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Change in Healthcare Use After a Self-Management Supportive Intervention for Low Back Pain—A Quasi-Experimental Study

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ABSTRACT

Background: Individuals with low back pain (LBP) have high healthcare use (HCU). It is currently unclear whether self-management supportive interventions can decrease HCU among patients with LBP. The aim of this study was to investigate changes in visits to primary care and redeemed prescriptions of analgesics after enrolment in a self-management supportive programme compared to usual care.

Methods: This quasi-experimental study included adults with LBP who enrolled in the Danish GLA:D Back programme between 2018 and 2022. GLA:D Back is a structured 10-week programme of group-based patient education and supervised exercises aiming to enhance self-management skills. HCU was obtained from national registries as the total quarterly visits to primary care (general practitioner, physiotherapists or chiropractor) or quarterly total redeemed defined daily doses (DDD) of analgesics (paracetamol, non-steroidal anti-inflammatory drugs or opioids).

Results: We included 4205 individuals. From 2 to 14 quarters post-enrolment, the additional quarterly reduction in HCU after the programme compared to the control group was −1.1 (95% CI −1.5 to −0.8) visits to primary care and −5.3 (95% CI −9.2 to −2.2) DDDs of redeemed analgesics. Sensitivity analyses questioned the statistical significance of the reduction in analgesic use, but results for people with LBP duration > 1 year were robust for both outcomes. The largest reductions were observed in those with high HCU at baseline.

Conclusion: Participation in a structured self-management programme led to a sustained reduction in primary care visits and analgesic use over a 3-year period, although regression to the mean may partly explain these reductions.

Significance Statement: This quasi-experimental study demonstrated that a structured self-management supportive programme for low back pain reduced future healthcare use, especially among individuals with long-lasting pain or high initial healthcare use. These findings suggest a potential to alter healthcare use through structured interventions to support self-management.

1 | Introduction

Low back pain (LBP) is a highly prevalent condition that substantially impacts individuals and societies globally. (Fatoye et al., Fatoye, Gebrye, Mbada, and Useh 2023, Fatoye, Gebrye, Ryan, et al. 2023; Hartvigsen et al. 2018) Part of the impact is that people with LBP have higher healthcare use (HCU) than people without. (Dieleman et al. 2020; Sundhedsstyrelsen 2023).

A key reason for the high HCU is the recurrent nature of LBP and the lack of a definitive cure (Hartvigsen et al. 2018; Kongsted et al. 2016). Therefore, clinical guidelines recommend self-management support as first-line management. (Lin et al. 2020) In this context, self-management support can be defined as 'equipping the patients with skills to actively participate and take responsibility in the management of their LBP condition in order to function optimally'. (Jonkman et al. 2016).

Healthcare that supports self-management has been shown to reduce HCU without compromising health outcomes for other chronic conditions such as diabetes, respiratory and cardiovascular disorders. (Panagioti et al. 2014) Thus, we hypothesised that when people with LBP acquire self-management skills, they may become less dependent on healthcare providers, leading to decreased HCU. This hypothesis was recently investigated in a systematic review, but the evidence was inconclusive due to high variation in outcomes and very low-quality evidence (Grøn et al. 2024).

Therefore, this study aimed to investigate the extent of changes in HCU from before to after enrolment in a structured self-management supportive programme and to identify potential subgroups of participants with larger changes.

2 | Methods

This quasi-experimental study used a staggered difference-in-difference design and is reported according to the STROBE statement (Cuschieri 2019). The study was described in the protocol for GLA:D Back (Kongsted et al. 2019), and the analysis plan was registered online on 2024-08-13 at https://osf.io/5gyhz

2.1 | Intervention

GLA:D Back is a structured 10-week group-based education and supervised exercise programme intended for people with recurrent or long-lasting LBP affecting their daily living. It aims to enhance participants' self-management skills and reduce reliance on ineffective or potentially harmful healthcare services. Participants and clinicians decide on enrolment without firm inclusion criteria. While some participants are referred to the programme by their GP, a referral is not required and enrolment is open to all individuals with LBP. The intervention is based on a cognitive-behavioural approach that helps participants understand pain as less threatening through education and movement. The education sessions include key messages such as 'pain does not equal harm' and 'the back is made for movement', which aim to reduce fear-avoidance beliefs and promote active coping. The exercise sessions encourage participants to explore variation in movement to build physical confidence and autonomy. Clinicians facilitate discussions and guide participants in problem-solving during exercises to foster self-efficacy. Individual goal setting initiates the programme to foster motivation for active engagement and a sense of meaning. A TiDieR sheet for the programme can be found in Table S1 in the supporting information and further details on the theoretical framework, the programme structure and content are described elsewhere. (Kjaer 2018) The programme is implemented in primary care and delivered by physiotherapists and chiropractors, primarily in private clinics and some municipality-based rehabilitation centres. In private clinics, participants must pay an out-of-pocket payment of approximately 3000 DKK (around 450 USD). Clinicians can offer the programme after participating in a 2-day course at the University of Southern Denmark. The programme has been ongoing since 2018 and is gradually being rolled out nationwide in Denmark. Upon enrolment in the programme, participants have since implementation been registered in the GLA:D Back registry via REDCap (Vanderbilt University) and invited to complete electronic questionnaires (see https://gladryg.sdu.dk/ for more information).

2.2 | Participants and Setting

Eligible participants were adults (over 18 years) with LBP who enrolled in GLA:D Back between 2018 and 2022 and lived in Denmark between 2016 and 2022. They were free to use any kind of healthcare during this period.

2.3 | Outcomes, Descriptive Variables and Data Sources

The primary outcomes were HCU, measured as all-cause visits to primary care and use of prescribed analgesics. Visits to primary care were defined as the total number of consultations (both digital and physical) within a quarter to a physiotherapist, chiropractor or general practitioner (GP), with the restriction of one consultation per provider type per day. These providers are the primary sources of care for low back pain (LBP) in Denmark (Sundhedsstyrelsen). We investigated both the overall visits and those stratified by profession. Use of analgesics was defined as the quarterly total redeemed defined daily doses (DDD) of prescribed paracetamol, nonsteroidal anti-inflammatory drugs (NSAIDs), or opioids. Both overall DDDs and those stratified by type of drug were investigated. See Table S2 in supporting information for included anatomical therapeutic chemical classification system codes.

Data on primary care visits were obtained from the Danish National Health Insurance Service Registry, which covers all reimbursed visits to physiotherapists, chiropractors and GPs (Andersen et al. 2011). Data on prescribed analgesics were obtained from the Danish National Prescription Registry, including all drug prescriptions redeemed at pharmacies in Denmark (Kildemoes et al. 2011; Pottegård et al. 2017).

We obtained data on occupation, level of education, death, migration and other chronic conditions (asthma, dementia,

chronic obstructive lung disease, rheumatoid arthritis, osteoporosis, schizophrenia, diabetes type 1 or 2) from the Income Register(Baadsgaard and Quitzau 2011), Population Education Register(Jensen and Rasmussen 2011), Death Registry, Migration Registry and Register for Selected Chronic Diseases respectively. Data from national registries and the GLA:D Back registry were linked using the civil registration number (Pedersen 2011). All administrative data were obtained from January 2016 to December 2022, except for analgesics data, which were available until June 2022.

From the GLA:D Back baseline questionnaires, we included data on age, sex, duration of current LBP episode (up to 1 year, over 1 year), LBP intensity (numerical rating scale 0–10(Strong et al. 1991)), disability (Oswestry disability index [ODI] 0–100(Lauridsen et al. 2006b, 2006a)) and pain self-efficacy (The Arthritis Self-efficacy Scale, subscales pain and other symptoms, 1–10) (Primdahl et al. 2010).

2.4 | Statistical Methods

The descriptive statistics of baseline variables were presented as mean with SD, median with interquartile ranges (IQR), or frequencies with percentages. Baseline HCU refers to the total use during the year leading up to enrolment, divided by 4 to represent quarterly use. This is reported as either the median or mean baseline.

The change in HCU was estimated using a staggered Difference-in-Differences (DiD) model with multiple time periods. We used the Callaway and Sant'Anna estimator, which employs a double-robust DiD approach based on stabilised inverse probability weighting and ordinary least squares. (Callaway and Sant'Anna 2021; Sant'Anna and Zhao 2020) Essentially, this method calculates the difference in HCU from before to after enrolment between the intervention and control groups, allowing us to assess the impact of GLA:D Back on HCU.

The study period (2016–2022) was divided into quarters, and participants were assigned a group based on their quarter of enrolment (from Q2 2018 to Q4 2022), resulting in 19 groups. For a given quarter, groups of participants not yet enrolled constituted the control group and shifted to be part of the intervention group when enrolled in GLA:D Back. Thus, the control group reflects Danish usual care. We assumed that controls were candidates for GLA:D Back throughout the study period and that the time of enrolment was mainly determined by the gradual national roll-out of the programme. We based this on the natural course of LBP, which suggests participants would have had previous LBP and most participants reported long-lasting LBP. (Dunn et al. 2013; Kongsted et al. 2016) Index (t0) was defined as the quarter before enrolment to ensure that HCU related to GLA:D Back was included in the follow-up periods. The follow-up periods were noted as t0 + x, with x indicating subsequent quarters; likewise, pretreatment periods were noted as t0-x. The aggregated event-study effect and 95% confidence intervals (CI) were estimated for each period.

The main results were reported as the average aggregated event-study effects from t0 + 3 to t0 + 14, with corresponding 95% CI. This is referred to as the 'average difference,' which resembles the average quarterly difference in HCU between the intervention and control groups for 3 years after the programme. T0 + 1 and t0 + 2 were excluded from the main result as the intervention takes place during these periods. A descriptive measure of the relative change in HCU was calculated by dividing the average difference by the mean baseline HCU across the entire study population.

There was no missing outcome data, but we restricted the model to estimate 14 quarters before and after the index. Due to the staggered enrolment, participants contributed different amounts of data to the model as either the control or intervention group. For example, participants enrolling towards the end of data collection did not have 14 quarters of follow-up data available, but still contributed data to the control group before they enrolled.

To identify subgroups of participants with potentially greater changes, subgroup analyses were conducted by stratifying the sample on the duration of the current episode (more than a year, less than a year), sex, age (tertile distribution), baseline HCU of visits and DDDs (tertile distribution based on the overall amount in the year leading up to enrolment), dichotomised (yes/no) use of physiotherapist, chiropractor, paracetamol, NSAID, or opioids at baseline, baseline use of GP (below vs. above or equal to the median), education (primary, vocational, higher), baseline disability ('mild' ODI 0 to 20, 'moderate and severe' ODI > 20), baseline pain intensity (below vs. above or equal to the median) and additional chronic conditions (none/any). Subgroup analyses were conducted only on overall visits and overall DDDs. Participants reporting a current episode of less than 1 year were potentially less likely to have been candidates for the programme throughout the study period. Thus, the analysis stratified by the duration of the current episode also helped assess the validity of the control group.

We conducted separate secondary adjusted analyses for each outcome by including the subgroup variables that showed potential for driving the change in that outcome as covariates in the DiD models. This was based on the average difference for each subgroup, where the 95% CI of each subgroup did not overlap.

The DiD analyses were conducted in STATA 18 (StataCorp LLC, USA) using the csdid extension. (Callaway and Sant'Anna 2021; Sant'Anna and Zhao 2020).

2.5 | Assumption of Parallel Trends

The validity of the DiD approach relies on the assumption that, in the absence of the intervention, the outcome trends for the intervention and control groups would have followed parallel trajectories (Callaway and Sant'Anna 2021; Wing et al. 2018). In our study, where we use the not-yet-treated as a control group, this implies that these individuals were candidates for the programme throughout the study period. This assumption is justified by the target group for the programme being individuals with recurrent or persistent LBP and the natural course of LBP, making it likely that participants also experienced LBP in the periods when they were classified as controls. Additionally, a gradual national roll-out of the

intervention made it plausible that participants would have enrolled in GLA:D Back based on opportunity rather than symptom severity.

To assess the plausibility of the parallel trends assumption, we examined the event-plots and corresponding estimates from the pre-intervention period. Furthermore, we conducted a sensitivity analysis by moving the index quarter (t0) back one additional quarter. This analysis addressed the potential threats to the parallel trends assumption in the form of elevated HCU before enrolment and the subsequent risk of overestimating the results.

3 | Results

From 2018 to 2022, 4388 adults enrolled in GLA:D Back, of which 4205 were eligible for inclusion in our study. The reasons for exclusion were failure to link individuals in the clinical cohort with the national registries ($n = 84$), and death ($n = 61$) or migration ($n = 38$) during the study period. The mean age was 58 years (SD 13); most participants were female (2817/4205; 67%) and reported their current LBP episode to have lasted more than 1 year (2424/4130; 59%). (Table 1).

3.1 | Baseline Healthcare Use

At baseline, the median number of quarterly primary care visits during the year before enrolment was 4.3 (IQR 2.3–6.8), and 4135/4205 (98%) had at least one visit to primary care. The most frequently visited provider was GP, visited by 4024/4205 (96%) (Table S3). For redeemed DDDs at baseline, the median was 10 (IQR 0 to 35) and 2212/4205 (35%) had redeemed a prescription. (Table 1) The analgesic most frequently redeemed was paracetamol (1592/4205; 38%) (Table S3).

3.2 | Visits to Primary Care

Prior to the intervention, the groups followed a common trend in visits to primary care, except at t0–2 and t0–1, where the intervention group had more visits than the control group, which may challenge the plausibility of the parallel trends assumption. From t0 to t0 + 2, there was an increase in visits compared to the control group, reflecting increased visits pre-enrolment at t0 and participants receiving the programme at t0 + 1 and t0 + 2 (Figure 1). Estimates for each period can be found in Table S4. For overall visits, the average difference after the programme was −1.1 (95% CI −1.5 to −0.8) visits less per quarter than the control group, reflecting a relative change of −22% (Table 2). For visits to physiotherapists, the average difference was −0.5 (95% CI −0.7 to −0.2), for chiropractor −0.4 (95% CI −0.5 to −0.3), and for GP −0.2 (95% CI −0.5 to −0.01). (Table S5 and Figure S1).

3.3 | Redeemed DDDs of Prescribed Analgesics

Prior to the intervention, the groups followed a common trend in redeemed DDDs, except at t0–1, where the intervention group redeemed more DDDs, which may challenge the plausibility of the parallel trends assumption. At t0 and t0 + 1, participants in the intervention group had an increased use, followed by a reduction from t0 + 2 and onward (Figure 2). Estimates for each period can be found in Table S4. The average difference for overall DDDs after the programme was −5.3 DDDs (95% CI −8.2, −2.4), and the relative change in the intervention group was −20% (Table 3). For paracetamol, the average difference was −2.6 (95% CI −4.5 to −0.6); for NSAIDs, it was −2.2 (95% CI −3.6 to −0.7); and for opioids, it was −0.6 (95% CI −1.3 to 0.2). (Table S5 and Figure S1).

3.4 | Subgroup Analyses

All subgroup analyses are presented in Table S6 in the online supporting content. For the overall number of visits, we found differences in the average difference (between subgroups) stratified by age, baseline visits (overall, to physiotherapists, chiropractors and to GPs), and baseline DDDs (overall, NSAIDs and opioids). For overall DDDs, we found differences when stratified by baseline visits (overall and to GP), as well as baseline DDDs (overall, paracetamol, NSAIDs and opioids). The subgroups stratified by age revealed the reduction in visits to be larger among the youngest tertile compared to the oldest. The analyses stratified by baseline visits or DDDs revealed opposing results for both outcomes. Those with no or low baseline usage increased their HCU after the programme, whereas those with high usage decreased their HCU after. (Tables 2 and 3, for event plots, see Figures S3 and S4).

The plausibility of the parallel trends assumption appeared stronger among those reporting LBP duration above 1 year, compared to the total sample and those reporting duration of LBP below 1 year. (Figures S5 and S6) In the group with LBP above 1 year, the average difference after the programme was −1.3 visits (95% CI −1.8 to −0.7) and −6.4 DDD (95% CI −10.3 to −2.6) (Tables 2 and 3).

3.5 | Adjusted Analyses and Sensitivity Analyses

The adjusted model showed similar results to the crude model for both outcomes. (Table 3, Figures S7 and S8). When t0 was moved backward, the difference between intervention and control in the HCU pre-index was removed, and the estimated average difference was smaller. For visits, the average difference remained statistically significant (−0.69, 95% CI −1.1 to −0.3), but not for analgesics (−2.1 DDDs, 95% CI −5.0 to 0.9). Subgroup analyses based on baseline HCU still yielded opposed results after moving t0. (Tables 2 and 3).

4 | Discussion

This quasi-experimental study demonstrated a statistically significant decrease in HCU following participation in the self-management supportive programme GLA:D Back compared to a control group of individuals not yet enrolled in the programme. The decrease was most prominent in visits to physiotherapists and chiropractors and the use of paracetamol

TABLE 1 | Baseline characteristics of study participants.

Characteristic	Overall $N=4205$	Year of enrolment in the GLA:D Back programme				
		2018 $N=735$	2019 $N=1470$	2020 $N=809$	2021 $N=618$	2022 $N=573$
Sex						
Male	1388/4205 (33%)	223/735 (30%)	450/1470 (31%)	283/809 (35%)	226/618 (37%)	206/573 (36%)
Female	2817/4205 (67%)	512/735 (70%)	1020/1470 (69%)	526/809 (65%)	392/618 (63%)	367/573 (64%)
Age						
Mean (SD)	58 (13)	57 (13)	58 (13)	57 (13)	58 (13)	59 (13)
Min, Max	19, 90	21, 86	21, 88	19, 90	20, 87	19, 88
Age group						
18–53	1458/4205 (35%)	276/735 (38%)	498/1470 (34%)	296/809 (37%)	211/618 (34%)	177/573 (31%)
54–64	1350/4205 (32%)	221/735 (30%)	472/1470 (32%)	265/809 (33%)	203/618 (33%)	189/573 (33%)
65–90	1397/4205 (33%)	238/735 (32%)	500/1470 (34%)	248/809 (31%)	204/618 (33%)	207/573 (36%)
Duration of current LBP episode						
Less than a year	1706/4130 (41%)	292/723 (40%)	595/1446 (41%)	338/791 (43%)	255/609 (42%)	226/561 (40%)
More than a year	2424/4130 (59%)	431/723 (60%)	851/1446 (59%)	453/791 (57%)	354/609 (58%)	335/561 (60%)
Missing	75	12	24	18	9	12
Backpain intensity (0–10)						
Mean (SD)	5.4 (2.3)	5.25 (2.3)	5.4 (2.4)	5.3 (2.3)	5.5 (2.35)	5.65 (2.4)
Missing	54	9	18	15	5	7
Oswestry disability index (0–100)						
Mean (SD)	25 (13)	25 (13)	25 (13)	24 (12)	24 (13)	24 (13)
Missing	208	33	56	46	32	41
Pain self-efficacy (0–10)						
Mean (SD)	6.7 (1.9)	6.7 (1.85)	6.8 (1.9)	6.6 (1.9)	6.8 (1.9)	6.7 (1.9)
Missing	274	46	75	57	47	49
Highest completed education						
Primary education	686/4166 (16%)	137/730 (19%)	241/1454 (17%)	120/804 (15%)	102/611 (17%)	86/567 (15%)
Vocational education	1845/4166 (44%)	300/730 (41%)	662/1454 (46%)	362/804 (45%)	272/611 (45%)	249/567 (44%)
Higher education	1635/4166 (39%)	293/730 (40%)	551/1454 (38%)	322/804 (40%)	237/611 (39%)	232/567 (41%)
Missing	39	5	16	5	7	6
Occupation						

(Continues)

TABLE 1 | (Continued)

Characteristic	Overall $N=4205$	Year of enrolment in the GLA:D Back programme				
		2018 $N=735$	2019 $N=1470$	2020 $N=809$	2021 $N=618$	2022 $N=573$
Labor force	2350/4205 (56%)	406/735 (55%)	791/1470 (54%)	475/809 (59%)	359/618 (58%)	319/573 (56%)
Under education	31/4205 (0.7%)	≤1%	≤1%	≤1%	≤1%	≤1%
Unemployed	31/4205 (0.7%)	≤1%	≤1%	≤1%	≤1%	≤1%
Welfare payment	443/4205 (11%)	73/735 (9.9%)	167/1470 (11%)	73/809 (9.0%)	63/618 (10%)	67/573 (12%)
Retirement	1292/4205 (31%)	228/735 (31%)	475/1470 (32%)	239/809 (30%)	176/618 (28%)	174/573 (30%)
Other	58/4205 (1.4%)	18/735 (2.4%)	17/1470 (1.2%)	7/809 (0.9%)	8/618 (1.3%)	8/573 (1.4%)
Other chronic conditions[a]						
One or more	1205/4205 (29%)	221/735 (30%)	444/1470 (30%)	218/809 (27%)	165/618 (27%)	157/573 (27%)
Using primary care						
At least one visit in year leading up to enrolment	4135/4205 (98%)	726/735 (99%)	1458/1470 (99%)	792/809 (98%)	601/618 (97%)	558/573 (97%)
Total Visits primary care[b]						
Median (IQR)	4.3 (2.3, 6.8)	4.5 (2.5, 7.3)	4.3 (2.3, 7.0)	3.8 (2.3, 6.3)	4.0 (2.3, 6.4)	3.8 (2.0, 6.0)
Using analgesics						
At least one redeemed prescription in year leading up to enrolment	2651/4205 (63%)	468/735 (64%)	967/1470 (66%)	515/809 (64%)	363/618 (59%)	338/573 (59%)
Total DDD of analgesics[c]						
Median (IQR)	10 (0, 35)	9 (0, 32)	13 (0, 38)	10 (0, 35)	8 (0, 34)	8 (0, 29)

[a]Asthma, dementia, chronic obstructive lung disease, rheumatoid arthritis, osteoporosis, schizophrenia, diabetes type 1 or 2.
[b]Total number of visits to physiotherapist, chiropractor or general practitioner in the year leading up to enrolment divided by 4 to represent quarterly use.
[c]Total number of redeemed DDDs of prescribed paracetamol, non-steroidal anti-inflammatory drugs, or opioids in the year leading up to enrolment divided by 4 to represent quarterly use.

and NSAIDs. Sensitivity analyses indicated that the results may have been overestimated and influenced by regression to the mean, which imposes uncertainty regarding the magnitude of the change. This was especially true for analgesics, for which sensitivity analyses indicated no change after the programme.

Subgroups based on baseline HCU showed sustained reduction in HCU among high users and a sustained increase among low users after the programme. While regression to the mean likely contributes to this pattern, the consistent reduction over the full study period supports the interpretation that the demonstrated group difference was at least partly due to the intervention influencing care-seeking behaviour. Additionally, a high baseline HCU likely reflects a stable and high level of habitual care-seeking behaviour rather than temporary spikes.

A sustained reduction in HCU aligns with the intention to equip participants in GLA:D Back with skills to self-manage pain. However, some individuals may have reduced HCU due to other factors, including potential disengagement from healthcare after experiencing unsatisfactory results. The increase in visits among participants with low prior usage was unintended but may be worthwhile if these individuals' health outcomes are positively affected. This aligns with the understanding that effective self-management support for LBP does not preclude HCU. (Kongsted et al. 2021) The rise in analgesic use among participants who had not previously redeemed a prescription is, however, concerning, as clinical guidelines do not advocate the use of analgesics as a long-term strategy and reasons for this increased use should be explored. (World Health Organization 2023) However, the observed increase in both visits and analgesics among low baseline users could be the result of a floor effect with even minor post-intervention use constituting a substantial relative increase given the zero or near-zero use.

Reducing HCU among individuals with long-lasting pain and high HCU could free up resources and aid in the sustainability of the healthcare system. Even a small decrease in HCU may be relevant from a public health perspective. Despite some uncertainty related to the magnitude of the reduction, the results suggest a potential for alleviating the societal burden of LBP.

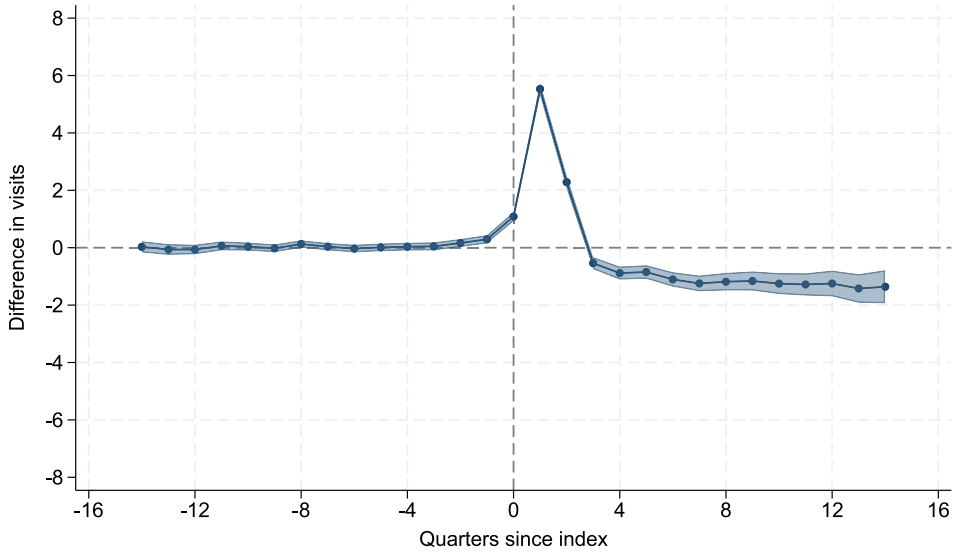

FIGURE 1 | Event plot showing the difference in primary care visits between intervention and control groups at each period. Quarter 0 (T0) reflects the quarter before enrolment in the intervention.

TABLE 2 | Average quarterly difference between intervention and control groups in visits to primary care during 3 years after participating in GLA:D Back.

	Primary analysis		Sensitivity analysis T0-1[a]	
Group	**Average difference (95% CI)**	**Relative change compared to baseline (%)**	**Average difference (95% CI)**	**Relative change compared to baseline (%)**
Total sample crude	-1.1 (−1.5; −0.8)	−22	−0.7 (−1.1; −0.3)	−13
Total sample adjusted model[b]	−1.2 (−1.6; −0.8)	−24	−0.8 (−1.3; −0.4)	−16
Duration of low back pain above 1 year[c]	−1.2 (−1.8; −0.4)	−25	−1.0 (−1.5; −0.4)	−20
Duration of low back pain below 1 year[d]	−1 (−1.5; −0.4)	−27	−0.2 (−0.7; 0.3)	−6
Low use of visits at baseline[e]	2.2 (1.8; 2.6)	214	2.2 (1.8; 2.7)	217
Medium use of visits at baseline[f]	−0.8 (−1.3; −0.3)	−24	−0.3 (−0.8; 0.2)	−9
High use of visits at baseline[g]	−5.5 (−6.3; −4.6)	−62	−4.6 (−5.5; −3.7)	−52

Note: Event plots for these analyses be found in eFigures 3, 5 and 7 in Supplement 1.
[a]Index moved 1 quarter back.
[b]Adjusted for age, baseline visits to primary care (total, physiotherapists, chiropractors and general practitioners), baseline redeemed defined daily doses of analgesics, (total, nonsteroidal anti-inflammatory drugs and opioids).
[c]$n = 2424$.
[d]$n = 1706$.
[e]0–11 visits in the year leading up to the programme ($n = 1429$).
[f]12–23 visits ($n = 1374$).
[g]24–178 visits ($n = 1402$).

It remains to be explored how a decrease in HCU is associated with self-management success and changes in other health outcomes.

Usual care for LBP often includes exercise, education and some advice for self-management. (Madsen et al. 2023) However, individuals with LBP can feel frustrated with healthcare due to a lack of cohesiveness. (Petersen et al. 2020; Rossen et al. 2021) An important aspect of GLA:D Back may be the structured nature of the intervention. Overall, the findings suggest that offering a structured programme to support self-management has potential benefits not gained from extensive usual care.

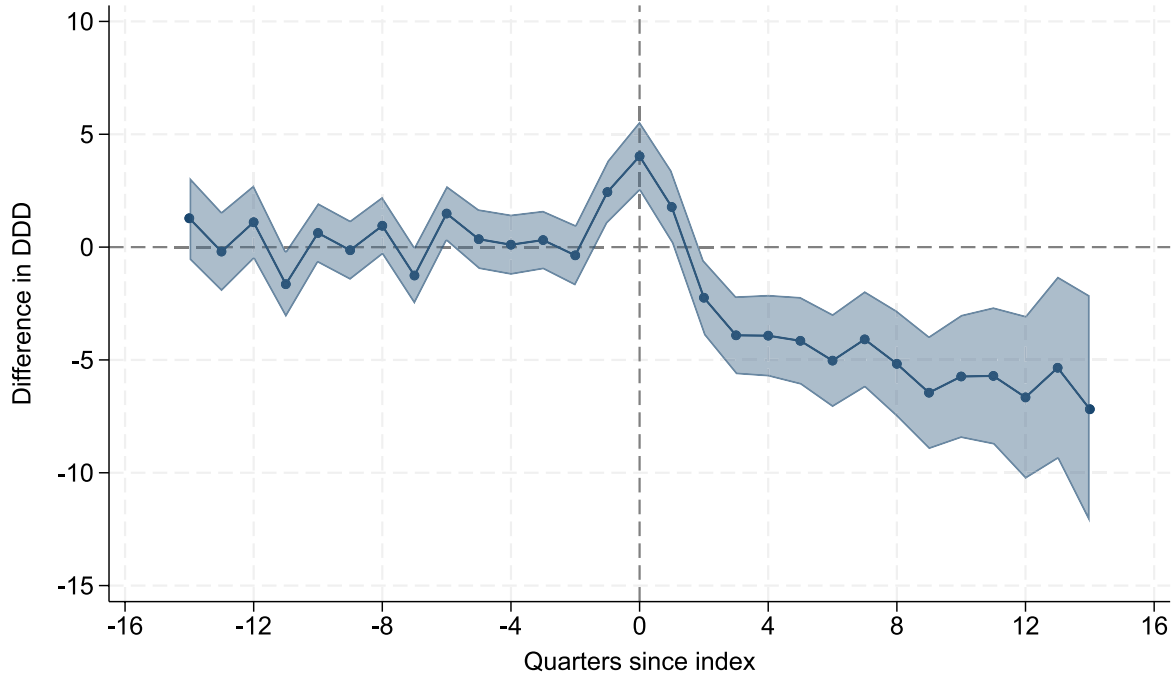

FIGURE 2 | Event plot showing the difference in redeemed DDDs of prescribed analgesics between intervention and control groups at each period. Quarter 0 (T0) reflects the quarter before enrolment in the intervention. DDD: Defined daily dose.

TABLE 3 | Average quarterly difference between intervention and control groups in redeemed DDDs of prescribed analgesics during 3 years after participating in GLA:D Back.

	Primary analysis		Sensitivity analysis T0-1[a]	
Group	**Average difference (95% CI)**	**Relative change compared to baseline (%)**	**Average difference**	**Relative change compared to baseline (%)**
Total sample crude	−5.3 (−9.2; −2.4)	−20	−2.1 (−5.0; 0.9)	−8
Total sample adjusted model[b]	−5.9 (−9.5; −2.3)	−22	−2.0 (−5.3; 1.4)	−7
Duration of low back pain above 1 year[c]	−6.4 (−10.3; −2.6)	−38	−4.5 (−8.6; −0.4)	−16
Duration of low back pain below 1 year[d]	−3.7 (−8.3; 0.9)	−24	1.6 (−2.6; 5.8)	10
No DDD at baseline[e]	8.9 (6.8; 11.1)	NA[h]	8.3 (6.16; 10.54)	NA[h]
Medium DDD at baseline[f]	2.3 (−1.2; 5.8)	27	4.9 (1.3; 8.5)	59
High DDD at baseline[g]	−29.9 (−37.4; −22.4)	−48	−21.6 (−29.4; −13.8)	−35

Note: Event plots for these analyses be found in eFigures 4,6 and 8 in Supplement 1.
Abbreviation: DDD: defined daily dose.
[a]index moved 1 quarter back.
[b]adjusted for baseline visits to primary care (total and general practitioner), baseline redeemed DDD of analgesics (total, paracetamol, non-steroid anti-inflammatory drugs and opioids).
[c]$n = 2424$.
[d]$n = 1706$.
[e]0 redeemed DDDs of analgesics in the year leading up to enrollment ($n = 1951$).
[f]1–97.5 DDD ($n = 862$).
[g]98.3–1699 ($n = 1392$).
[h]cannot compute when baseline = 0.

4.1 | Strengths and Limitations

A key strength of this study was the use of real-world data to investigate changes in HCU since this reflects GLA:D Back as delivered in clinical practice. This enabled enrolment of a large sample and a long follow-up period, which would have been costly in a traditional randomised controlled trial. The outcome data from Danish National Registries are considered highly accurate and complete due to economic incentives for providers to register services(Andersen et al. 2011; Kildemoes et al. 2011), and are not prone to recall bias. The study period included the COVID-19 pandemic, and enrolment rates were lower during this period. However, reductions in HCU due to the pandemic were unlikely to affect the analysis since both intervention and control groups would be equally affected, and the chosen DiD estimator accounts for time trends in HCU. (Callaway and Sant'Anna 2021).

The most critical assumption of the DiD analysis is the parallel trend assumption (Callaway and Sant'Anna 2021; Wing et al. 2018). While a common trend was generally observed for most of the pre-intervention period, the parallel trends assumption was somewhat challenged by the increase in HCU leading up to enrolment for the intervention group. This increase may reflect symptom aggravation that triggered healthcare-seeking and, ultimately, enrolment in GLA:D Back. While intuitive, this could challenge our assumption that participants enrolled primarily based on programme availability rather than symptom severity. Reassuringly, the parallel trends assumption was clearly supported among individuals reporting LBP episode duration of more than 1 year, and findings in this subgroup were consistent with the overall results. While moving t0 in the sensitivity analysis does not reflect the enrolment in the programme accurately, this analysis strengthened the parallel trends assumption as it mitigated the elevation in HCU prior to enrolment. This robustness check reduced the estimated reduction in HCU after the programme, suggesting that the main analysis may have overestimated the effect size, while supporting that the effect was not solely due to regression to the mean.

Visit counts and analgesic usage were likely underestimated because visits not reimbursed by the Danish national health insurance, and over-the-counter analgesics, are not included in the registries. However, this has unlikely affected the intervention and control groups differently. The out-of-pocket expense required to enter the programme can be a barrier for individuals with low socioeconomic status to participate, which can have affected the generalisability of the results. (Hestbæk et al. 2023).

5 | Conclusion

This study demonstrated sustained reductions in primary care visits and analgesic use over a 3-year period following participation in a structured self-management programme. The most consistent effects were observed for visits among individuals with long-lasting pain and the largest effects were found in participants with high HCU at baseline. This indicates that these subgroups were the main drivers of the observed reduction, although regression to the mean may partly explain the estimated effects. Overall, our findings suggest a potential for structured self-management supportive interventions to reduce HCU. Future studies should investigate relevant target groups and determine whether a reduction in HCU can be achieved without negatively affecting clinical outcomes.

Author Contributions

Søren Grøn conceived and planned the study and thus takes responsibility for the integrity. Søren Grøn performed analysis of the data, interpretation of results and wrote the initial draft of the manuscript. Melker Johansson made a substantial contribution to data analysis, interpretation of results and revision of the manuscript. Kim Rose Olsen made a substantial contribution to study design, data analysis, interpretation of results and revision of the manuscript. Bart Koes made a significant contribution to interpretation of the results and revision of the manuscript. Stine Haugaard Clausen made a significant contribution to interpretation of the results and revision of the manuscript. Alice Kongsted made substantial contributions to study design, data analysis, interpretation of results and revision of the manuscript. All authors have read and approved the final manuscript.

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Disclosure

Use of Artificial Intelligence: During the preparation of this work, the authors used Microsoft Copilot in order to improve readability, language and grammar of some of the text in the submitted manuscript, as well as help with syntax for some of the coding of statistical analysis. After using these tools, the authors reviewed and edited the content as needed and took full responsibility for the content of the publication.

Ethics Statement

The data collection for GLA:D Back has obtained authorisation from the Danish Data Protection Agency (DPA) as part of the University of Southern Denmark's institutional authorisation (DPA no. 2015–57-0008 SDU no. 17/30591). The Regional Committees on Health Research Ethics for Southern Denmark decided that the study did not need ethical approval (file number S-20172000-93). When registered by the clinician, the patient receives an email with a link to a patient-reported survey. Written information about the study, data protection and participants' rights is in the survey with a request to confirm consent for using data for research purposes.

Conflicts of Interest

The authors declare no conflicts of interest.

Data Availability Statement

The data from the GLA:D Back cohort can be accessed on reasonable request by contacting Alice Kongsted, alicek@sdu.dk, leader of the GLA:D Back research programme. The data from the national registries used in this study are based on microdata that are analysed at a server on Statistics Denmark. Data cannot be shared outside the server, but are available for Danish Research Institutions following applicable regulations for application to Statistics Denmark.

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Supporting Information

Additional supporting information can be found online in the Supporting Information section. **Data S1:** STROBE checklist. **Data S2:** Supporting Information S1.