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BRIEF REPORT

Comparative Cost Analysis of Neck Pain Treatments for Medicare Beneficiaries

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Abstract

Objective: To evaluate longitudinal cost outcomes of initial treatment strategies for new neck pain (NP) episodes among Medicare beneficiaries.

Design: Retrospective cohort study using Medicare Part A, B, and D claims data.

Setting: Not applicable.

Participants: Medicare beneficiaries aged 65-99 years, continuously enrolled in Parts A, B, and D from 2018 to 2021, who experienced a new NP episode in 2019.

Interventions: Three cohorts were developed based on the index visit provider: chiropractic (spinal manipulative therapy [SMT]), primary care with prescription analgesics (PCP [+A]), and primary care without analgesics (PCP [-A], reference group).

Main Outcome Measures: Medicare allowed costs for total and NP-related claims (Parts A and B), and medication claims (Part D) over 24 months from the index visit.

Results: Among 291,604 older adults with NP, most were White women with few comorbidities. Compared to PCP (-A), the SMT cohort had 6% (cost ratio, 0.94; 95% CI, 0.93-0.95) lower total Medicare Part A costs, whereas the PCP (+A) cohort showed no difference. For NP-related Part A claims, PCP (+A) had 7% (0.93; 95% CI, 0.88-0.98) lower costs, whereas SMT showed no difference. The SMT cohort had 6% (0.94; 95% CI, 0.94-0.95) lower total Medicare Part B costs and 36% (0.64; 95% CI, 0.64-0.65) lower NP-related costs, whereas PCP (+A) had 2% (1.02; 95% CI, 1.01-1.02) higher total costs. The SMT had 2% (0.98; 95% CI, 0.98-0.99) lower nonanalgesic and 13% (0.87; 95% CI, 0.87-0.88) lower analgesic Part D costs; the PCP (+A) had 13% (1.13; 95% CI, 1.12-1.14) higher nonanalgesic but 14% (0.86; 95% CI, 0.86-0.87) lower analgesic costs. Propensity weighting balanced covariates among cohorts.

Conclusions: For older adults with new NP episodes, initial SMT was associated with lower health care costs, particularly for Part A total and NP-related claims, with a less pronounced effect on Part B and D claims than PCP-related strategies. These findings suggest potential for health care savings based on the initial treatment choice.

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Neck pain (NP) and low back pain represent the third largest health care expenditure category among 155 conditions. These conditions account for nearly \$135 billion in annual health care costs, with Medicare and Medicaid covering about one-third of the total.¹ A 6-fold increase in spending relative to prevalence highlights a growing reliance on high-cost interventions, such as spinal injections and fusion surgeries.¹⁻³

A recent review of NP treatment guidelines indicates a consensus supporting the use of manipulation or mobilization, with about half also recommending medications either alone or in combination with other therapies.⁴ A systematic review comparing spine-related treatment costs between chiropractic care and medical management found that of 44 studies, only one focused on NP, specifically involving younger, commercially insured individuals.⁵ This study aims to address a crucial gap by examining long-term costs associated with different initial care strategies for new NP episodes among Medicare beneficiaries.

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Methods

We conducted a retrospective cohort study using Medicare claims from beneficiaries aged 65-99 years who were continuously enrolled in Parts A, B, and D from 2018 to 2021 and experienced a new episode of NP in 2019. A comprehensive set of ICD-10 diagnosis codes was used to identify NP episodes ([supplemental appendix S1](#), available online only at <http://www.archives-pmr.org/>); individuals with cancer diagnoses, skilled nursing facility claims, or hospice care use in 2018 were excluded to avoid opioid medication confounding.

New NP episodes were defined as at least one paid claim with a primary NP diagnosis after a 90-day period without such claims. The episode ended when another 90-day period passed without a primary NP visit. If multiple episodes occurred, only the first was analyzed. Each participant had a standardized 24-month follow-up from the index visit. Incident and prevalent NP cases were not distinguished because of the inability to rule out prior NP.

We obtained demographic characteristics from the Beneficiary Summary File, whereas chronic conditions and Charlson Comorbidity Index scores were identified through Part A and B claims from 2018. Because of low frequencies, the 7 race codes were consolidated into 4 categories. Dual Medicare/Medicaid enrolment and Part D subsidy—highly correlated low-income markers—were combined; beneficiaries with either were classified as low-income. Chronic conditions were selected based on literature linking them to opioid prescriptions.⁶

Based on the index visit provider in 2019, we identified 3 cohorts: (1) SMT: beneficiaries whose index visit was with a chiropractor (specialty code 35); (2) primary care physician without analgesics (PCP [−A]): beneficiaries who visited a primary care physician (codes 01, 08, or 11) without a Part D claim for an analgesic medication within 7 days; and (3) primary care physician with analgesics (PCP [+A]): beneficiaries who visited a PCP and had at least one Part D claim for an analgesic medication within 7 days. Analgesic medications included nonsteroidal anti-inflammatory drugs and opioids; all other medications were classified as nonanalgesics. Medicare guidelines restrict reimbursement for chiropractic services to only SMT, making chiropractic care synonymous with SMT in Medicare claims data.⁷

We assessed total and NP-related Medicare allowed costs per beneficiary over a 24-month period starting with the index visit, categorized by treatment cohort and Medicare program (Parts A, B, and D). To adjust for variations across cohorts and large standard deviations, we calculated weighted mean costs and standard deviations using the inverse probability of treatment weighting.

The propensity scores were computed using multinomial logistic regression based on covariates in [table 1](#). These scores were applied as the inverse probability of treatment weights in generalized linear models (PROC GENMOD) using a γ distribution with a log link. Separate models were conducted for Medicare Parts A, B, and D. All covariates were included in the weighted models for a doubly robust estimation of allowed cost ratios for Medicare Parts A and B (total and NP-related claims) and Part D (nonanalgesic and

analgesic claims). Our study adhered to the STROBE guidelines for cohort studies (see [supplemental appendix S1](#)), and protocols were approved by the institutional review board.

Results

Among the 291,604 older adults with NP, the majority were White women, with most having 0 or 1 comorbidity. The SMT cohort constituted 63% of index visits and was characterized by a predominantly White demographic, a lower proportion of low-income beneficiaries, and overall better health. This cohort had fewer chronic conditions and a higher number of individuals with a Charlson Comorbidity Index score of 0 than other cohorts (all differences were statistically significant at $P < .05$). The PCP (−A) cohort accounted for 29% of index visits, whereas the PCP (+A) cohort represented 8% ([table 1](#)). Propensity weighting effectively balanced covariates, as indicated by the standard mean difference values of less than 0.1 across all covariate comparisons, thereby minimizing bias from nonrandom treatment selection (see [supplemental appendix S1](#)).

Regarding Part A claims, the SMT cohort demonstrated 6% lower total costs (cost ratio, 0.94; 95% CI, 0.93-0.95), whereas the PCP (+A) cohort did not show a significant difference than the PCP (−A) cohort. For NP-related Part A claims, the results were reversed: the PCP (+A) cohort had 7% lower costs (cost ratio, 0.93; 95% CI, 0.88-0.98), whereas the SMT cohort did not show a significant difference.

For Medicare Part B claims, the SMT cohort again demonstrated 6% lower total costs (cost ratio, 0.94; 95% CI, 0.94-0.95), whereas the PCP (+A) cohort showed 2% higher costs than PCP (−A) cohort. Regarding NP-related Part B claims, the SMT cohort was associated with a 36% cost savings (cost ratio, 0.64; 95% CI, 0.64-0.65), whereas the PCP (+A) cohort had a 1% increase in costs.

When evaluating Medicare Part D allowed cost, the SMT cohort exhibited 2% lower total costs for nonanalgesic medications (cost ratio, 0.98; 95% CI, 0.98-0.99), whereas the PCP (+A) cohort demonstrated 13% higher cost (cost ratio, 1.13; 95% CI, 1.12-1.13). The SMT cohort exhibited 13% lower total costs for analgesic medications (cost ratio, 0.87; 95% CI, 0.87-0.88). Paradoxically, the PCP (+A) cohort also exhibited lower total analgesic costs (cost ratio, 0.86; 95% CI, 0.86-0.87) ([table 2](#)).

Discussion

This study is among the first to evaluate longitudinal costs associated with different NP-related treatment patterns. Although several cost differences were statistically significant, their clinical and economic relevance varied substantially. The most notable absolute cost differences were observed in Part A, where SMT was associated with approximately \$435 lower total costs and \$282 lower NP-specific costs than PCP (−A). In contrast, the differences in Part B were relatively minor, amounting to approximately \$5 and \$20 for total and NP-specific claims, respectively, within the same comparison groups. Similarly, Part D showed minimal variations of approximately \$7 and \$1 for analgesic and nonanalgesic categories, respectively, suggesting limited economic implications despite statistical significance.

The discrepancies between cost ratios and weighted mean costs in Parts A and D analyses highlight the methodological nuances of

List of abbreviations:

- (+A) prescription analgesics
- (−A) no prescription analgesics
- NP neck pain
- PCP primary care physician
- SMT spinal manipulative therapy

Table 1 Cohort characteristics

	SMT (n=182,596)	PCP (-A) (n=85,765)	PCP (+A) (n=23,243)
Mean age \pm SD (y)	75.5 \pm 5.9	76.0 \pm 6.6	75.6 \pm 6.4
Age category (y)			
66-70 (n [%])	56,301 (31%)	20,403 (24%)	5792 (25%)
71-75	58,542 (32%)	25,208 (30%)	7047 (30%)
76-80	37,766 (21%)	19,531 (23%)	5286 (23%)
81-85	19,609 (11%)	11,946 (14%)	3130 (13%)
86-99	10,378 (6%)	8677 (10%)	1988 (9%)
Sex			
Female	120,445 (66%)	58,313 (68%)	15,214 (65%)
Race/ethnicity			
White	168,349 (92%)	68,924 (81%)	19,113 (82%)
Black	2016 (1%)	4483 (5%)	1395 (6%)
Hispanic	3709 (2%)	5015 (6%)	1203 (5%)
Other/unknown	8552 (5%)	7343 (9%)	1532 (7%)
Low-income marker			
Present	8458 (5%)	12,531 (15%)	2433 (10%)
Geographic region			
Northeast	26,084 (14%)	13,233 (15%)	3104 (13%)
Midwest	60,232 (33%)	15,932 (19%)	4937 (21%)
South	54,854 (30%)	34,732 (41%)	11,179 (48%)
West	41,423 (23%)	21,865 (25%)	4022 (17%)
CCI score			
0	121,250 (68%)	52,586 (61%)	14,264 (61%)
1	42,522 (24%)	22,965 (27%)	6172 (27%)
2	11,228 (6%)	6961 (8%)	1747 (8%)
3	2747 (2%)	2049 (3%)	495 (2%)
4+	1686 (1%)	1204 (1%)	284 (1%)
Chronic conditions			
Depressive disorder	13,904 (8%)	8665 (10%)	2023 (9%)
Fibromyalgia	4224 (2%)	2778 (3%)	529 (2%)
Low back pain	113,061 (62%)	31,174 (36%)	7167 (31%)
Opioid use disorder	810 (1%)	1218 (1%)	164 (1%)
Hip osteoarthritis	2835 (2%)	1874 (2%)	444 (2%)
Knee osteoarthritis	10,039 (6%)	6363 (7%)	1460 (6%)

NOTE: Low-Income marker: dual enrolment and/or Part D subsidy; Geographic regions based on US Census Bureau regions; Abbreviation: SMT, Spinal Manipulative Therapy; PCP (-A), Primary Care without prescription analgesics; PCP (+A), Primary Care with prescription analgesics; CCI, Charlson Comorbidity Index.

health care cost data. For Part A NP-related claims, the cost ratio indicates comparable costs between SMT and PCP (-A), but the weighted means reveal a striking disparity (\$37.8 vs \$319.9), underscoring the skewed distribution of inpatient care, as evidenced by very large standard deviations.

Conversely, outpatient (Part B) costs appear more consistent, as evidenced by smaller standard deviations. For Part D nonanalgesics, the cost ratio suggests 2% lower costs for SMT, whereas the weighted means indicate slightly higher costs (\$20.3 vs \$19.5). This apparent discrepancy likely reflects how these 2 measures (geometric versus arithmetic means) respond differently to the underlying cost distribution.⁸ These distinctions emphasize the need to consider both metrics to fully understand cost comparisons.

Demographic characteristics and high utilization of SMT align with findings from similar studies evaluating NP treatment among Medicare beneficiaries.^{9,10} Given the scarcity of directly comparable research on NP-related cost outcomes, we refer to a systematic review comparing the cost-effectiveness of chiropractic care versus medical management for musculoskeletal pain.⁵ This review,

encompassing 44 studies, revealed that 6 of 8 studies evaluating per-episode costs found chiropractic care to be more economical. In addition, both studies examining long-term health care costs favored chiropractic care. Cost reductions in the chiropractic group were attributed to decreased utilization of imaging studies, prescription opioids, surgeries, hospitalizations, injections, specialist visits, and emergency department visits.

Interestingly, our study observed reduced analgesic costs in the PCP (+A) cohort. Although the exact reason for this is unclear, it may be attributed to effective early pain management, potentially mitigating the need for long-term prescription analgesic use.

Study limitations

Several limitations should be acknowledged. First, our dataset did not include Medicare Advantage enrollees. Second, insurance claims data lack information on the use of nonprescription medications. Third, NP severity and disability cannot be determined from insurance claims. Fourth, although we implemented a 90-day clean window without an NP-related visit, the previous episodes

Table 2 Cost ratio estimates and weighted mean cost by cohort, Medicare program, and claim category

		SMT	PCP (+A)	PCP (-A)
PART A	Cost ratio (95% CI)			
	Total claims	0.94 (0.93-0.95)	1.00 (0.98-1.02)	Ref.
	NP claims	0.97 (0.92-1.03)	0.93 (0.88-0.98)	Ref.
	Weighted mean cost (SD)			
	Total claims (\$)	1957.3 (6547.0)	2314.0 (7474.3)	2392.2 (7714.1)
	NP claims (\$)	37.8 (996.9)	287.3 (2806.0)	319.9 (2702.5)
PART B	Cost ratio (95% CI)			
	Total claims	0.94 (0.94-0.95)	1.02 (1.01-1.02)	Ref.
	NP claims	0.64 (0.64-0.65)	1.01 (1.00-1.02)	Ref.
	Weighted mean cost (SD)			
	Total claims (\$)	80.0 (284.6)	86.9 (328.8)	85.2 (289.7)
	NP claims (\$)	39.8 (70.2)	60.2 (159.8)	59.5 (181.3)
PART D	Cost ratio (95% CI)			
	Analgesics	0.87 (0.87-0.88)	0.86 (0.86-0.87)	Ref.
	Nonanalgesics	0.98 (0.98-0.99)	1.13 (1.12-1.14)	Ref.
	Weighted mean cost (SD)			
	Analgesics (\$)	96.0 (516.8)	96.5 (503.8)	103.4 (675.4)
	Nonanalgesics (\$)	20.3 (43.2)	22.9 (59.4)	19.5 (47.2)

NOTE: Bold values indicate statistically significant cost ratio estimates ($p < 0.05$). Total claims: cumulative paid claims over 24 months post index visit; NP claims: primary neck pain diagnosis; analgesics: National Drug Code for specified analgesics; nonanalgesics: any other medication; weighted mean cost=allowed cost averaged over all episodes, weighted by the inverse probability of treatment weighting. Abbreviations: SMT, Spinal Manipulative Therapy; PCP (-A), Primary Care without prescription analgesics; PCP (+A), Primary Care with prescription analgesics; Ref., reference group.

or ongoing care for persisting NP cannot be ruled out. Finally, despite robust methodological strategies, observational data preclude the identification and elimination of all potential confounders, including treatment selection bias. Future research should investigate the underlying mechanisms driving the cost disparities identified in this study, as well as explore additional nonsurgical interventions, such as physical therapy.

Conclusions

For older adults with new NP episodes, the initial SMT is associated with lower health care costs, particularly for Part A total and NP-related claims, with a less pronounced effect on Part B and D claims than PCP-related strategies. These results underscore the potential for health care cost savings based on the initial treatment approaches.

Keywords

Analgesics; Cervical pain; Cost analysis; Medicare; Primary care physicians; Rehabilitation; Spinal manipulation

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