

Patient-Reported Outcomes in an Interdisciplinary Spine Care Pathway for Low Back Pain: A Prospective Pilot Study

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Abstract

Introduction: Low back pain is a leading cause of global disability, placing substantial burdens on individuals and healthcare systems. Traditional single-discipline pathways often yield fragmented delivery and suboptimal outcomes. Interdisciplinary spine center models emphasizing shared decision-making and nonsurgical pathways may streamline care, improve clinical outcomes, and enhance patient satisfaction. This study aimed to describe short-term patient-reported outcomes among adults with low back pain managed within an interdisciplinary spine care pathway.

Methods: In this prospective longitudinal cohort pilot study conducted at an academic spine center, 89 adults (aged 18-75) with low back pain with or without radicular symptoms were evaluated. Primary outcomes included PROMIS Pain Interference (PROMIS-PI), PROMIS Physical Function (PROMIS-PF), and the Patient Satisfaction Questionnaire-18 (PSQ-18) administered at baseline and three months after enrollment in the interdisciplinary spine care pathway. Secondary measures tracked physical therapy (PT) participation, acupuncture utilization, spinal injections, opioid prescribing, MRI/CT imaging, and surgical referrals.

Results: Among participants who completed the three-month follow-up, PROMIS-PI scores decreased significantly and PROMIS-PF scores increased significantly. PSQ-18 satisfaction scores remained high and did not change significantly. For secondary measures, 51 individuals participated in PT, 33 individuals received acupuncture, 20 individuals underwent spinal injections, 39 individuals had MRI/CT imaging, five individuals required opioid therapy, and three individuals were referred to spine surgery. In exploratory subgroup analyses, participants who received PT had significant within-group improvement in both pain interference and physical function. Among participants who received acupuncture, significant within-group improvement was observed in pain interference only. No statistically significant short-term change in either domain was observed among participants who underwent spinal injections.

Conclusions: In this prospective pilot cohort, participants who completed follow-up demonstrated improvement in PROMIS-PI and PROMIS-PF over three months at the overall cohort level. These findings are descriptive and hypothesis-generating; comparative studies are needed to determine whether the observed changes are attributable to the interdisciplinary care pathway or to specific components of care.

Categories: Pain Management, Physical Medicine & Rehabilitation

Keywords: functional outcomes, interdisciplinary spine care, low-back pain (lbp), nonsurgical care, patient satisfaction, physiatrist, spine center

Introduction

Low back pain is a leading cause of disability worldwide and represents substantial burdens on individuals and healthcare systems. Across the United States, most adults experience low back pain at some point in their lives, with substantial implications on function and quality of life [1,2]. Current treatment options for low back and radicular pain range from nonsurgical management, including physical therapy, acupuncture, medications, and spinal injection procedures, to surgical interventions, with varying outcomes reported [3].

Efforts to reduce healthcare costs and improve quality of care for patients with low back pain have become increasingly important due to the high prevalence and resultant economic burden [4]. For patients who require care from multiple services, limited coordination between providers may contribute to fragmented care, variation in treatment sequencing, duplicate assessment, and delays in referral. In contrast, interdisciplinary management integrating care from nonsurgical and surgical spine specialists streamlines treatment and may foster a more evidence-based and patient-centered care model [5,6]. Prior research has demonstrated that interdisciplinary, shared decision-making approaches can influence treatment choices and utilization patterns in spine care, potentially leading to enhanced clinical outcomes and patient

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satisfaction [5-9].

Within this context, in 2014, our academic medical center established a pilot spine center program to introduce a collaborative, interdisciplinary, and evidence-based approach to spine care. The spine center provides comprehensive care for patients presenting with the full spectrum of spinal disorders. The center includes physicians from the disciplines of orthopedic spine surgery, neurological spine surgery, physiatry, radiology, and other consulting specialists such as neurology and rheumatology, as well as physical therapy and acupuncture. In the initial spine center model, patients considered appropriate were initially directed to a physiatrist for nonsurgical treatment and care coordination. This initial evaluation also served a diagnostic triage function, helping to identify patients appropriate for conservative management while recognizing clinical features that warranted expedited surgical evaluation or further workup for serious pathology. Nonsurgical care pathways might include education, medication management, physical therapy, acupuncture, as well as diagnostic and therapeutic spinal injections when indicated. In the setting of apparent nonsurgical treatment failure, consultation with an orthopedic or neurological spine surgeon was arranged.

A core objective of the spine center is to improve patient outcomes and satisfaction while employing an evidence-based approach to spine care. To describe patient-reported outcomes within this care model, we launched a prospective, longitudinal pilot study of spine center patients across multiple domains, including pain interference with daily activities, physical function, patient satisfaction with care, use of nonsurgical interventions, pharmacologic pain management, and referral for surgical consultation. This prospective study enrolled new patients presenting to the interdisciplinary spine center, where initial evaluation was performed by a physiatric spine specialist, followed by individualized interdisciplinary management over a three-month interval. Prior studies have indicated that directing patients to initial nonsurgical physiatric consultation may be associated with reduced surgical rates and treatment costs while preserving clinical outcomes and patient satisfaction [10,11].

We hypothesized that spine care delivered with an initial comprehensive consultation by a nonsurgical spine specialist would be associated with clinically meaningful improvements in patient-reported pain and physical function. We further aimed to characterize patient satisfaction with this care model at the spine center.

Materials And Methods

A prospective longitudinal pilot study was conducted to describe patient-reported outcomes and satisfaction among patients seeking care for low back pain with or without a radicular pain complaint within an interdisciplinary spine care pathway at an academic spine center from March 28, 2018 to March 18, 2025. This study was approved by the local institutional review board. This pilot study used convenience sampling without a prior power analysis.

Inclusion and exclusion criteria are summarized in Table 1. Eligible participants were male or female adults aged 18 to 75 years, English-speaking, and seeking care for low back pain within the spine center. Low back pain eligibility was defined by ICD codes; eligible ICD-9 codes included 724.02, 722.10, 722.1, 724.4, and 724.2, and eligible ICD-10 codes included M48.07, M51.26, M51.27, M54.16, M54.17, and M54.5.

Category	Criterion
Inclusion	Male or female
Inclusion	Age 18 to 75 years
Inclusion	English-speaking
Inclusion	Seeking care for low back pain within the spine center
Exclusion	Prior back surgery within the last 10 years
Exclusion	Involvement in workers' compensation or no-fault proceedings
Exclusion	Current history of long-standing and regular opioid use
Exclusion	Active spinal malignancy
Exclusion	Autoimmune or rheumatological disorder
Exclusion	Progressive neurological symptoms or deficits
Exclusion	Any other serious medical condition that may interfere with participation or confound interpretation of collected data
Exclusion	Epidural steroid injections for low back pain within the past three years
Exclusion	Participation in an interventional research trial or receipt of any experimental treatment for low back pain
Exclusion	Current pregnancy
Exclusion	Previous treatment within the spine center

TABLE 1: Inclusion and exclusion criteria.

Study participants were recruited from a single academic medical center. All participants had an initial visit with a nonsurgical physiatrist specializing in spine and musculoskeletal care. Potential participants were contacted by study personnel after their initial visit, and informed consent was obtained prior to participation. Participants were emailed a study-specific survey link to complete the patient-reported outcome surveys from a HIPAA-compliant study-specific REDCap (Vanderbilt University, Nashville, TN) database. Data on patient demographics, PROMIS-PI, PROMIS-PF, and PSQ-18 were collected at baseline and again three months later. Recruitment was conducted as a convenience sample rather than through consecutive enrollment.

As shown in Figure 1, a total of 182 records were reviewed for eligibility. Of these, 162 participants completed all of the baseline surveys, including demographic survey, Patient-Reported Outcome Measures Information System Pain Interference (PROMIS-PI), PROMIS Physical Function (PROMIS-PF), and Patient Satisfaction Questionnaire-18 (PSQ-18). Of those who completed all baseline measures, 89 participants completed all of the three-month follow-up surveys: PROMIS-PI, PROMIS-PF, and PSQ-18.

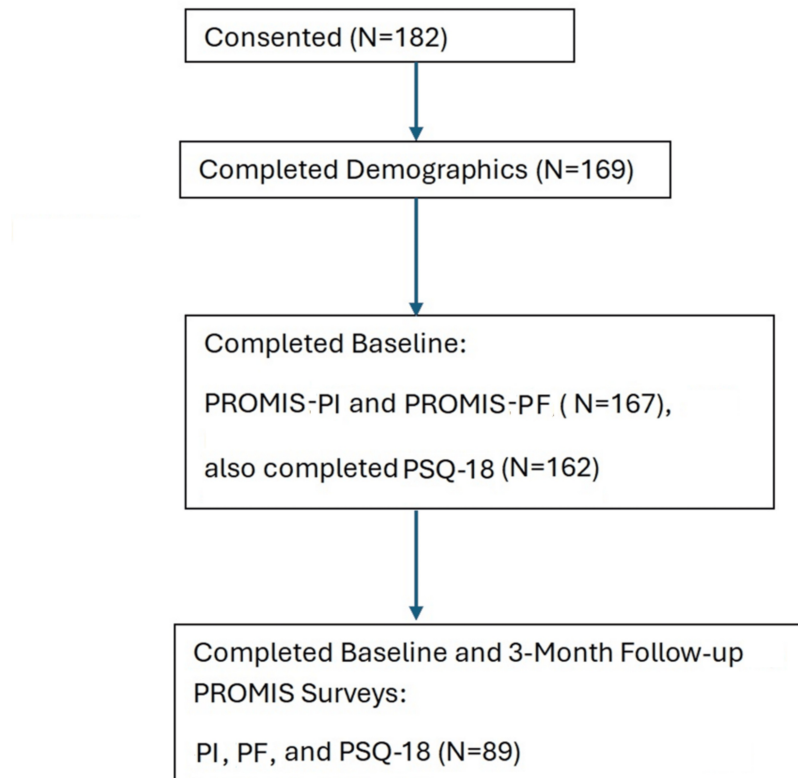


FIGURE 1: Study flow diagram of participant enrollment and follow-up.

PROMIS: Patient-Reported Outcomes Measurement Information System; PI: Pain Interference; PF: Physical Function; PSQ-18: Patient Satisfaction Questionnaire-18.

PROMIS assessments are quantified using the T-score metric [11]. PROMIS scores have a mean of 50 and a standard deviation (SD) of 10 in the reference population of the United States General Population [12,13]. The PROMIS-PI (Short Form 4a) is a four-item survey of questions regarding how pain impacts different aspects of daily living. The score ranges from 4 to 20, and a reduction in score represents an improvement in symptoms. The minimal clinically important difference (MCID) is considered 3.5 to 5 points. The PROMIS-PF (Short Form 4a) is a four-item survey of questions to ascertain how well someone can perform physical activities [14]. The score ranges from 4 to 20, and an increase in score indicates an increase in function. The MCID is considered 3.5 to 5 points. The PSQ-18 is an 18-item survey of questions to assess patient satisfaction with care they received for low back pain, with a score range of 5-90 [15]. An increase in PSQ-18 indicates an increase in patient satisfaction. The PSQ-18 was analyzed as a total score in accordance with standard instrument scoring guidance, with higher scores indicating greater patient satisfaction. Reverse-scored items were handled according to standard PSQ-18 scoring instructions. PROMIS and PSQ-18 instruments were used in accordance with their publicly available terms of use; no separate license or permission fee was required.

During the initial physiatric consultation, patients underwent clinical history-taking, physical examination, and review of available prior imaging and records. Treatment recommendations were individualized based on clinical presentation, patient preferences, and shared decision-making rather than by a predetermined treatment protocol. Patients could receive one or more nonsurgical interventions during follow-up, including physical therapy, acupuncture, medication management, imaging, or spinal injections. Accordingly, treatment subgroups were not mutually exclusive, and participants who received more than one service were included in more than one subgroup analysis. The timing, sequencing, and duration of individual treatments were not standardized as part of the study protocol. The study was not designed to isolate the independent effect of the initial physiatric consultation from the broader interdisciplinary care pathway.

Descriptive statistics were calculated for age, gender, and smoking status. The primary analysis compared the change in score mean from baseline to three-month follow-up using a Wilcoxon signed-rank test for

each survey tool. Statistical significance was defined as p < 0.05. All analyses were performed using GraphPad Prism 10 (GraphPad Software, San Diego, CA). It was then determined if the change in score mean reached the validated minimal clinically significant difference. Secondary analyses evaluated within-group changes in PROMIS scores among participants who received selected interdisciplinary services, including physical therapy, acupuncture, and spinal injections. Analyses were conducted as complete-case analyses using available data from participants who completed both baseline and three-month follow-up assessments. No imputation of missing follow-up data was performed. No formal adjustment for multiple comparisons was applied because subgroup analyses were considered exploratory. We designed and reported this observational study in accordance with the Strengthening the Reporting of Observational Studies in Epidemiology (STROBE) checklist [16].

Results

Of the 89 patients who completed both the PROMIS-PI and PROMIS-PF at baseline and three-month follow-up, 38.2% (n=34) were male, 61.8% (n=55) were female, 70.8% (n=63) were non-smokers, 27.0% (n=24) were previous smokers, and 2.2% (n=2) were current smokers. Ages ranged from 20 to 75 years (mean ± SD: 57.82 ± 13.71).

As shown in Table 2, PROMIS-PI scores decreased significantly from baseline to three-month follow-up, indicating reduced pain interference, while PROMIS-PF scores increased significantly, indicating improved physical function. Both changes exceeded established minimally important clinical thresholds. In contrast, PSQ-18 scores remained high and did not change significantly over the three-month follow-up period. Overall, cohort-level changes in PROMIS-PI and PROMIS-PF exceeded established minimally important clinical difference thresholds; however, this was not observed uniformly across all treatment subgroups.

Survey tool	Baseline	Three-month follow-up	Change in score	p-value
PROMIS-PI	62.63 ± 6.71	56.78 ± 9.11	-5.86 ± 9.69	<0.0001*
PROMIS-PF	40.18 ± 7.62	43.86 ± 8.57	3.68 ± 7.96	<0.0001*
PSQ-18	74.19 ± 9.30	72.73 ± 10.35	-1.46 ± 0.96	0.092

TABLE 2: Comparison of patient-reported outcomes from baseline to three-month follow-up.

PROMIS: Patient-Reported Outcomes Measurement Information System; PI: Pain Interference; PF: Physical Function; PSQ-18: Patient Satisfaction Questionnaire-18.

Values are presented as mean ± SD.

*Statistically significant (p < 0.05) by Wilcoxon signed-rank test.

Among the 89 patients who completed follow-up, 57.3% (n=51) received physical therapy, 43.8% (n=39) had imaging by MRI or CT, 37.1% (n=33) received acupuncture, 22.5% (n=20) underwent spinal injection procedures, 5.6% (n=5) were prescribed opioid therapy, and 3.4% (n=3) were referred to spine surgery within three months.

As shown in Table 3, participants who received physical therapy had statistically significant improvements in both PROMIS-PI and PROMIS-PF from baseline to three-month follow-up. Among participants who received acupuncture, significant within-group improvement in PROMIS-PI was observed, whereas PROMIS-PF did not change significantly. In the spinal injection subgroup, neither PROMIS-PI nor PROMIS-PF changed significantly over the three-month follow-up period. Because radicular status, injection indication, procedural details, and timing were not consistently available, the injection subgroup results should be interpreted descriptively and not as estimates of treatment response.

Treatment subgroup	Outcome measure	Baseline	Three-month follow-up	Change in score	p-value
Physical therapy (n=51)	PROMIS-PI	63.20 ± 6.57	56.35 ± 9.19	-6.85 ± 9.44	<0.0001*
Physical therapy (n=51)	PROMIS-PF	39.49 ± 7.22	43.85 ± 8.68	4.36 ± 8.07	<0.0001*
Acupuncture (n=33)	PROMIS-PI	62.35 ± 6.22	58.68 ± 8.32	-3.68 ± 8.93	0.0079*
Acupuncture (n=33)	PROMIS-PF	40.81 ± 5.61	42.83 ± 7.30	2.02 ± 7.11	0.0909
Spinal injections (n=20)	PROMIS-PI	61.52 ± 8.32	60.22 ± 7.58	-1.31 ± 9.96	0.2731
Spinal injections (n=20)	PROMIS-PF	40.33 ± 7.19	40.52 ± 6.64	0.19 ± 6.51	0.6441

TABLE 3: Patient-reported outcomes by treatment subgroup at baseline and three-month follow-up.

PROMIS: Patient-Reported Outcomes Measurement Information System; PI: Pain Interference; PF: Physical Function.

Values are presented as mean ± SD.

*Statistically significant (p < 0.05) by Wilcoxon signed-rank test.

Discussion

This study observed improvement in patient-reported pain and physical function over a three-month period among participants who completed follow-up within an interdisciplinary spine center pathway. The improvements in PI and PF scores for the overall cohort align with prior work suggesting that initial nonsurgical consultation and interdisciplinary, patient-centered pathways can reduce pain burden and enhance function for patients with low back pain [9-11]. By leveraging a shared-decision framework and a physiatric consultation approach, the spine center may support coordinated nonsurgical care; however, the present single-arm study cannot determine whether the care model itself reduced progression to more invasive interventions or opioid use.

Mean PSQ-18 scores did not change significantly between baseline and three months. Because baseline satisfaction was measured near the start of care and scores were already high, these findings may reflect a ceiling effect and should be interpreted cautiously. Subscale-level analyses were not performed, limiting interpretation of which aspects of care may have influenced satisfaction.

Secondary analyses highlight the variable selection of patient-centered treatment pathways and observed changes within treatment subgroups. Participants who received physical therapy had statistically significant within-group improvements in both PROMIS-PI and PROMIS-PF; however, these changes cannot be attributed specifically to physical therapy because treatment allocation was non-random and co-interventions were not controlled. Participants who received acupuncture had a significant within-group improvement in pain interference, whereas physical function did not change significantly. Although these findings are consistent with prior literature suggesting that acupuncture may be associated with pain relief in low back pain, this study was not designed to isolate the independent effect of acupuncture [17,18].

No statistically significant changes in pain interference or physical function were observed in the spinal injection subgroup over the three-month follow-up period. Interpretation of this finding is limited by the small subgroup sample size and by the absence of detailed stratification by injection type, indication, timing, or symptom phenotype. The study was not designed to determine whether treatment timing, injection type, or clinical presentation modified injection-associated outcomes. Although overall cohort-level changes in PROMIS-PI and PROMIS-PF exceeded established minimally important clinical difference thresholds, subgroup changes did not uniformly meet these thresholds and should therefore be interpreted cautiously. These exploratory findings justify further evaluation of coordinated nonsurgical spine care pathways in adequately powered comparative studies.

Additionally, the minority of participants who required surgical consultation (three of 89 patients, 3.4%) and the limited use of opioid therapy (five of 89 patients, 5.6%) within the three-month window are notable, particularly in the context of a growing emphasis on nonoperative management for low back pain. The low rate of opioid use aligns with broader concerns regarding chronic analgesic and controlled substance use in the chronic pain population and the documented limited efficacy and potential adverse effects associated with such use for back pain [19]. Additionally, many patients (39/89, 43.8%) in this study underwent MRI or CT imaging within three months. While imaging can be a valuable tool in patients presenting with

lumbosacral spinal disorders, such diagnostics should be used judiciously and only when such studies are required to clarify a diagnosis, rule out more concerning clinical presentations, and/or direct further care.

A previous study of 4,855 spine center patients demonstrated that only 5% of patients ultimately required surgery, 28% used opioids, and 68% underwent imaging, primarily MRI [20]. Observed opioid and imaging utilization in our cohort differed from those reported in an external spine center cohort; however, direct comparison is limited by differences in health systems, referral patterns, eligibility criteria, diagnoses, follow-up duration, and outcome definitions. An additional study of 215 patients demonstrated maximized surgical candidacy and shorter patient wait times when care was initially directed through an interdisciplinary spine center pathway [9]. Taken together, these findings suggest that coordinated interdisciplinary spine care pathways may be a useful framework for low back pain management, although comparative studies are needed to determine their effects on resource utilization, outcomes, patient satisfaction, and referral patterns.

One limitation of this study is substantial loss to follow-up. Only 89 of 167 participants with baseline PROMIS data completed the three-month follow-up assessments. If more participants had completed the three-month surveys, the observed results may well have differed. The higher attrition rate likely reflects, in part, the initial launch of this prospective pilot during the COVID-19 pandemic. The lack of integration of digital outcome tools with our electronic medical record also resulted in a significant lost-to-follow-up population. Additionally, in physiatric care settings, patients who improved substantially after the initial encounter may have been less likely to complete subsequent follow-ups, while patients with persistent or worsening symptoms may also have been lost to follow-up. Therefore, attrition may have biased the observed results in either direction. Another limitation of this study is its observational nature and more limited follow-up duration, which prevents an assessment of the longer-term durability of clinical response. Because this was a single-arm observational pilot study without a comparator group, the observed improvements cannot be attributed definitively to the interdisciplinary care model, to any specific treatment received, or to the passage of time alone. Regression to the mean may also have contributed to the observed improvements.

The number of patients ultimately utilizing resources such as MRI, requiring more long-standing opioid analgesic use, and requiring surgical consultation or intervention may increase over the longer term of their care. Finally, outcomes were not further stratified between those patients presenting with low back pain alone and those with a limb pain component. Treatment subgroups were not mutually exclusive, and patients selected to receive physical therapy, acupuncture, or spinal injections may have differed in important ways that were not controlled for, including symptom severity, treatment indication, and co-interventions. In addition, adverse events and safety outcomes were not systematically collected or analyzed over the three-month follow-up period. Despite these limitations, the current findings provide preliminary descriptive data on short-term outcomes observed within this interdisciplinary spine care pathway. The current findings also highlight the need for larger randomized-controlled trials that compare similar interdisciplinary care pathways with more traditional and less structured spinal care. Such studies should implement strategies and technology to maximize patient follow-up, assess longer-term outcomes, and evaluate generalizability across more diverse healthcare settings and populations.

Conclusions

In this prospective pilot cohort, participants who completed follow-up demonstrated improvement in pain interference and physical function over three months. These findings should be interpreted as descriptive and hypothesis-generating. Comparative studies are needed to determine whether the observed changes are attributable to the interdisciplinary care pathway or to specific components of care.

Additional Information

Author Contributions

All authors have reviewed the final version to be published and agreed to be accountable for all aspects of the work.

Acquisition, analysis, or interpretation of data: Christopher Zhang, Jason Lipetz, Ona Bloom, Joy Cambe, Marquis Holder

Drafting of the manuscript: Christopher Zhang, Jason Lipetz, Ona Bloom, Perry Zelinger, Joy Cambe, Marquis Holder

Critical review of the manuscript for important intellectual content: Christopher Zhang, Jason Lipetz, Ona Bloom, Perry Zelinger

Concept and design: Jason Lipetz, Perry Zelinger

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Disclosures

Human subjects: Informed consent for treatment and open access publication was obtained or waived by all participants in this study. Northwell Health issued approval IRB #17-0950. **Animal subjects:** All authors have confirmed that this study did not involve animal subjects or tissue. **Conflicts of interest:** In compliance with the ICMJE uniform disclosure form, all authors declare the following: **Payment/services info:** All authors have declared that no financial support was received from any organization for the submitted work. **Financial relationships:** All authors have declared that they have no financial relationships at present or within the previous three years with any organizations that might have an interest in the submitted work. **Other relationships:** All authors have declared that there are no other relationships or activities that could appear to have influenced the submitted work.

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