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Association between chiropractic spinal manipulation and lumbar discectomy in adults with lumbar disc herniation and radiculopathy: retrospective cohort study using United States' data

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ABSTRACT

Objectives Chiropractic spinal manipulative therapy (CSMT) and lumbar discectomy are both used for lumbar disc herniation (LDH) and lumbosacral radiculopathy (LSR); however, limited research has examined the relationship between these therapies. We hypothesised that adults receiving CSMT for newly diagnosed LDH or LSR would have reduced odds of lumbar discectomy over 1-year and 2-year follow-up compared with those receiving other care.

Design Retrospective cohort study.

Setting 101 million patient US health records network (TriNetX), queried on 24 October 2022, yielding data from 2012 query.

Participants Adults age 18–49 with newly diagnosed LDH/LSR (first date of diagnosis) were included. Exclusions were prior lumbar surgery, absolute indications for surgery, trauma, spondylolisthesis and scoliosis. Propensity score matching controlled for variables associated with the likelihood of discectomy (eg, demographics, medications).

Interventions Patients were divided into cohorts according to receipt of CSMT.

Primary and secondary outcome measures ORs for lumbar discectomy; calculated by dividing odds in the CSMT cohort by odds in the cohort receiving other care.

Results After matching, there were 5785 patients per cohort (mean age 36.9±8.2). The ORs (95% CI) for discectomy were significantly reduced in the CSMT cohort compared with the cohort receiving other care over 1-year (0.69 (0.52 to 0.90), p=0.006) and 2-year follow-up (0.77 (0.60 to 0.99), p=0.040). E-value sensitivity analysis estimated the strength in terms of risk ratio an unmeasured confounding variable would need to account for study results, yielding point estimates for each follow-up (1 year: 2.26; 2 years: 1.92), which no variables in the literature reached.

Conclusions Our findings suggest receiving CSMT compared with other care for newly diagnosed LDH/LSR is associated with significantly reduced odds of discectomy over 2-year follow-up. Given socioeconomic variables were unavailable and an observational design precludes inferring causality, the efficacy of CSMT for LDH/LSR

STRENGTHS AND LIMITATIONS OF THIS STUDY

⇒ This study was based on an a priori protocol developed by a multidisciplinary research team with the intention of reducing bias.

⇒ This study included patients with newly diagnosed lumbar disc herniation or lumbosacral radiculopathy and excluded those with absolute indications for surgery to make cohorts more comparable.

⇒ While an extensive propensity matching model was used to control for confounding variables, several variables were unavailable in the dataset including those relating to socioeconomic status, examination and imaging findings, pain severity and impact, catastrophising, self-efficacy and disability.

⇒ While this study examined a large population, only large, academically affiliated healthcare organisations in the US were included, thus results may not be broadly generalisable.

⇒ As this study is observational, a randomised controlled trial would be needed to eliminate possible residual confounding.

should be examined via randomised controlled trial to eliminate residual confounding.

INTRODUCTION

A lumbar disc herniation (LDH) is a focal displacement of intervertebral disc material beyond the normal limit of the disc margin,[1] which may compress one or more nerve roots, causing lumbosacral radiculopathy (LSR). The clinical features of LSR include radicular (radiating) lower extremity pain, predictable sensory disturbances, weakness and/or diminished muscle stretch reflexes.[2] LDH and LSR are common reasons for patients to receive chiropractic care or undergo surgery to remove LDH material, a procedure called discectomy. However, limited research has

examined the association between chiropractic care and discectomy.

In the USA, chiropractors are portal-of-entry providers that often manage low back pain, including LDH/LSR.[3 4] While chiropractors may use soft tissue or exercise therapies for these patients,[5] they most often employ chiropractic spinal manipulative therapy (CSMT).[4] Prior studies have documented the benefits of CSMT for LDH/LSR, including randomised prospective studies.[6 7] In a meta-analysis, spinal manipulation was found to be one of the most effective treatments for discogenic LSR.[8] Accordingly, US and international clinical practice guidelines have recommended spinal manipulation for low back pain and LSR.[9–13]

Prior studies examining the association between chiropractic care and lumbar spine surgery have examined a broader population and/or outcome.[14–20] Two studies identified a significant reduction in odds of lumbar surgery among individuals receiving early chiropractic care, with one examining surgical fusion or decompression among patients with an occupational back injury,[18] and another examining discectomy and fusion among patients with back pain.[14] The current study differs by examining a narrower range of LBP conditions (ie, LDH/LSR) with an outcome specific to discectomy.

Several factors may influence whether a patient undergoes a discectomy, including clinical features, patient preferences and the response to conservative care.[21–23] While the presence of severe or 'red flag' neurologic deficits and/or cauda equina syndrome (CES) are absolute indications for lumbar discectomy, continued pain despite conservative treatment that affects quality of life is considered a relative indication.[24] For patients without absolute indications, early discectomy can provide short-term benefits for LDH with LSR; however, long-term outcomes are similar at 1–2 years in those receiving conservative care.[25]

This study was conducted considering that CSMT and lumbar discectomy are both viable treatment options for LDH and LSR, yet there has been limited research examining the relationship between these care pathways.

Objectives
This study aimed to examine the association between receipt of CSMT for newly diagnosed LDH and/or LSR and odds of lumbar discectomy, with the hypothesis that adults receiving CSMT would have reduced odds of lumbar discectomy over 1-year and 2-year follow-up windows after index diagnosis compared with those receiving other care.

METHODS
Study design
This study followed an a priori protocol registered with the Open Science Framework (https://osf.io/2gkcd),[26] and incorporated a retrospective, new user, active comparator design[27] to compare recipients and non-recipients of

CSMT from age 18–49 of any sex (figure 1). The study included patients meeting selection criteria from 24 October 2012 to 24 October 2020 to capture more recent data, considering the treatment of LDH and LSR may have changed over time. Strengthening the Reporting of Observational Studies in Epidemiology guideline structure was followed.[28]

Setting and data source
This study used a 101 million patient's population within the TriNetX US research network (TriNetX, Cambridge, Massachusetts, USA).[29] Data in this network is deidentified, aggregated and frequently updated from the health records of multiple healthcare organisations in the USA, which are typically large, academically affiliated health centres and their ambulatory offices. This network includes insured and uninsured patients.[30] The TriNetX dataset routinely undergoes automated and manual assessments to ensure data conformance, completeness and plausibility.[29 31] One previous study estimated a completeness of at least 87% for medications in the TriNetX dataset[32]; however, the completeness of other variables has not been examined to our knowledge.

Queries of this dataset are performed using standardised nomenclatures such as the International Classification of Diseases (ICD-10) procedural classification system (ICD-10-PCS), current procedural terminology (CPT) and Veterans Health Administration National Drug File and others. ICD-10 codes may also be used, which are interconverted automatically to older ICD-9 codes using general equivalence mappings.[29] At University Hospitals of Cleveland, the Clinical Research Center manages all use of the TriNetX platform.

As of January 2022, there were 10 healthcare organisations within the TriNetX network that had providers administering CSMT.[33] In accordance with of privacy regulations, these institutions remain anonymous. Although this study only examined a fraction of US chiropractic providers, integration of chiropractors into hospitals is a growing trend, with 5% of US chiropractors reporting a hospital affiliation in 2019.[3] Integrated chiropractors are most often employed within physical medicine, rehabilitation or physical therapy settings and on average have 21-year experience in practice.[34]

Participants
Eligibility criteria
This study identified patients with newly diagnosed LDH and/or LSR by querying the TriNetX dataset with a custom set of codes (online supplemental table 1). These patients were identified at the index date of diagnosis, which we defined as the first instance of LDH or LSR codes appearing in the medical record. This effectively required that patients had no previous instance of LDH or LSR diagnosis occurring over any time available in the dataset preceding the index date. As the length of time patients were available in the dataset prior to inclusion varied, this washout window also varied per patient.
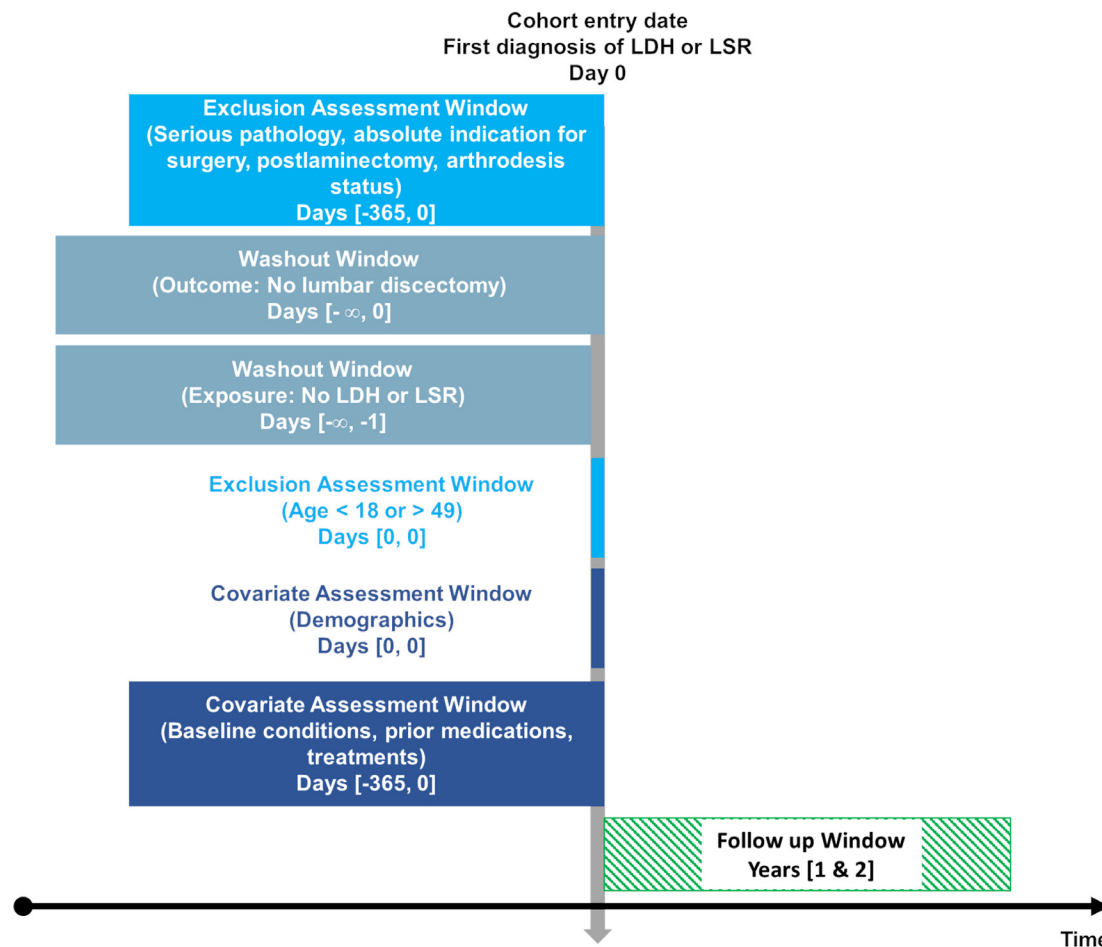
Figure 1 Study design. The vertical grey arrow represents the date of index diagnosis of lumbar disc herniation (LDH) or lumbosacral radiculopathy (LSR). Assessment windows to the left of this arrow represent time periods occurring before this date over a span of days [#,#]. The '∞' indicates that the time window extends as far as data are available in the dataset for each patient. The follow-up window occurs after the index diagnosis and is represented by a green rectangle representing 1-year and 2-year follow-up. Figure created by RT using Creative Commons template from Schneeweiss et al.[74]

Patients were required to be represented in the dataset for at least 2 years after the index diagnosis date to be eligible.

Patients with diagnoses of lumbar or sacral radiculopathy or sciatica were included as these diagnoses often reflect underlying LDH or LSR,[35] and evidence suggested that these diagnosis codes are often used by clinicians.[36] The age bracket of 18–49 years was used as LDH is more common in younger patients aged 30–50.[37] Conversely, lumbar stenosis is a more prevalent cause of LSR in older patients.[38] Accordingly, the upper age cut-off was intended to exclude patients with lumbar stenosis from our study.

Patients with serious spine pathology or absolute indication for surgery, such as CES, signs of CES such as bowel or bladder incontinence, fracture, infection and malignant neoplasms were excluded over 365 days preceding and including the date of index diagnosis (online supplemental table 2).[39] Patients with conditions that could alter the CSMT or surgical approach and/or increase the odds of lumbar surgery were also excluded: lumbar fusion, arthrodesis or post-laminectomy syndrome,[40 41]

lumbar spine trauma[42] and degenerative lumbar scoliosis and spondylolisthesis.[43] As an additional measure of ensuring patients had no previous discectomy, we excluded patients with any instance of discectomy occurring over any time available in the dataset preceding and including the index date of diagnosis.

Diagnoses of lumbar spondylosis (eg, ICD-10: M47.26) were not used in our inclusion criteria, given these are not specific to LDH. In addition, codes specifying lumbar disc disorders with myelopathy (eg, ICD-10: M47.16) were not used as myelopathy has different clinical features and management strategies than LDH/LSR. Diagnosis codes specifying lumbar or lumbosacral disc degeneration were not included, as a strategy to create more uniformity between cohorts. Disc degeneration is not associated with radicular symptoms, unlike LDH, which has a strong association with radicular symptoms.[44]

Included patients were divided into two cohorts according to receipt of CSMT (online supplemental table 3). The CPT codes 98940, 98941 and 98942 for CSMT were included in the 'CSMT' cohort and excluded in the 'other care' cohort. These 9894* codes are almost

exclusively used by chiropractors in the USA.[45] Patients in the CSMT cohort were required to receive CSMT on the date of index date of diagnosis of LDH or LSR (ie, the first instance of the diagnosis in the medical record), while those in the cohort receiving other care could not receive CSMT on the index date of diagnosis.

Variables
Discectomy
A definition for the outcome of lumbar discectomy was developed based on discussion among coauthors and comparison with previous publications (online supplemental table 4).[36 39 46 47] This definition included multiple procedure codes for discectomy, as well as the ICD-10-PCS code 0SB4* which includes open, percutaneous and percutaneous endoscopic approaches to excise lumbosacral disc material,[48] and the Healthcare Common Procedure Coding System code C9757 for lumbar discectomy with implantation of an annular closure device.[47] Feasibility testing was conducted in June, 2021, to ensure these codes were represented in the TriNetX database. Two follow-up windows of 1 year and 2 years were used in this study to allow for comparisons to prior similar studies also using long-term endpoints.[16 18]

Potential confounders
Propensity score matching is a method of balancing confounding variables between cohorts to improve their comparability.[27] Based on previous recommendations, confounders were propensity matched when having evidence of an association with the outcome of interest (ie, lumbar discectomy).[49] Variables present within a 365-day window preceding the index diagnosis of LDH and/or LSR were eligible for propensity matching (online supplemental table 5).

Demographic variables associated with the likelihood of lumbar surgery were propensity matched including increasing age,[23 50] male sex[23 50 51] and race.[50] Other factors associated with increased likelihood of lumbar surgery were matched including obesity,[23 50] being a non-smoker,[23] psychological disorders,[50] a history of lumbar injections[23 52] and prior treatment with opioids[42] or prescription pain medications.[23] Radicular symptoms or radiculopathy are also predictors of lumbar surgery in those with low back pain[23 52] and were matched via the ICD-10 codes for LSR and sciatica.

Study size
A required sample size of 198 was calculated using G*Power[53] z-tests for logistic regression, with an alpha error 0.05, power of 0.95, probability of the outcome in the null hypothesis of 0.02 and OR of 0.18, assuming a normal distribution and a moderate interaction between covariates (R2=0.5). Probabilities were taken from a prior similar study that examined surgical rates in recipients vs non-recipients of chiropractic care.[16] This sample was deemed to be feasible given the large patient population within the TriNetX network.

Statistical methods
Statistical analysis was performed using built-in statistical functions available in the TriNetX software platform in real-time. Baseline characteristics were compared using a Pearson χ^2 test for categorical variables and independent-samples t-test for continuous variables. We did not perform any imputations for missing data.

Propensity scores for each cohort were calculated using logistic regression. Propensity scores were matched 1:1 using a greedy nearest-neighbour algorithm and a calliper of 0.01 pooled SD. A visual diagnostic was used to assess the balance between cohorts following propensity score matching. Odds of discectomy in each cohort were calculated by dividing the number of patients undergoing discectomy by the number of patients not undergoing discectomy. ORs for discectomy for each follow-up window were calculated by dividing odds in the CSMT cohort by odds in the other care cohort.

A sensitivity analysis was conducted by computing E-values for both follow-up windows after propensity matching.[54] The E-value is defined as the minimum strength of association an unmeasured confounder would need to account for an association between the outcome (ie, CSMT) and exposure (lumbar discectomy).[55]

Patient and public involvement
No patient or public involvement.

RESULTS
Participants
Patients meeting selection criteria were identified from 70 healthcare organisations, 10 of which included CSMT services. A large sample size was identified for each cohort (table 1). Before propensity matching, there were 5785 patients in the CSMT cohort and 482 704 in the other care cohort. After propensity matching, which discarded non-matching patients in the larger other care cohort, there were 5785 patients in each cohort (mean age 36.9±8.2 years).

Before matching, there were several differences between cohorts. Most notably, the CSMT cohort had a significantly lower percentage of patients who were Black/African American or Hispanic/Latino and significantly higher percentage of patients who were prescribed central nervous system medications. The frequency of LDH/LSR codes also varied between cohorts. All differences between cohorts were no longer statistically significant after propensity matching, aside from body mass index. However, this difference was minimal, varying only 0.5 kg/m² between cohorts.

Descriptive data
The average number of data points per patient was high in both cohorts (CSMT 2442, other care 1527). After propensity matching, the frequency of unknown demographic variables was the same both cohorts, with 15% having unknown race, 14% having unknown ethnicity and

Table 1 Baseline characteristics before and after propensity score matching

Characteristic	Before matching			After matching		
	CSMT	Other care	P value	CSMT	Other care	P value
N	5785	482 704		5785	5785	
Age	36.9±8.2	37.4±8.2	<0.001	36.9±8.2	36.9±8.2	0.972
Sex						
Female	3535 (61%)	288 061 (60%)	0.028	3535 (61%)	3539 (61%)	0.939
Male	2250 (39%)	194 587 (40%)	0.029	2250 (39%)	2245 (39%)	0.924
Race						
Black or African American	431 (8%)	90 838 (19%)	<0.001	431 (8%)	433 (8%)	0.944
White	4389 (76%)	313 938 (65%)	<0.001	4389 (76%)	4368 (76%)	0.649
Asian	99 (2%)	9913 (2%)	0.068	99 (2%)	100 (2%)	0.943
Ethnicity						
Hispanic/Latino	157 (3%)	37 715 (8%)	<0.001	157 (3%)	154 (3%)	0.863
Not Hispanic/Latino	4839 (84%)	311 836 (65%)	<0.001	4839 (84%)	4808 (83%)	0.439
Conditions (ICD-10)						
Mental, behavioural and neurodevelopmental disorders (F01-F99)	2177 (38%)	145 444 (30%)	<0.001	2177 (38%)	2158 (37%)	0.715
Lumbosacral root disorders, not elsewhere classified (G54.4)	24 (<1%)	878 (<1%)	<0.001	24 (<1%)	16 (<1%)	0.205
Radiculopathy, lumbar region (M54.16)	1713 (30%)	138 388 (29%)	0.115	1713 (30%)	1666 (29%)	0.337
Radiculopathy, lumbosacral region (M54.17)	1420 (25%)	73 363 (15%)	<0.001	1420 (25%)	1375 (24%)	0.328
Radiculopathy, sacral and sacrococcygeal region (M54.18)	62 (1%)	1052 (<1%)	<0.001	62 (1%)	58 (1%)	0.714
Sciatica (M54.3)	1432 (25%)	150 984 (31%)	<0.001	1432 (25%)	1407 (24%)	0.589
Lumbago with sciatica (M54.4)	1411 (24%)	158 467 (33%)	<0.001	1411 (24%)	1360 (24%)	0.267
Procedure (ICD-10-PCS)						
Introduction of anaesthetic agent into spinal canal, percutaneous approach	10 (<1%)	991 (<1%)	0.588	10 (<1%)	10 (<1%)	1
Medications (VANDF)						
Opioid Analgesics (CN101)	1883 (33%)	156 838 (33%)	0.925	1883 (33%)	1881 (33%)	0.968
Central nervous system medications (CN000)	3619 (63%)	279 764 (58%)	<0.001	3619 (63%)	3603 (62%)	0.759
BMI (kg/m²)	30.6±6.9	30.6±7.2	0.571	30.6±6.9	30.1±7.2	0.005

BMI, body mass index; CSMT, chiropractic spinal manipulative therapy; ICD, International Classification of Disease; ICD-10-PCS, International Classification of Disease procedure coding system; VANDF, Veterans Health Administration National Drug File.

0% having unknown sex or age. These findings suggested there was no difference between cohorts with respect to missing data. A visual propensity score density graph revealed that cohorts were comparable after propensity matching (see online supplemental figure 1).

Key results

Discectomy was less frequent in the CSMT cohort throughout 1-year and 2-year follow-up windows before and after propensity matching. After matching, 1.5% of patients (CSMT) and 2.2% (other care) underwent discectomy over 1-year follow-up, while 1.9% (CSMT) and 2.4% (other care) underwent discectomy over 2 years

(table 2). After matching, odds of discectomy were significantly lower in the CSMT compared with other care cohort, with an OR (95% CI) of 0.69 (0.52 to 0.90; p=0.006) over 1-year and 0.77 (0.60 to 0.99; p=0.040) over 2-year follow-up from index diagnosis.

Sensitivity analysis

After propensity matching, ORs for the current study allowed calculation[54] of an E-value for the point estimate of 2.26 with an E-value for the lower CI of 1.46 for the 1-year follow-up, and an E-value for the point estimate of 1.92 with an E-value for the lower CI of 1.11 for the 2-year follow-up.

Table 2 Key results before and after propensity score matching

	Before matching		After matching	
	CSMT n=3093	Other care n=747 594	CSMT n=3093	Other care n=3093
1 year				
Discectomy number (%)	89 (1.5%)	8854 (1.8%)	89 (1.5%)	129 (2.2%)
OR (CI)	0.84 (0.68 to 1.03)	(Reference)	**0.69** (0.52 to 0.90)*	(Reference)
2 years				
Discectomy number (%)	108 (1.9%)	9749 (2.0%)	108 (1.9%)	140 (2.4%)
OR (CI)	0.92 (0.76 to 1.12)	(Reference)	**0.77** (0.60 to 0.99)*	(Reference)

Bold indicates results pertinent to the study hypotheses.
*Indicates a p value of <0.05.
%, percentage of patients with discectomy; CSMT, chiropractic spinal manipulative therapy.

While our protocol suggested patients have a small increase in likelihood of visiting a chiropractor if they have higher income (ie, risk ratio of 1.23),[56] this was based on data from the 1990s,[57 58] which has been contradicted by more recent data. A more recent study found that income, education level and insurance coverage are not associated with patients' initial choice of provider for spinal pain (ie, chiropractor, physical therapist or medical physician).[59] Regardless, the risk ratio from the earlier study suggesting income was a predictor is less than the E-value point estimates for our study (ie, 1.23, <1.92 and 2.26).

An unmeasured variable associated with both likelihood of visiting a chiropractor and likelihood of undergoing discectomy would require a risk ratio greater than the study E-value point estimates, 1.92 and 2.26, to fully explain away our results of a significant reduction in odds of discectomy from the 2-year and 1-year follow-up outcomes, respectively.[55] We are unaware of any socioeconomic or other variable that were not measured in the current study that could fully explain away our results based on the E-value estimates.

DISCUSSION

This retrospective cohort study was the first to examine the association between receiving CSMT for newly diagnosed LDH and/or LSR and odds of lumbar discectomy and included a large US sample of over 3000 patients per cohort after several exclusions and propensity matching to improve cohort comparability. These real-world results support our hypothesis that patients initially receiving CSMT for LDH/LSR have reduced odds of discectomy over 1-year and 2-year follow-up.

The frequency of discectomy in this study (ie, 1.5%–2.2% over 1 year) is comparable to previous studies, and suggestive that our methods of capturing this outcome were valid. One prior study which examined 2.5 million adults in the USA with low back and/or lower extremity pain and no red flag diagnosis found that 1.2% of patients underwent surgery over a 1-year follow-up

period.[60] While smaller studies have reported a higher frequency of discectomy of 5% or greater,[44 61–63] our study had a relatively young population and several exclusions, which could explain the frequency of discectomy being on the lower end of the range of prior studies. Further, most discectomies occurred in the first year of follow-up in our study, with only a small increase during the 2-year follow-up window. This is in agreement with a previous systematic review that reported the majority of patients undergo surgery within 2 and 12 months from onset of symptoms.[24]

The overall rate of surgery over 2-year follow-up including both cohorts combined in our study was 2.1%, whereas in previous similar studies examining CSMT this value was 5%[14] and 9%.[18] The lower frequency of discectomy in our study could relate to a declining rate of lumbar surgery in the USA.[64] While our study included the most recent data, from 2012 to 2022, the 5% value derived from data from 2012 to 2018,[14] and 9% value derived from older data from 2002 to 2004.[18] Finally, it is possible that the final 2 years of our data included a lower frequency of discectomy related to the COVID-19 pandemic, as studies have reported delays and cancellations in elective spine surgeries during this time.[65 66]

Previous studies have reported a reduction in surgery among patients receiving CSMT. In one study, the reduction in odds of lumbar spine surgery was of a greater magnitude than our study (ie, 0.22); however, this study focused on a population with occupational back injury.[18] Another study examining a broader population identified a reduction in likelihood of surgery of greater magnitude than our study (ie, risk ratio of 0.30).[14] A third similar study found a reduction in surgery among CSMT recipients, which was not statistically significant, likely due to small sample size.[16] While the current study reinforces these previous findings, the smaller magnitude of our ORs could be explained by the extensive selection criteria, narrow age bracket, propensity matching methods and differences in patient population.

Our sensitivity analysis suggested that an unmeasured confounder associated with both CSMT and discectomy would require a risk ratio associated with patients' initial choice of CSMT for LDH/LSR of a magnitude of 1.92 to 2.26 to fully explain our results at 2-year and 1-year follow-up, respectively. While we are unaware of any unmeasured confounder of this magnitude based on recent research on this topic,[59] it is possible that one will be elucidated in future studies. Although the data in the current study includes insured and uninsured patients, socioeconomic variables were not included in the dataset, which remain potentially important unmeasured confounders.

Considering the current study excluded absolute indications for surgery and serious pathology, we suggest our findings may be explained by pain relief afforded by CSMT. Previous studies have shown that LDH/LSR have good prognosis with at least half of patients experiencing significant relief in the first 3–12 months.[67 68] As most patients will undergo surgery within 2–12 months of symptom onset,[24] we suggest initial pain relief afforded by CSMT could allow patients to avoid surgery during this early critical period.

Further research is needed to expand on the current study. Chiefly, a randomised controlled trial could eliminate residual sources of confounding such as socioeconomic variables. In such a study, several outcomes could be measured in tandem including pain severity, disability, cost of care and pain medication utilisation, in addition to the rate of lumbar discectomy. The current study provides preliminary data to justify such a study, which would be more costly and time-consuming to conduct yet provide a higher level of evidence. Further, given our selection criteria focused on younger adults undergoing discectomy for LDH/LSR, a follow-up study could examine the likelihood of lumbar fusion surgery among older adults with lumbar stenosis.

Limitations

First, because of its observational design, this study is unable to conclude that CSMT is causative in reducing the odds of lumbar discectomy. There are several variables unavailable in the TriNetX dataset that could lead to unmeasured confounding such as those relating to socioeconomic status, clinical examination findings,[22] detailed spinal imaging data such as measures of disc herniation,[69] self-reported pain severity and impact and measures of catastrophising, self-efficacy and disability.

Second, data entered into a patient medical record may not be accurate, leading to an information bias in the aggregated health records data.[70] Certain comorbidities, prior diagnoses, treatments, medications or other patient variables could be absent, incorrect or outdated,[71] which could affect propensity matching or impact a patient's eligibility for the current study. We were also unable to examine data completeness for all variables at an individual patient level. It was not feasible to validate our query against a gold standard of chart review given data was deidentified and sourced from outside healthcare organisations.

Third, we are unable to determine the techniques of CSMT employed by chiropractors for each patient, which may have differing efficacy.[72] Knowledge of techniques performed such as mobilisation, low-force, or high-velocity, low-amplitude CSMT could allow us to standardise the CSMT cohort to include a more uniform treatment, or enable subgroup analysis according to technique (eg, flexion distraction, lumbar high-velocity, low-amplitude manipulation, instrument assisted, etc). In addition, the number of visits in which CSMT was used likely varied between patients in the CSMT cohort, and this variable cannot be tracked in the study dataset.

Fourth, we were unable to examine the likelihood of visiting a surgeon due to a lack of provider codes in the dataset. Previous research has found that patients who initiate care for low back pain with a chiropractor have significantly reduced odds of visiting a surgeon.[16] Accordingly, it is unclear if a difference in surgical visits between cohorts mediates the association observed in our study.

Finally, as the study results derived from large, academically affiliated healthcare institutions, they may not be generalisable to patients seeking chiropractic care in private facilities.[73] These results also may not be generalisable to healthcare settings outside of the USA.

CONCLUSION

These findings suggest that patients receiving CSMT for newly diagnosed LDH and/or LSR without serious pathology, spinal deformity or absolute indications for surgery have significantly reduced odds of discectomy through 2-year follow-up after index diagnosis compared with those receiving other care. While socioeconomic variables were unavailable in the dataset, current data suggests these unmeasured variables would not completely explain our findings. However, given the possibility of residual confounding, the efficacy of CSMT for LDH/LSR should be explored further using a randomised controlled trial.

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Disclaimer The views expressed are those of the authors and do not necessarily reflect the official policy or position of the US Department of Veterans Affairs or the US Government.

Competing interests RJT reports he has received book royalties as the author of two texts on the topic of sciatica.

Patient and public involvement Patients and/or the public were not involved in the design, or conduct, or reporting, or dissemination plans of this research.

Patient consent for publication Not applicable.

Ethics approval This study was determined Not Human Subjects Research by the University Hospitals Institutional Review Board (Cleveland, Ohio, USA; STUDY20220571).

Provenance and peer review Not commissioned; externally peer reviewed.

Data availability statement Data may be obtained from a third party and are not publicly available. We are unable to make the data used in this study publicly available. This data was obtained via a data use agreement with the TriNetX network that does not allow release or sharing of this data. Those interested in accessing this network may contact TriNetX (https://www.trinetx.com/).

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