chiropractic Care of Pregnant Women

To date, Study 1 in this thesis provides the most comprehensive and cohesive characterisation of the practice of chiropractic involving pregnancy care. Although the characteristics of pregnancy care have been examined in a number of papers [53, 113-114, 256, 258, 254, 257, 260, 261-262, 332, 361], they lacked depth and cohesion, were drawn from small samples or from chiropractor informants not versed in pregnancy care. The consequence may be data that is inaccurate, lack credibility and of limited external validity.

The first aim of this thesis was therefore to characterise chiropractic practice in the care of pregnant women from chiropractor informants that care for a relatively high number of pregnant patients per week. [48] Characterising the day-to-day practice of chiropractors that attend to an average of 25.8 visits per week from pregnant women

resulted in data that is not only reliable and have external validity but provide for credible insights into the practice of chiropractic involved in pregnancy care.

Study 1 found that practitioners involved in pregnancy care were more likely to be female than male, relatively young (i.e., average age = 39.0 years), have postgraduate education in perinatal care, practise with other chiropractors, and have ≤ 15 years practice experience. Pregnant patient visits were described as reimbursed more out-of-pocket by the patient rather than by health insurance.

In terms of patient care, the growing foetus is accommodated with the use of pregnancy pillows or a table with a drop piece, avoidance of rotation of the lumbopelvic region, and the reduction of the amount of force normally applied during spinal manipulation. The Webster Technique was identified by the respondents as their primary technique in pregnancy care to restore and maintain the neurobiomechanical integrity in the lumbo-pelvic region. [358]. The technique involves a specific analytic approach and spinal manipulation directed to the sacroiliac joint followed by a sustained thumb contact on the abdomen overlying the round ligament of the uterus.

Chiropractors have reported that pregnancy care is a collaborative effort with other healthcare providers. [678] This was confirmed in Study 1 with respondents indicating a professional relationship most commonly with massage therapists followed by midwives, acupuncturists, medical doctors, mental health professionals and least commonly with naturopathic physicians. Referrals of pregnant women to chiropractors from other providers were to address pregnancy-related low back pain (LBP) and/or pelvic girdle pain (PGP) and specifically from midwives and obstetricians/gynaecologists, to address foetal malposition and malpresentation. Chiropractic referrals to other providers were dependent on the unique specialty of the practitioner. For example, referrals to massage therapists were for soft tissue work, to medical doctors for health issues outside the scope of

chiropractic, including mental health issues. These findings underscore the importance of chiropractors in recognising health issues outside their scope of practice and care expertise, acknowledge the expertise and contribution of other healthcare professionals and refer to them in a coordinated effort to ensure pregnant patients receive the care they need.

Study 1 constitutes the primary study into the management strategies of chiropractors in the care of pregnant women with pre-existing comorbidities. For comorbidities involving LBP, PGP, cramping, urinary calculus, ovarian cyst in the first trimester, inguinal hernia, placenta previa, fibroids, pre-eclampsia/eclampsia, gestational diabetes and gestational hypertension, the majority of respondents indicated that they would perform a clinical work-up (i.e., history and physical examinations), provide SMT and/or adjunctive therapies, and refer to a specialist. For comorbidities involving vaginal bleeding or spotting due to cervix irritation, spotting due to ectopic pregnancy, premature labour, appendicitis, and ectopic pregnancy, the majority of chiropractors indicated as performing a clinical work-up but make an immediate referral to a specialist for further care. In the case of a ruptured amniotic membrane in the second trimester and placenta abruptio, these were indicated as absolute contraindications to chiropractic care. The clinical approach of chiropractors in the care of pregnant women with comorbidities requires further investigation to ensure the provision of safe, effective, and collaborative care that is congruent with standards of care.

8.1.2 Patient Characteristics

Study 1 established a typical profile of a pregnant woman attending chiropractic care in Canada and the United States. The woman is in their early 30s, more likely White, highly educated (i.e., with a baccalaureate degree or higher), and of high socioeconomic status (i.e., mean family income of $153 222). Pregnant women were attracted to chiropractic care based on the recommendation of friends and family, previous positive

experience with chiropractic to address MSK conditions, chiropractic's conservative approach to care (i.e., drug-free and noninvasive procedures), the promise of a natural childbirth, and overall wellness care. Study 1 presented a new perspective on the presenting complaints of pregnant women to chiropractors other than pregnancy related musculoskeletal (MSK) complaints. In the first trimester, morning sickness (i.e., nausea and vomiting), fatigue and headache were common presenting complaints. In the second trimester, acid reflux and fatigue were common complaints. In the third trimester, complaints of abnormal foetal positioning (i.e., breech foetus), heartburn, abdominal pain and constipation were common clinical presentations.

8.2 Study 2. Sense of Coherence and Associated Factors in Pregnant and Non-Pregnant Women Attending Care in a Practice-Based Research Network

The findings of Study 2 of this thesis are novel. Unique to pregnant and non-pregnant women under chiropractic care, SOC was assessed with the SOC-29 [79], GSE with the scale by Schwarzer and Jerusalem [511], MHLOC with the scale by Wallston et al. [525], IPC experience with the IPC-18 by Stewart [534], and QoL with the PROMIS-29. [495] Relative to non-pregnant respondents of similar age, QoL measures were more compromised in pain interference and physical functioning but less compromised in depression in a clinically significant manner. Relative to non-pregnant respondents of similar patient visits, pregnant women were compromised in physical functioning and better scores in anxiety, depression, SOC, and its subdomains of manageability and meaning, in a clinically significant manner.

This confirms that patient age and patient visits affect measures of QoL and SOC but not GSE, MHLOC and IPC experience of pregnant and non-pregnant women as they did not differ statistically or clinically in a significant manner based on patient age or number of patient visits.

While other studies have reported measures of SOC, GSE and HLOC [779-783], the use of the SOC-29 [79] in combination with GSE scale by Schwarzer and Jerusalem [511] and the condition-specific (Form C) MHLOC scale [525] in this study is unique. Along with measures of QoL and IPC experience, these health constructs provided an insight into the respondents' individual and group perceptions and beliefs in their abilities to manage and control their health and well-being. The similarities, differences, and interrelationships of these health constructs among pregnant and non-pregnant women can be applied to discern the respondents' actions and choices that affect their health while under chiropractic care.

8.2.1 Sense of Coherence

After eliminating the possible effects of age and number of patient visits, the mean SOC score among the pregnant respondents was clinically significantly greater than those of the mean SOC score of the non-pregnant respondents. The difference in mean SOC scores between pregnant and non-pregnant women cannot be inferred from the chiropractic care received as both cohorts were under chiropractic care. The difference in mean SOC score between pregnant and non-pregnant women may be due to self-selection (i.e., pregnant women present for chiropractic care with a relatively greater SOC) or due to unidentified factors. Chiropractic care has been posited to have a positive influence on a pregnant woman's SOC to address the stressors associated with pregnancy. The objectives of chiropractic pregnancy care are to restore and maintain a balanced spine and the neurobiomechanical integrity of the pelvis with chiropractic adjustments and adjunctive therapies (i.e., patient education, exercise, diet and nutrition). Through this process of care, a pregnant woman's ability to mobilise their general resistance resources (GRRs) may be increased in order for them to comprehend and manage their pregnancy and labour and view their pregnancy as more meaningful (i.e., maintain their individual health and the

health of their child). This aligns with the study findings of Ferguson and Davis [784] in that Australian women with strong SOC express a positive, relaxed and baby-focused attitude with labour and birth, and increased internal and external GRRs. Future research should further examine the effects of chiropractic care on pregnant women's SOC.

In Study 2, measures of SOC and its associated factors (i.e., GSE, HLOC, QoL) were from the context of Canadian and American pregnant and non-pregnant women receiving chiropractic care. As discussed in our systematic review on measures of SOC during pregnancy (see Chapter 2.2 Sense of Coherence in Pregnancy: A Systematic Review of the Literature), measures of SOC are dependent on many factors including study design (i.e., prospective versus retrospective cohort), individual factors (i.e., trimester of pregnancy, pre-existing comorbidities) and country of study. For example, Hellmers and Schuecking [190] found that German women with a high SOC preferred a spontaneous birth while those with lower SOC scores favoured Caesarean births. Among American women however, the choice of birthing was not associated with their SOC score. According to Hellmers and Schuecking [190], the differences in country of study could also account for the wider social, cultural, economic and environmental view of pregnancy such job status during pregnancy, back to work requirements, and access to affordable healthcare. Measures of SOC may be dependent on these factors and other yet to be unidentified factors.

8.2.2 General Self-Efficacy

The differences in the mean GSE score between pregnant and non-pregnant respondents were not statistically and clinically significantly different, regardless of age or number of visits to the chiropractor. This implies that pregnant and non-pregnant women under chiropractic care may have similar belief in their competence to cope with a broad range of stressful or challenging demands. [511] While it is acknowledged that individual

variations in measures of GSE may occur within and among pregnant and non-pregnant women and that factors such as social support [785] and resources [786] may impact GSE, the findings of Study 2 implies that pregnant and non-pregnant women have similar levels of belief (i.e., confidence, motivation and decision-making [787-790]) in their abilities to influence their health behaviours.

8.2.3 Health Locus of Control

The MHLOC domains of Internal, Chance, Doctors and Other People LOC were not statistically or clinically significantly different among the pregnant and non-pregnant respondents, regardless of the respondents' age and number of visits to the chiropractor. In both group of respondents, relative to the maximum scores, Doctors LOC was greatest followed by Internal LOC, Other People LOC, and Chance LOC. These findings indicate that the domains of the MHLOC instrument are not mutually exclusive in pregnant and non-pregnant women. While internal versus external LOC may have different LOC belief systems, they were represented in varying degrees such that in both groups of respondents, the belief that their health outcomes depend on their health behaviours is reflected in a high internal LOC but that external factors/LOC also influences their health. This mix of LOC indicates that respondents were also taking personal responsibility for their health by seeking alternative resources such as chiropractic care. For the pregnant women, their pregnancy status placed them in a health situation outside their control and other health professionals such as a chiropractor may have been seen as having a great impact on their health. [791]

8.2.4 Interpersonal Process of Care Experience

The scoring interpretation of the domains of the IPC-18 by pregnant and non-pregnant respondents indicate a high IPC experience with chiropractic care. This is

consistent with the literature documenting high patient satisfaction among chiropractic patients [116, 693] and pregnant patients in particular. [113] On initial analysis, the seven domains of the IPC-18 did not differ in a statistically or clinically significant manner among both group of respondents. However, after eliminating differences in age or patient visits attended, the subdomain of Communication (Lack of clarity) was found to differ in a clinically significant manner. Relative to non-pregnant women, the pregnant respondents assessed their chiropractor as communicating with lesser clarity. [113, 116] The disparity may be explained in that the health information demands of pregnant women may be more complex and that chiropractors need to communicate to them more clearly and effectively. Furthermore, pregnant women have been shown to suffer from impairment in some memory measures, including recall and naturalistic prospective memory and mood changes. [792-793]

8.2.5 Quality of Life

In terms of physical health (i.e., physical functioning and pain interference), the hypothesis that the QoL of pregnant women was more compromised compared to non-pregnant women was confirmed in Study 2.

8.2.6 Correlation of Health Constructs

The collection of measures of SOC and its related health constructs allowed for the exploration and hypothesis testing of their correlational relationship in pregnant and non-pregnant women.

The stronger correlation between SOC and the mental health relative to physical health domains confirms previous findings [220, 711-712]. Given the moderate intercorrelation between SOC with Fatigue, Sleep Disturbance and Satisfaction with

Participation in Social Roles and Activities, the findings that these QoL domains have both physical and mental health characteristics is supported. [674]

The hypothesis that SOC was positively correlated with Physical Function and Satisfaction with Participation in Social Roles and Activities and negatively correlated with Anxiety, Depression, Fatigue, Pain Interference and Pain Intensity was confirmed. However, on examination of the overall correlation (i.e., pregnant and non-pregnant data combined), the hypothesis that SOC was strongly correlated with Physical Function and Satisfaction with Participation in Social Roles and Activities was not confirmed. The hypothesis that SOC is strongly correlated with Depression is confirmed but not the strong correlation between SOC and Anxiety, Fatigue, Pain Interference and Pain Intensity.

The hypothesis that SOC was strongly correlated with GSE in both pregnant (r = .63) and non-pregnant women (r = .69) was confirmed in Study 2. This supports the idea that SOC and GSE share similar characteristics among the pregnant and non-pregnant respondents and point to convergent validity. As pointed out by Trap et al. [429], both constructs have a cognitive component (i.e., anticipatory of events), a motivational component (i.e., goal setting and personal investment), and a capability component (i.e., ability to cope and perceive resources). Furthermore, the components of SOC (i.e., comprehensibility, meaningfulness, and manageability) can include the learning processes for GSE (i.e., mastery experience, vicarious experience, social persuasion, psychological factors).

A study utilising SOC-29 [79] and GSE [511] found a correlation of .38 among young adult immigrants from the former Soviet Union to Israel. [794] Other studies applying the GSE [511] with SOC-13 [795] found correlations ranging from .33 to .51 [712, 714, 796-798] One study found negative weak correlations between SOC-13 and GSE. [799] The differences in the correlation between SOC and GSE in these studies and

in Study 2 may be due to confounding variables. For example, the studies involved different types of respondents (immigrants, coronary artery patients, chronic illness patients), different SOC instruments (i.e., SOC-13, SOC-29, 10-item versus 3-item GSE), and differences in cultural and societal study settings (i.e., Italian versus immigrants from former Soviet Union to Israel). A strong SOC is associated with coping [800] and strengthens resilience and promotes an individual's state of well-being [801] while high levels of GSE are associated with increased resilience [787], high motivation and adherence to prescribed protocols. [788] SOC-29 and GSE may have a synergistic effect upon each other such that individuals with high GSE may perceive a greater SOC and vice versa. Chiropractors therefore have greater options in their interventions to increasing SOC or GSE in order to improve their patients' health outcomes and overall QoL.

The correlational pattern between SOC-29 [79] and the domains of Form C MHLOC [525] was different in pregnant and non-pregnant women. Among the pregnant respondents, Internal LOC was moderately positively correlated with SOC while Chance LOC, Doctors LOC and Other People LOC were weakly positively correlated with SOC. Study 2 failed to confirm the hypothesis that SOC was strongly positively correlated with the Internal LOC and strongly negatively correlated with Chance, Doctor and Other People LOC in pregnant women. Among the non-pregnant respondents, Chance LOC was moderately negatively correlated with SOC and its subdomains of Comprehensibility, Manageability and Meaning. All other correlations were weakly positively correlated. Study 2 failed to confirm the hypothesis that SOC was strongly positively correlated with the Internal LOC and strongly negatively correlated with Chance, Doctor, and Other People LOC in non-pregnant women. The differences in correlational patterns between SOC and MHLOC in pregnant and non-pregnant women may be due to differing LOC mechanisms. For example, pregnant women may be motivated and will go through great

effort to ensure their health and that of their unborn child. [802] A higher SOC among pregnant women may result in a greater sense of perceived control over their health behaviour resulting in the perception of their internal and external environment as understandable and predictable. Among the non-pregnant women, such motivation for the safety of another does not exist and Chance LOC played a more prominent role in determining their health outcomes. This greater role of chance may be reflective of their lower SOC and a lower perception of their internal and external environment as understandable and predictable.

The correlational relationship between SOC and the subdomains of the IPC-18 were also different in pregnant and non-pregnant women. Among the pregnant respondents, SOC and its subdomains (i.e., Comprehensibility, Manageability, and Meaning) were strongly negatively correlated with Communication (Lack of clarity); SOC was moderately positively correlated with the Interpersonal Style (Emotional support, compassion); and the SOC subdomain of Meaning was moderately positively correlated with Communication (Elicited concerns, responded). Among the non-pregnant women, SOC and its subdomain of Meaning were moderately positively correlated with Communication (Elicited concerns, responded). All other correlations were positive and weak between SOC and the remining subdomains of the IPC-18. These findings imply that clarity in communication and being compassionate and respectful were important aspects of the pregnant women's interaction with their chiropractor. Among the non-pregnant women, their chiropractor's ability to respond to their concerns was the most important aspect if their interaction with their chiropractor.

It was hypothesised that as the respondents experienced increasingly poor IPC experience (i.e., increasing measures of Communication [Lack of clarity] or Interpersonal Style [Discriminated due to race/ethnicity] and Interpersonal Style [Disrespectful office

staff]), the respondents' SOC would decrease. It was also hypothesised that the degree or strength of association between SOC and these variables was strong. Among the non-pregnant respondents, it was found that with increasing measures of Communication (Lack of clarity) and Interpersonal Style (Disrespectful office staff), but not Interpersonal Style (Discriminated due to race/ethnicity), SOC decreased. Among the pregnant respondents, increasing measures of Communication (Lack of clarity) were associated with decreasing measures of SOC. The hypothesis on the strong association between SOC and the increasing measures of poor IPC experience was confirmed only with SOC and Communication (Lack of clarity) among the pregnant respondents. The strength of association between SOC and Communication (Elicited concerns, responded) was moderate among non-pregnant respondents. All other strengths of association among pregnant and non-pregnant respondents were weak.

Among the respondents, it was hypothesised that increasing measures of good IPC experience (i.e., experience good communication, participated in decision making) would be associated with increasing measures of SOC. It was also hypothesised that the strength or degree of association between SOC and these variables would be strong. Among both pregnant and non-pregnant respondents, it was found that increasing measures of the aforementioned variables was associated with increasing measures of SOC. However, the degree of association was weak except for the moderate strength of association between SOC and Interpersonal Style (Emotional support, compassion) among pregnant respondents.

The different correlations between SOC (including it subdomains) and the subdomains of the IPC-18 indicate that these variables or factors affecting these variables are operating differently in pregnant and non-pregnant women. First, the mean SOC was clinically significantly greater among the pregnant respondents. A stronger SOC allowed

the pregnant women to see the world as more comprehensible, manageable, and meaningful. Stressors are more predictable, GRRs to face stressors are more readily available and to face such stressors are worth the effort and more meaningful. [801] Individuals with a higher SOC have been shown to have higher health promoting activities or lifestyles. [803-804] Additionally, pregnant women are motivated to be healthier for the health of their unborn child. [805] Consequently, a pregnant woman's patient activation or having the knowledge, skills, and confidence to manage one's health and engagement with their chiropractor may be different from those of non-pregnant women.

The different correlations between SOC and IPC-18 highlight the potential for increasing SOC among pregnant women by ensuring that chiropractors have clarity in communication, elicit and respond to their concerns, and are compassionate and respectful. Among non-pregnant women, their chiropractors should focus on ensuring that their patients' concerns are heard and responded to.

8.3 The Lived Experience of Pregnant Women under Chiropractic Care: A Phenomenological Analysis

The experiences of pregnant women under chiropractic care have been examined qualitatively by Sadr et al. [332] and Bernard-Giglio et al. [678]. However, both these studies were specific to pregnant women presenting for LBP and/or PGP with the analysis guided by Grounded Theory. Study 3 in this thesis constitutes the inaugural examination of the lived experience of pregnant women (regardless of clinical presentation) under chiropractic care from a transcendental phenomenological perspective. Three themes emerged to describe the essence of the lived experience of pregnant women under chiropractic. First, pregnant women described a greater capacity for self-determination to achieve the pregnancy experience they desired. Central to self-determination were the participants' motivations (i.e., conservative approach to care, use of the Webster

Technique to facilitate chances for a natural childbirth), overcoming barriers (e.g. lack of insurance coverage, out-of-pocket cost, bias against chiropractic, finding a chiropractor with pregnancy care experience, and logistical challenges such as time and distance travelled for patient visits) and acknowledge facilitators to (i.e., recommendation of friends to attend chiropractic care) to receiving chiropractic as part of their pregnancy experience.

The second theme was an enhanced pregnancy experience, which was characterised by high patient satisfaction, feelings of support (i.e., social and emotional support, informational support), and attitude of safety for themselves and their unborn child with the care they received. Chiropractic care allowed the pregnant women to maintain a level of normality in terms of their physical, mental, and social functioning, and gave them an optimistic attitude towards their labour and delivery.

The third theme described a transformative experience for the pregnant women. Integral to this theme was the participants' cognitive and emotional shift in how they viewed themselves, their pregnancy and pregnancy care. This epistemic and personal transformation occurred as a result of their experience with chiropractic care and in their acculturation to the chiropractic principles of chiropractic pregnancy care, namely to restore and maintain neurobiomechanical integrity of the lumbopelvic region with chiropractic adjustments (also known as spinal manipulation), and the use of adjunctive therapies (i.e., patient education through maintenance of proper posture and body mechanics, diet and nutrition, and exercise) for overall health.

8.4 Triangulation

The credibility and validity of the research findings in this thesis were increased with the process of triangulation, the process of combining multiple sources of data to gain a more holistic understanding of the research questions. The quantitative measures of SOC, GSE, HLOC and IPC experience obtained from Study 2 (see Chapter 6) among the

pregnant participants were provided context and meaning from the qualitative study of pregnant women described in Study 3 (see Chapter 7).

Based on the semistructured interviews of pregnant women under chiropractic care in Study 3, the quantitative measures of SOC, GSE, HLOC and IPC experience are provided context and meaning and described below. The triangulation matrix provides a summary of the triangulation findings and provided in Table 8.1. The rows provide the quantitative measures of GSE, the subdomains of MHLOC, SOC and IPC-18. The corresponding column provides the summary of the context and meaning from the qualitative study.

Table 8.1. Triangulation of Health Constructs Based on Quantitative and Qualitative Studies

Health construct	Mean (*SD*)*	Qualitative description
General Self-Efficacy	33.37 (3.72)	The pregnant women had a high GSE characterised as being proactive to findings solutions to a problem (i.e., pregnancy related MSK complaints) by doing their own research using the internet, asking people in their social circle and consulting with their healthcare provider (i.e., midwife). In terms of addressing their pregnancy-related LBP and/or PGP, the participants were certain that chiropractic care was the solution to their problem. The participants did not dwell on their problem but decided quickly to address it due to concerns or fear for the safety of their unborn child. The participants recognized the complexity of pregnancy and the limitations in their knowledge and hence the consultation with a chiropractor. The participants high GSE stems from: Mastery experiences: In addition to the participants past positive experience with chiropractic care, the participants' holistic and conservative approach to healthcare in general contributed to their belief or competence to cope with a challenging situation such as addressing their LBP or achieve their desired pregnancy experience. Vicarious experiences: Family and friends who had positive pregnancy experience(s) with chiropractic care contributed to the participants belief or competence to cope with a challenging situation such as addressing their LBP or achieve their desired pregnancy experience. Verbal persuasion: People in the participants' social circle as well as their healthcare provider (i.e., midwife) encouraged the participants to seek chiropractic care for their pregnancy and increased their belief or competence to cope with a challenging situation such as addressing their LBP or achieve their desired pregnancy experience. Physiological and affective state: Being pregnant and concern for the safety of their unborn child contributed to the participants' belief or competence to cope with a challenging situation such as addressing their LBP or achieve their desired pregnancy experience.
Internal LOC	25.91 (4.01)	The participants' high internal LOC is reflected in the participants belief that their own health behaviors determined if their health and that if their unborn child worsened or improved. The pregnant participants were determined to have a certain pregnancy experience characterised by the minimal use of medication and invasive procedures to address their LBP and/or PGP, avoid a Caesarean birth and have a physiological birth, preferably at home.
Chance LOC	13.51 (4.49)	While the majority of the participants indicated that chance or luck had no role to play in the course of their pregnancy, one individual indicated that luck does play a role in whether adverse events (i.e., fetal and maternal death) occur during one's pregnancy based on their work experience as an obstetric nurse.

Health construct	Mean (*SD*)*	Qualitative description
Doctors LOC	13.77 (3.69)	A high Doctors LOC was characterised in the acknowledgement of the participants' limitations in their knowledge and ability to self-care and their reliance on their chiropractor for their health and wellbeing.
Other People LOC	8.09 (2.65)	The participants identified family members (i.e., spouse/partner, mother and sister) as being supportive in their pursuit of health. For example, a spouse took on household chores or pay for chiropractic visits or the participant's parents as babysitters and sister providing psychological support and a sounding board to the participant's concerns.
Comprehensibility	56.82 (7.67)	Given the majority of the participants' previous experience with chiropractic care, the majority of participants had a high sense of comprehensibility in terms of addressing their pregnancy related musculoskeletal complaints. To the participants, the solution was clear to using chiropractic care as a conservative approach to their symptoms of LBP and/or PGP as well as to enhance their chances of having a natural home birth and avoid a Caesarean section.
Manageability	52.94 (6.87)	When the participants encountered an unpleasant symptom (i.e., LBP and/or PGP), they did not dwell on the experience or procrastinate in addressing them. The participants took immediate action to address their LBP and/or PGP with chiropractic care based on their previous experience and the strong recommendation by people in their social circle (i.e., friends and family). The pregnant participants mobilized their resources to overcome the barrier of cost to chiropractic care.
Meaning	40.66 (5.89)	For the participants, chiropractic care provided for them a certain level of quality of life and functionality to go through their activities of daily living. Chiropractic care facilitated their desire to achieve a certain pregnancy experience (i.e., minimal use of medication and avoidance of invasive procedures, an easier birth, the avoidance of a Caesarean and having a natural home birth).
Communication (Lack of clarity)	1.40 (0.59)	The participants rated their chiropractor's 'lack of clarity' as low indicating that the chiropractor was very good in communicating with the participants in terms of patient education/instructions and in listening to the participants' comments or concerns.

Health construct	Mean (*SD*)*	Qualitative description
Communication (Elicited concerns, responded)	4.74 (0.38)	The participants rated their chiropractor's 'elicited concerns, responded' as high. The participants described their chiropractor as attentive to their concerns and always asking how they are feeling and where they are at in their pregnancy. One participant described as being 'held' through their pregnancy experience. Another said her chiropractor recognized and acknowledged the changes that she was undergoing while another participant described her interaction with her chiropractor as making her feel confident about addressing her concerns/symptoms. Another participant indicated that she felt like she was given permission to be heard while another felt that her specific issues were addressed instead of being lumped in as symptoms and data. One participant indicated that she felt seen and understood by her chiropractors and not just another transactional relationship.
Communication (Explained results)	(0.93)	The participants rated their chiropractor as high in terms of explaining results. One participant described her chiropractor as providing good advice related to alignment and wellness care in pregnancy. Another participant described that her chiropractor explained to her the spinal adjustments that her chiropractor was performing. Another participant described that her chiropractor made her aware of what was happening, what was taking place and what was supposed to take place. Another participant described her chiropractor as happy to explain things to her as they proceeded with her care.
Decision-making (Decided together)	4.26 (0.99)	The participants scored their chiropractor as high in deciding together where the participants felt that they were involved in the decision-making. As one participant described, her chiropractor provided and discussed with her a number of care options to choose from. Another participant described discussing her care with her chiropractor to ensure her care plan were in line with her goals for care. Another participant described her discussions with her chiropractor as being able to advocate for herself.
Interpersonal Style (Emotional support, compassion)	4.92 (0.14)	The participants indicated that their chiropractors were compassionate and respectful. They used words to describe their chiropractor as nice, warm and friendly. The participants indicated that they were made to feel comfortable and relaxed, and put at ease by their chiropractor. Several of the participants indicated as having an established relationship with their chiropractor and placed a lot of trust in them.
Interpersonal Style (Discriminated due to race/ethnicity)	(0)	No forms of discrimination were indicated by the participants due to their race and ethnicity.

Health construct	Mean (*SD*)*	Qualitative description
Interpersonal Style (Disrespectful office staff)	1.04 (0.19)	No disrespectful office staff was described by the participants.

Note. LOC = locus of control.
*Rated from 1 = *never* to 5 = *always*.

8.4.1 Sense of Coherence

Comprehensibility was emphasised by the pregnant participants' ability to receive and process information that was relevant in their pregnancy and in their pregnancy care. For example, many turned to the Internet for sources of information regarding chiropractic and pregnancy care. Pregnant participants indicated that chiropractic care resonated with their desire for conservative care and the relief of their symptoms of LBP and/or PGP. The pregnant participants understood the importance of maintaining a properly aligned spine and the neurobiomechanical integrity of the lumbopelvic region.

Manageability is the conviction or ability to mobilise resources to cope or meet the demands of a difficult situation in an active and effective way to influence one's own life situation. [94] Examples of manageability on the part of the pregnant participants was their ability to mobilise their financial resources to pay for their chiropractic visits, ensuring proper posture, maintenance of proper diet and exercise.

Meaningfulness refers to the ability of an individual to classify and understand the significance of events and to perceive them as a challenge worthy of investment and engagement. [94] With chiropractic care, pregnant participants maintained a level of functionality in their day-to-day activities, improved their QoL and facilitated a natural home birth.

Overall, the relatively greater measures of SOC among the pregnant respondents appeared to be congruent with the essence of the lived experience of pregnant women under chiropractic care – namely one of self-determination, epistemic transformation and an enhanced pregnancy experience.

8.4.2 General Self-Efficacy

The pregnant participants' GSE was enhanced by their previous experience with chiropractic care to address a musculoskeletal complaint (i.e., mastery experience), the encouragement of family, friends and midwife to seek chiropractic care during pregnancy (i.e., verbal persuasion), observing pregnant friends with positive outcomes (i.e., natural childbirth) with chiropractic care (i.e., vicarious experience), and acknowledging that their bodies are changing and continued symptoms of LBP was a cause for concern in how it was affecting their day-to-day activities and their unborn child (i.e., physiological states).

8.4.3 Health Locus of Control

An Internal LOC among the pregnant respondents reflected a strong belief in their abilities to control their health. The pregnant participants engaged in health behaviours such as attending chiropractic care to achieve a certain pregnancy experience. The pregnant participants had to overcome a number of barriers to care such as cost and logistical issues (i.e., the challenge of finding a pregnancy chiropractor, time commitment and driving distance for scheduled visits). The high mean Doctors LOC score among the pregnant participants reflected their reliance on their chiropractor to achieve their desired pregnancy experience and the recognition that chiropractic plays an essential role in their pregnancy care. The score in Other People LOC among the pregnant women acknowledged the role that individuals in their social circle played in assisting the participants' journey to a healthy pregnancy. 'Other People' were described as a spouse or partner who took on the majority of chores around the house or took care of their children or paid for the chiropractic visits. The pregnant woman's mother or sister provided emotional support as well as babysitting services. Although the mean score for Chance LOC was relatively the lowest scoring among pregnant women, the pregnant participants nonetheless indicated that chance does play a role in their health. As an example, one

pregnant participant mentioned preeclampsia in pregnancy. According to her, there was no rhyme or reason as to who gets it and who does not, regardless of one's healthy behaviour efforts.

8.4.4 Interpersonal Process of Care Experience

The pregnant women IPC-18 scores indicated that they experienced good communication, were part of the decision-making with respect to their care, and overall, experienced good IPC experience. Pregnant participants indicated that their chiropractor was clear and concise in their communication and asked how they were feeling, addressed any concerns that they may have had and scheduled with increased visits prior to their labour and delivery. The pregnant women indicated that their chiropractor explained the reasons why and how certain chiropractic procedures were being performed. Interestingly, relative to non-pregnant respondents, the pregnant respondents indicated a significantly greater measures of Communication (Lack of clarity). This was attributed to the complexity of pregnancy health information and impairments in memory and mood swings in pregnant women. The pregnant participants described that they were part of the decision-making process in their care, particularly in terms of scheduled patient visits. As an active part of their care, the pregnant participants were prescribed and taught self-care options at home. In the domain of interpersonal process, participants described their chiropractor as caring and respectful and felt as part of a community of chiropractic patient. Any issues related to race or ethnicity were not addressed during the interviews but both pregnant and non-pregnant respondents scored race or ethnicity as a non-issue in the IPC-18 questionnaire.

8.5 Strengths and Limitations

The studies presented in this thesis had strengths and limitations. Common to survey studies are the limitations of recall bias and response bias (i.e., social desirability bias, acquiescence bias, neutral and extreme response bias). Some of the questions were designed to obtain a reasonable response without going into great depth or breadth of the topic.

In Study 1, while the data were informed by chiropractors with a focus on caring for pregnant women and likely reflected real-world data and the day-to-day practice of pregnancy care, the small sample size, selection bias with convenience sampling (i.e., respondents were members of the International Chiropractic Pediatric Association (ICPA), the generalisability of the research findings to the wider chiropractic profession must be cautioned.

In Study 2, reliable and valid outcome measures were applied to measure the SOC, QoL, GSE, MHLOC and IPC experience of pregnant and non-pregnant patients. The use of chiropractic patients and validated outcome measures was vital to the veracity of the study findings and in making appropriate, meaningful, and useful inferences about data in the context of chiropractic care. However, Study 2 is subject to the same limitations as Study 1.

The phenomenological study described in Study 3 provided a rich and detailed description of the essence of the lived experience of pregnant women under chiropractic care. The interviews involved 10 pregnant women under care from different chiropractors in varying geographic regions of the United States. Although the women were interviewed in their third trimester of pregnancy, they began chiropractic care at various stages of pregnancy and received care for varying periods of time. Furthermore, their age, parity, marital and socioeconomic status varied. Heterogeneity of such characteristics minimised

the possible bias from these variables. However, the willingness of the interviewees to share their experiences under chiropractic care may have added an element of selection bias. Despite the process of bracketing or epoche, the phenomenological approach acknowledges the potential bias on the part of the interviewer/researcher. As with all qualitative studies, the findings are context-dependent and not intended to be generalised. Despite these limitations, the shared experiences among interviewees provided insight into their lived experience under chiropractic care.

Finally, this thesis utilised a mixed methods approach which allowed for cross verification though triangulation and decreased the threats to the integrity of the results. In this thesis, the result of the qualitative study in Study 3 (see Chapter 7) provided context for the results of the quantitative findings of Study 2 (see Chapter 6).

8.6 Implications to the Chiropractic Profession

The findings in this thesis have several implications for the chiropractic profession. The results of Study 1 (see Chapter 5) provide the most comprehensive characterisation of the practice of chiropractic involving the care of pregnant women. This thesis marks the initial reporting on the preponderance of female chiropractors in chiropractic pregnancy care. Similar observations have been made in paediatric chiropractic. [399] While gender disparity in medical specialties have been explored [806], the impact of gender disparity in chiropractic specialties such as pregnancy care requires further investigation.

After the 1960s, chiropractic specialties began to be offered as postgraduate courses in many chiropractic colleges or universities. Today, accredited chiropractic schools all over the world offer specialty postgraduate programs that lead to certifications, diplomates, or master's degrees. [12] An overwhelming majority of the chiropractors involved in Study 1 had postgraduate training in perinatal care to chiropractors. The ICPA is reportedly the only accredited organisation providing postgraduate specialty training in

perinatal care in the world. [616] To meet the potential demand for this specialty training at the matriculation and postgraduate level, accredited chiropractic colleges and other organisations similar to the ICPA need to adapt to provide the necessary curriculum. Towards informing such efforts, this thesis characterised the practice of pregnancy care and notably the common chiropractic techniques and adjunctive therapies employed by chiropractors, their technique modification approaches and the MSK and non-MSK presenting complaints of pregnant women. These findings provide the basis for the appraisal of current curriculum and its relevance to modern clinical practice.

Chiropractors acknowledge and value the importance of cross-referrals in pregnancy care. [399] This thesis marks the initial efforts to characterise the direction of cross-referrals between chiropractors and other healthcare professionals involved in pregnancy care. Collaboration is essential for patient safety. [807] Just as cultural differences between obstetricians and midwives have been recognised as a barrier to interprofessional collaboration [808], it is expected that such barriers also exist between chiropractors and other healthcare professionals. It is incumbent on the chiropractic profession to identify barriers and facilitators to facilitate and increase interprofessional collaboration with other healthcare practitioners in pregnancy care.

SOC, GSE and MHLOC have been shown to be a causal mechanism in a wide range of health behaviours. [809-811] This thesis reported that patient care involved a number of prescribed adjunctive therapies and health advice (i.e., nutrition and diet, physical activity, posture correction and biomechanical advice) from chiropractors who highlight their role in disease prevention and health promotion (i.e., wellness care). The findings of this thesis with respect to SOC and its related health constructs (i.e., GSE, MHLOC) provide a framework and a starting point for the chiropractic profession to pursue wider health promotion and disease prevention activities in chiropractic patients.

The findings of this thesis also provide a framework from which to examine the traditional chiropractic paradigm of health (i.e., subluxation-based chiropractic care) with established health theories such as salutogenesis, locus of control and self-efficacy.

8.7 Recommendations for Future Research

The scoping and systematic review of the literature on chiropractic pregnancy care in this thesis highlight the paucity of research in this area of chiropractic practice. Although a wealth of data was garnered as a result of the studies performed in this thesis, many of the research findings should be confirmed by further investigation. First, as reproducibility and replicability are hallmarks of good science [812], future research could examine the veracity of the quantitative studies and the trustworthiness of the qualitative study in this thesis. The survey of chiropractors in Study 1 could be performed with a representative sample of chiropractors with a focus on pregnancy care and not restricted to ICPA members. The Webster Technique was identified as a primary technique in pregnancy care. The technique has been clinically applied to facilitate correction of foetal malposition and malpresentation. [53] Future research should examine the effectiveness of the Webster Technique to facilitate foetal corrections in a clinical trial. The Webster Technique has also been touted to improve labour and delivery (i.e., avoidance of Caesarean and minimising use of induction). Future research should examine whether the use of the Webster Technique in pregnancy care results in improved labour and delivery outcomes.

Patient safety is the cornerstone of high-quality health care. [813] Prior to this thesis, no study had addressed safety in chiropractic pregnancy beyond systematic reviews [55-56] and the opinion of chiropractors with limited clinical experience on the safety of chiropractic pregnancy care. [260] Future research should examine the prevalence of adverse events in pregnant women under chiropractic care.

The original proposed design of Study 2 was a prospective cohort study. Unfortunately, the response rate was poor in the follow-up survey due to the Covid-19 pandemic (see Chapter 5, Section 5.5.1 Response Rate) and a cross-sectional analysis proceeded only with the baseline data. Pregnant and non-pregnant chiropractic patients could be recruited from a representative sample of chiropractors with a focus on pregnancy care to implement a prospective cohort study to examine the impact of chiropractic care on pregnant and non-pregnant chiropractic patients' SOC, QoL, GSE, MHLOC and IPC experience. Using a qualitative approach, future research could explore the barriers to and facilitators of interprofessional collaboration from the perspective of chiropractors and other healthcare professionals.

8.8 Conclusion

This thesis provided the most cohesive and comprehensive characterisation of the practice of chiropractic involving pregnancy care. An in-depth characterisation of the practice of chiropractic pregnancy care was made and the findings suggest that pregnancy care requires specialised knowledge and skills, including a unique approach to patient care. From the patient perspective, their motivations for seeking care, their MSK and non-MSK clinical presentations along with their lived experience with chiropractic care was assessed. In addition to practitioner and practices characteristics, this thesis examined the management protocols of chiropractors in terms of technique modification and commonly applied chiropractic techniques and adjunctive therapies in pregnancy care. Insights into the attitudes and beliefs of chiropractors about the safety of pregnancy care, their management approach to pregnant women with common comorbidities of pregnancy were also assessed along with their collaborative efforts with other healthcare practitioners in pregnancy care.

The use of validated patient-reported outcome measures (PROMs) to assess the SOC, QoL, GSE, MHLOC and IPC experience of pregnant and non-pregnant women under chiropractic care demonstrated the ecological validity (i.e., the degree to which scores reflect experience in the natural environment) and clinical utility (i.e., sensitivity to change/differences in scores or ability to detect meaningful change) of these various PROMs in the chiropractic clinical setting and show promise for their widespread integration into routine clinical chiropractic care. Measures of SOC and its related constructs may provide a framework for chiropractic pregnancy care from a salutogenic perspective rather than from a framework of pathology and risk management. The ability to measure SOC and its related constructs in pregnant chiropractic patients also provide a framework for improving patient outcomes by providing guidance in the design of an effective chiropractic intervention strategy for pregnant women. For example, in Study 2, multiple regression analysis determined that among pregnant (and non-pregnant women), levels of Depression and GSE were significantly predictive of SOC (see Tables 6.15–6.17). This highlights the need for chiropractors to collaborate with mental health professionals to address a patient's mental health challenges such as depression and institute effective interventions to increasing their patients' GSE to increase their SOC.

Overall, this thesis brought to the forefront the unique role of chiropractors in the care of pregnant women. In addition to addressing their pregnancy-related LBP and/or PGP, chiropractors can help in supporting a pregnant woman's health and wellbeing, provide a positive pregnancy experience and provide support in promoting a healthy lifestyle during pregnancy and beyond.

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