Published in final edited form as:

Spine J. 2018 August ; 18(8): 1318–1324. doi:10.1016/j.spinee.2017.11.016.

Does reduction in sciatica symptoms precede improvement in disability and physical health among those treated surgically for intervertebral disc herniation? Analysis of temporal patterns in data from the Spine Patient Outcomes Research Trial

Richard L. Skolasky, ScD^{a,b}, Emily A. Scherer, PhD^c, Stephen T. Wegener, PhD^b, and Tor D. Tosteson, ScD^c

^aDepartment of Orthopaedic Surgery, The Johns Hopkins University School of Medicine, 601 N. Caroline Street, Baltimore, MD 21287, USA

^bDepartment of Physical Medicine and Rehabilitation, The Johns Hopkins University School of Medicine, 601 N. Caroline Street, Baltimore, MD 21287, USA

^cDepartment of Community and Family Medicine, The Geisel School of Medicine at Dartmouth, 1 Rope Ferry Rd, Hanover, NH 03755, USA

Abstract

BACKGROUND CONTEXT—Pain, pain-related disability, and functional limitations are common consequences of intervertebral disc herniation (IDH). We hypothesized that surgical treatment reduces pain, leading to improvement in pain-related disability and, ultimately, better physical health.

PURPOSE—To evaluate pathways for improvements in quality of life during the first year after surgery for IDH by studying temporal relationships between sciatica symptoms, pain-related disability, and physical health.

DESIGN—Secondary analysis of randomized controlled trial using “as treated” dataset.

PATIENT SAMPLE—The sample comprised 803 patients in the Spine Patient Outcomes Research Trial.

OUTCOME MEASURES—We used the Sciatica Bothersome Index, Oswestry Disability Index, and the Medical Outcomes Study Short Form 36 physical component score.

Address all correspondence and reprint requests to: Richard L. Skolasky, Department of Orthopaedic Surgery, The Johns Hopkins University, 601 N. Caroline Street, Suite 5244, Baltimore, MD 21287 (410-502-7975; rskolas1@jhmi.edu).

Publisher's Disclaimer: This is a PDF file of an unedited manuscript that has been accepted for publication. As a service to our customers we are providing this early version of the manuscript. The manuscript will undergo copyediting, typesetting, and review of the resulting proof before it is published in its final citable form. Please note that during the production process errors may be discovered which could affect the content, and all legal disclaimers that apply to the journal pertain.

LEVEL OF EVIDENCE

1

The authors declare no conflicts of interest.

METHODS—We included 803 patients in the Spine Patient Outcomes Research Trial who underwent elective decompressive surgery for IDH between 2000 and 2004. Sciatica, pain-related disability, and physical health were assessed preoperatively and at 3 and 12 months postoperatively using the Sciatica Bothersome Index, Oswestry Disability Index, and Medical Outcomes Study Short Form 36 physical component score, respectively. Temporal associations of improvement in sciatica with pain-related disability and physical health were assessed using cross-lagged path analysis. $P < .05$ was considered significant. No funding was received in support of this study. The authors declare no conflicts of interest.

RESULTS—Preoperatively, mean scores were 16.2 ± 5.2 for sciatica, 54.2 ± 20.7 for pain-related disability, and 29.8 ± 8.4 for physical health. After adjustment for patient age and symptom duration, cross-lagged path analysis showed sciatica reduction at 3 months was correlated with pain-related disability reduction at 3 months ($\rho = .76$, $P < .001$), and pain-related disability at 3 months was predictive of physical health at 12 months ($\beta = -.33$, $P < .001$) and sciatica at 12 months ($\beta = .22$, $P < .001$).

CONCLUSION—Three months after surgery, patients reported reduced sciatica and pain-related disability. Improvements in pain and pain-related disability occurred within 3 months. Early reduction in pain-related disability is important because path analysis indicated that disability at 3 months was predictive of sciatica and physical health at 1 year.

Keywords

disability; function; leg pain; lumbar spine; sciatica; surgery

INTRODUCTION

Intervertebral disc herniation (IDH) is the most common cause of sciatica [1–3], leading to disability and functional limitations. The symptoms of sciatica (leg numbness and weakness and low back and radicular leg pain) can greatly interfere with an individual's ability to participate in normal work and recreational activities [4]. The interference caused by these symptoms may lead to reduced productivity and social participation that, in turn, lead to a diminished quality of life [5].

Degenerative conditions of the lumbar spine are associated with lower limb numbness, weakness, and pain [6], often leading to reduced ambulation [7]. Spine surgeons typically use patient-centered outcome tools that focus on the domains of pain, disability, and physical health. It is not clear how these 3 domains relate to one another. A recent meta-analysis reported no correlation between measures of these 3 domains (pain on visual analog scale, Oswestry Disability Index, or Medical Outcomes Study Short Form-36). A moderate correlation was reported (.69) between change in pain and disability score, demonstrating a potential temporal relationship between reduction in pain intensity and an improvement in physical function [8]. However, this review was limited by a lack of access to patient-level data to more fully explore the association between change in pain and disability score.

The effects of reduction in pain intensity after spine surgery on other health domains have been established. Depressive symptoms in the preoperative and early postoperative periods

are common among patients undergoing spine surgery [9,10]. It has been reported that resolution of pain symptoms after surgery is associated with improved depressive symptoms [11]. However, given their study's limited sample size, the authors were unable to evaluate fully the factors that influence the relationships among pain intensity, disability, and physical function. Although it is clear that reduction in pain has an effect on depressive symptoms, the temporal relationships among pain, disability, and physical health are not well known.

The current study focuses on the experience of patients who underwent surgical intervention to treat IDH. Research has shown the benefits of operative *versus* nonoperative care for those with IDH [3,12,13]. A recent study reported that, although most patients with IDH experience improvement from either operative or nonoperative care, patient-related factors can predict which subgroups will benefit from surgery [14].

The objective of the current study was to investigate the temporal relationship between sciatica (leg numbness and weakness and low back and radicular leg pain) and pain-related disability and physical health during the first 12 months after surgery for IDH. We hypothesized that reductions in pain and pain-related disability would occur within the first 3 months and that improvements in physical health would occur by 12 months after surgery.

PATIENT AND METHODS

Study Population

The Spine Outcomes Research Trial (SPORT) was a multicenter randomized controlled trial of operative *versus* nonoperative care of the 3 most common spine conditions: intervertebral disc herniation, spinal stenosis, and degenerative spondylolisthesis. The design of SPORT has been published elsewhere [15]. We analyzed 803 individuals who were prospectively enrolled in SPORT and who underwent elective surgery for IDH (Table 1). This study was approved by the institutional review boards at all 13 participating sites.

Participant Assessment

Demographic, social, and clinical information was assessed before surgery. Primary outcomes were sciatica, disability, and physical health. These were assessed before surgery and at 3 and 12 months after surgery.

Demographic, social, and clinical information was collected before surgery using participant self-reports on standard assessment instruments. Demographic information included age, sex, and race. Social information included education, marital status, and employment status. Clinical information included presence of comorbid conditions and duration of symptoms.

Sciatica was assessed using the 4-item Sciatica Bothersomeness Index (SBI) [16,17]. The SBI generates a score ranging from 0 to 24 by summing the frequency ratings of 4 symptoms: (1) radicular leg pain; (2) numbness or tingling in the leg, foot, or groin; (3) weakness in the leg or foot (e.g., difficulty lifting foot); and (4) back or leg pain while sitting. Lower numbers indicate less severe symptoms.

Pain-related disability was assessed using the 10-item Oswestry Disability Index (ODI). The ODI is a disease-specific instrument that assesses the impact of spinal disorders on 10 aspects of daily living [18,19]. These aspects address basic functions such as walking and climbing stairs and participation in sexual and social activities. The ODI has been shown to have excellent retest-reliability (Pearson $r > .80$) and validity (moderately high correlations with McGill Pain Questionnaire and visual analog scale for pain) [18,20]. An expert panel convened by the journal *Spine* recommended use of this instrument because it has shown good psychometric properties [20].

Physical health was assessed using the Medical Outcomes Study 36-Item Short Form General Health Survey (SF-36 [21]). The SF-36 consists of questions that can be aggregated into 8 subscales: physical function, mental health, general health perceptions, pain, physical role limitations, emotional role limitations, social functioning, and vitality. Two summary scores can be calculated from the SF-36: physical and mental health component scores. On each scale, higher scores indicate better health. The current study used the SF-36 physical component score (PCS).

Statistical Analysis

Descriptive statistics were used to characterize the cohort with respect to demographic variables and medical comorbidities before surgery. We also characterized the cohort before surgery and at 3 and 12 months after surgery with respect to sciatica, pain-related disability, and physical health. Correlations between measures at all timepoints were also estimated.

To explore the temporal relationship between reduction in sciatica and improvements in disability and physical health, we used a cross-lagged path analysis [22,23]. This path analysis was used to test the directional hypotheses about the 3 measures using the nominal survey times.

We hypothesized that the direction of the association was from sciatica through pain-related disability to physical health. To test this, we fit a series of models, including our hypothesized model, to determine if the best fit was from the model that described relationships in the hypothesized direction [24]. The first model was an autoregressive model (model 1), in which measures were correlated within timepoint, but the only association between timepoints was within measure. The next model added to the autoregressive model paths in the hypothesized direction (model 2), in which paths were included from sciatica at each timepoint to disability at the following timepoint and from disability at each timepoint to physical health at the following timepoint. The next model added to the autoregressive model paths in the direction opposite of that hypothesized (model 3), in which physical health predicted disability at the following timepoint, and disability predicted sciatica at the following timepoint. Finally, a “full model” was fit (model 4), which included paths in the hypothesized direction and the opposite direction. Because the autoregressive model is nested within all other models, the fit of each model is compared with that of the autoregressive model *via* χ^2 difference tests. In addition, models 2 and 3 are nested within model 4 and so were each compared with model 4 using a χ^2 difference test. The Akaike information criterion (AIC), root mean square error of approximation (RMSEA), and comparative fit index (CFI) were compared among the 4 models, regardless

of nesting. The best-fitting model according to these fit statistics is presented as the final model along with standardized path coefficients. Participant age (<65 vs. 65 years) and duration of symptoms (<6 vs. 6 months) were included as covariates in the cross-lagged models to account for deconditioning and physical capacity to recover.

Descriptive statistics and correlation analyses were performed using SAS/STAT, version 9.3, software (SAS Institute Inc., Cary, NC). Structural equation modeling was performed in Mplus, version 7, software (Muthén & Muthén, Los Angeles, CA). The level of significance was set at a P value of < .05.

RESULTS

Sciatica

Before surgery, the mean SBI score was 16.2 ± 5.2 points, indicating moderate pain (Table 2). After surgery, there were reductions in sciatica, with mean SBI scores of 5.0 ± 5.3 points at 3 months ($P < .001$) and 5.2 ± 5.7 points at 12 months ($P < .001$).

Pain-Related Disability

Before surgery, the mean ODI score was 54.2 ± 20.7 points, indicating a severe level of pain-related disability. After surgery, there were reductions in pain-related disability, with mean ODI scores of 17.5 ± 18.9 points at 3 months ($P < .001$) and 15.9 ± 19.1 points at 12 months ($P < .001$).

Physical Health

Before surgery, the mean SF-36 PCS was 29.8 ± 8.4 points. After surgery, there were improvements in physical health, with mean SF-36 PCS of 44.8 ± 10.5 points at 3 months and 46.5 ± 10.7 points at 12 months.

Associations Between Timepoints: Sciatica, Pain-related Disability, and Physical Health

All measures were correlated within timepoint, with the strength of the correlation between measures increasing over time (Figure 1). That is, the strongest correlations between measures within timepoint were observed at 12 months after surgery. Also, the correlation between measures between timepoints is stronger between 3 and 12 months than between baseline and 3 or 12 months.

Temporal Relationships Between Sciatica, Disability, and Physical Health

Improvements in sciatica and pain-related disability occur during the first 3 months after surgery. These early reductions in symptoms are predictive of improvement in physical health at 12 months following surgery. In the cross-lagged path analysis based on the nominal survey time, model 1 (autoregressive model) showed significant associations within measures between all timepoints and within-timepoint correlations between measures. The model fit was good (AIC = 49003.494, RMSEA = .066, and CFI = .962). Model 2 (hypothesized model) had a significantly better fit than the autoregressive model ($P < .0001$) and had better fit statistic values (AIC = 48955.138, RMSEA = .056, and CFI = .975). The path between sciatica at 3 months and disability at 12 months was significant ($\beta = 0.09$, $P =$

0=.03), as was that between disability at 3 months and physical health at 12 months ($\beta = -.27$, $P = .04$). The significant correlations between measures within timepoint remained significant in this model. Model 3 (opposite of hypothesized) also had better fit than the autoregressive model ($P < .0001$). Paths between physical health at 3 months and sciatica at 12 months were significant ($\beta = .13$, $P = .04$), as was the path between physical health at 3 months and disability at 12 months ($\beta = -.14$, $P = .03$). The significant correlations between measures within timepoint remained significant in this model.

Model 4 (full model) had better fit than the autoregressive model ($P < .0001$), the hypothesized model ($P < .0001$), and the opposite of hypothesized model ($P < .0001$) and had good overall fit (AIC = 48931.724, RMSEA = .051, CFI = .982). After adjusting for patient age and symptom duration, sciatica at 3 months was correlated with pain-related disability reduction at 3 months ($\rho = .76$, $P < .001$), and disability at 3 months was predictive of physical health at 12 months ($\beta = -.33$, $P < .001$) and sciatica at 12 months ($\beta = .22$, $P < .001$) (Figure 2).

DISCUSSION

Results of this analysis of the prospectively followed cohort of patients enrolled in SPORT indicate that improvements in sciatica at 3 months were associated with similar reductions in pain-related disability that, in turn, were predictive of improvements in physical health and sciatica 12 months after surgery for IDH. Although the relationships between pain-related disability and physical health were as we hypothesized, the relationship between reduction in pain-related disability and later reduction in sciatica was not in the expected direction based on the path analysis based on nominal survey time. Many patients experience clinically meaningful resolution of pain and pain-related disability at 3 months; however, there may be a subset of patients whose maximum improvement occurs later. Our observed relationship between early reduction in pain-related disability and later reduction in sciatica may reflect this subset of patients and an overlap of the ODI and SBI measurement tools.

Patient-reported measures of pain, pain-related disability, and physical health are sensitive to change after spine surgery [8]. Published studies have shown moderate bivariate correlations between measures of pain, pain-related disability, and physical health among spine patients [3,8,25]. In a systematic review, Devine et al. [8] reported moderate correlation between pain intensity and pain-related disability (as assessed by the ODI) and physical health (as assessed by the SF-36 or SF-12, version 2). Studies of long-term outcomes after lumbar discectomy to treat IDH have shown improvements in pain and pain-related disability [1–3,12,26,27]. Weber et al., in a randomized prospective study of patients with sciatica, reported improvements in subjective well-being in operative patients at 1 year relative to nonoperative patients; however, these differences diminished by 10 years after surgery [1,2,26,27]. The Maine Lumbar Spine Study, a multicenter randomized prospective trial, showed significant improvements in pain, pain-related disability, and physical health among operative patients treated with discectomy. Previous work in SPORT showed that maximum recovery of physical function and reduction in pain-related disability were reached by 6 months after surgery [3,12]. A study of 260 patients undergoing surgery for IDH or spinal stenosis showed that patients who experienced a clinically meaningful reduction in pain by 3

months after surgery were more likely to experience a reduction in pain-related disability and improvement in physical function at 12 months after surgery [28]. The current study complements this literature in its use of statistical modeling to show the temporal relationship between reductions in sciatica and pain-related disability and subsequent improvement in physical health.

Our study had limitations. First, we relied on self-reports of pain-related disability and physical health, which may have introduced additional bias and measurement error. However, the ODI and SF-36 have been shown to be sensitive and specific in their assessments of disability and physical health [18,21,29–31]. Second, the relationships between change in sciatica after surgery and in disability and physical health may be confounded by variables of which we are unaware.

We attempted to include in our model pertinent characteristics to account for physical capacity to recovery and deconditioning associated with disease; however, there may be unobservable characteristics that influence this relationship. Third, the cross-lagged path analysis tested our directional hypothesis of the associations among sciatica, disability, and physical health; however, although supported, causation cannot be confirmed in the absence of true experimental control. That our relationships were temporal in nature (i.e., reduction in disability at 3 months was predictive of improvements in physical health at 12 months) is supported by a causal model.

CONCLUSION

Our study has potentially important clinical implications. We have shown that, after surgery for IDH, reduction in sciatica at 3 months is associated with similar improvements in pain-related disability. We have also shown that reduction in pain-related disability at 3 months is predictive of subsequent improvements in physical health at 12 months. There is a growing body of evidence that pain reduction and management after surgery is related to reduced pain-related disability and improved physical health [25]. Chapman et al. [25] highlighted the importance of using patient-reported outcome measures that are aligned with the clinical priorities of the patient and that focus on pain, function, and quality of life. The utility of these measures has been shown in other cohorts. Our data suggest that this same recommendation is appropriate for assessing outcomes after spine surgery. Clinicians and patients may benefit from taking a multimodal approach to outcome assessment by consistently monitoring and, if necessary, treating pain and pain-related disability after surgery to maximize improvements in physical health.

Acknowledgments

COI/Funding: This project was supported by The Agency for Healthcare Research and Quality (R01-HS017990 and R03-HS016106); The National Institute of Arthritis and Musculoskeletal and Skin Diseases (U01-AR45444); The Office of Research on Women's Health, the National Institutes of Health; the National Institute of Occupational Safety and Health; and the Centers for Disease Control and Prevention. The Multidisciplinary Clinical Research Center in Musculoskeletal Diseases is funded by NIAMS (P60-AR048094 and P60-AR062799).

Abbreviations

AIC	Akaike information criterion
CFI	comparative fit index
IDH	intervertebral disc herniation
ODI	Oswestry Disability Index
PCS	physical component score
RMSEA	root mean square error of approximation
SBI	Sciatica Bothersomeness Index
SF-36	Short Form General Health Survey
SPORT	Spine Outcomes Research Trial

References

1. Atlas SJ, Deyo RA, Keller RB, et al. The Maine Lumbar Spine Study, Part II. 1-year outcomes of surgical and nonsurgical management of sciatica. *Spine (Phila Pa 1976)*. 1996; 21:1777–86. [PubMed: 8855462]
2. Weber H. Lumbar disc herniation. A controlled, prospective study with ten years of observation. *Spine (Phila Pa 1976)*. 1983; 8:131–40. [PubMed: 6857385]
3. Weinstein JN, Lurie JD, Tosteson TD, et al. Surgical versus nonoperative treatment for lumbar disc herniation: four-year results for the Spine Patient Outcomes Research Trial (SPORT). *Spine (Phila Pa 1976)*. 2008; 33:2789–800. [PubMed: 19018250]
4. Hicks GE, Gaines JM, Shardell M, et al. Associations of back and leg pain with health status and functional capacity of older adults: findings from the retirement community back pain study. *Arthritis Rheum*. 2008; 59:1306–13. [PubMed: 18759261]
5. Boakye M, Moore R, Kong M, et al. Health-related quality-of-life status in Veterans with spinal disorders. *Qual Life Res*. 2013; 22:45–52. [PubMed: 22311250]
6. Shen M, Razi A, Lurie JD, et al. Retrolisthesis and lumbar disc herniation: a preoperative assessment of patient function. *Spine J*. 2007; 7:406–13. [PubMed: 17630138]
7. Lin SI, Lin RM. Disability and walking capacity in patients with lumbar spinal stenosis: association with sensorimotor function, balance, and functional performance. *J Orthop Sports Phys Ther*. 2005; 35:220–6. [PubMed: 15901123]
8. DeVine J, Norvell DC, Ecker E, et al. Evaluating the correlation and responsiveness of patient-reported pain with function and quality-of-life outcomes after spine surgery. *Spine (Phila Pa 1976)*. 2011; 36:S69–74. [PubMed: 21897347]
9. Kerr D, Zhao W, Lurie JD. What Are Long-term Predictors of Outcomes for Lumbar Disc Herniation? A Randomized and Observational Study. *Clin Orthop Relat Res*. 2015; 473:1920–30. [PubMed: 25057116]
10. Sinikallio S, Aalto T, Airaksinen O, et al. Depressive burden in the preoperative and early recovery phase predicts poorer surgery outcome among lumbar spinal stenosis patients: a one-year prospective follow-up study. *Spine (Phila Pa 1976)*. 2009; 34:2573–8. [PubMed: 19927107]
11. Skolasky RL, Riley LH III, Maggard AM, et al. The relationship between pain and depressive symptoms after lumbar spine surgery. *Pain*. 2012; 153:2092–6. [PubMed: 22867701]
12. Lurie JD, Tosteson TD, Tosteson ANA, et al. Surgical versus nonoperative treatment for lumbar disc herniation: eight-year results for the spine patient outcomes research trial. *Spine (Phila Pa 1976)*. 2014; 39:3–16. [PubMed: 24153171]

13. Weinstein JN, Tosteson TD, Lurie JD, et al. Surgical vs nonoperative treatment for lumbar disk herniation: the Spine Patient Outcomes Research Trial (SPORT): a randomized trial. *JAMA*. 2006; 296:2441–50. [PubMed: 17119140]
14. Koerner JD, Glaser J, Radcliff K. Which variables are associated with patient-reported outcomes after discectomy? Review of SPORT disc herniation studies. *Clin Orthop Relat Res*. 2015; 473:2000–6. [PubMed: 24818737]
15. Birkmeyer NJ, Weinstein JN, Tosteson AN, et al. Design of the Spine Patient outcomes Research Trial (SPORT). *Spine (Phila Pa 1976)*. 2002; 27:1361–72. [PubMed: 12065987]
16. Atlas SJ, Deyo RA, Patrick DL, et al. The Quebec Task Force classification for spinal disorders and the severity, treatment, and outcomes of sciatica and lumbar spinal stenosis. *Spine (Phila Pa 1976)*. 1996; 21:2885–92. [PubMed: 9112713]
17. Patrick DL, Deyo RA, Atlas SJ, et al. Assessing health-related quality of life in patients with sciatica. *Spine (Phila Pa 1976)*. 1995; 20:1899–908. disc 909. [PubMed: 8560339]
18. Fairbank J. Use of Oswestry Disability Index (ODI) [letter]. *Spine (Phila Pa 1976)*. 1995; 20:1535–6. [PubMed: 8623078]
19. Fairbank JCT, Davies JB, Couper J, et al. The Oswestry low back pain disability questionnaire. *Physiotherapy*. 1980; 66:271–3. [PubMed: 6450426]
20. Roland M, Fairbank J. The Roland-Morris Disability Questionnaire and the Oswestry Disability Questionnaire. *Spine (Phila Pa 1976)*. 2000; 25:3115–24. [PubMed: 11124727]
21. McHorney CA, Ware JE Jr, Raczek AE. The MOS 36-Item Short-Form Health Survey (SF-36): II. Psychometric and clinical tests of validity in measuring physical and mental health constructs. *Med Care*. 1993; 31:247–63. [PubMed: 8450681]
22. Finkel SE. Causal analysis with panel data. In: Lewis-Beck MS, editor *Series: Quantitative Applications in the Social Sciences*. Vol. 105. Thousand Oaks, CA: Sage Publications, Inc; 1995.
23. Schleueter E, Davidov E, Schmidt P. Applying autoregressive cross-lagged and latent growth curve models to a three-wave panel study. In: van Montfort K, Oud J, Satorra A, editors *Longitudinal Models in the Behavioral and Related Sciences*. Mahwah, NJ: Lawrence Erlbaum Associates, Publishers; 2007. 315–36.
24. Little TD. *Longitudinal Structural Equation Modeling*. New York: The Guilford Press; 2013.
25. Chapman JR, Norvell DC, Hermsmeyer JT, et al. Evaluating common outcomes for measuring treatment success for chronic low back pain. *Spine (Phila Pa 1976)*. 2011; 36:S54–68. [PubMed: 21952190]
26. Atlas SJ, Keller RB, Chang Y, et al. Surgical and nonsurgical management of sciatica secondary to a lumbar disc herniation: five-year outcomes from the Maine Lumbar Spine Study. *Spine (Phila Pa 1976)*. 2001; 26:1179–87. [PubMed: 11413434]
27. Atlas SJ, Keller RB, Wu YA, et al. Long-term outcomes of surgical and nonsurgical management of sciatica secondary to a lumbar disc herniation: 10 year results from the maine lumbar spine study. *Spine (Phila Pa 1976)*. 2005; 30:927–35. [PubMed: 15834338]
28. Skolasky RL, Wegener ST, Maggard AM, et al. The impact of reduction of pain after lumbar spine surgery: the relationship between changes in pain and physical function and disability. *Spine (Phila Pa 1976)*. 2014; 39:1426–32. [PubMed: 24859574]
29. Deyo RA, Battie M, Beurskens AJHM, et al. Outcome measures for low back pain research. A proposal for standardized use. *Spine (Phila Pa 1976)*. 1998; 23:2003–13. [PubMed: 9779535]
30. Parker SL, Adogwa O, Paul AR, et al. Utility of minimum clinically important difference in assessing pain, disability, and health state after transforaminal lumbar interbody fusion for degenerative lumbar spondylolisthesis. *J Neurosurg Spine*. 2011; 14:598–604. [PubMed: 21332281]
31. Ware J Jr, Kosinski M, Keller SD. A 12-Item Short-Form Health Survey: construction of scales and preliminary tests of reliability and validity. *Med Care*. 1996; 34:220–33. [PubMed: 8628042]

Figure 1.

Correlation matrix between sciatica, pain-related disability, and physical health over 1 year after spine surgery. Stronger correlation is represented by more elliptical shape, and weaker correlation is represented by more circular shape. 1Y indicates 1-year assessment; 3M, 3-month assessment; BA, baseline assessment; ODI, Oswestry Disability Index; PCS, Short Form-36 physical health component; SBI, Sciatica Bothersomeness Index.

Figure 2.

Final cross-lagged path model of relationships between sciatica, pain-related disability, and physical health before and after surgery for intervertebral disc herniation. Solid lines represent significant path coefficients. Dotted lines represent nonsignificant path coefficients. 1Y indicates 1-year assessment; 3M, 3-month assessment; BA, baseline assessment; ODI, Oswestry Disability Index; PCS, Short Form-36 physical health component; SBI, Sciatica Bothersomeness Index.

TABLE 1

Demographic, Social, and Clinical Characteristics of 803 Patients With Intervertebral Disc Herniation Enrolled in the Spine Patient Outcomes Research Trial

Characteristic	Study Group N (% [†])
Age (yr.)	41 (11) [*]
Female sex	327 (43)
Race	
Asian	7 (1)
Black	39 (5)
Other/Mixed/Unknown	50 (6)
White	707 (88)
Attended college	544 (73)
Married	530 (71)
Employment status	
Full- or part-time	456 (60)
Disabled	117 (15)
Retired	21 (3)
Other	165 (22)
Comorbid conditions	
Bowel or intestinal disorder	49 (7)
Depression	88 (12)
Diabetes	28 (4)
Heart disorder	34 (5)
Hypertension	95 (13)
Joint disorder	119 (16)
Osteoporosis	9 (1)
Stomach disorder	82 (11)
Other disorder	159 (21)
Symptom duration	
6 months	587 (73)
>6 months	172 (23)

^{*} Age expressed as mean $\pm$ standard deviation.

[†] Percent is of non-missing records.

TABLE 2

Sciatica, Pain-Related Disability, and Physical Health Before and After Surgery for Intervertebral Disc Herniation in 803 Patients Enrolled in the Spine Patient Outcomes Research Trial

Timepoint	Sciatica Score [*] (Mean ± SD)	Pain-Related Disability Score [†] (Mean ± SD)	Physical Health Score [‡] (Mean ± SD)
Preoperative	16.2 ± 5.2	54.2 ± 20.7	29.8 ± 8.4
Postoperative			
3 months	5.0 ± 5.3	17.5 ± 18.9	44.8 ± 10.5
12 months	5.2 ± 5.7	15.9 ± 19.1	46.5 ± 10.7

SD indicates standard deviation.

^{*} As measured by the Sciatica Bothersomeness Index, which ranges from 0 to 24, with lower numbers indicated less severe symptoms.

[†] As measured by the Oswestry Disability Index, which ranges from 0 to 100, with higher numbers indicating greater pain-related disability.

[‡] As measured by the SF-36 Health Survey physical component, which ranges from 0 to 100, with higher numbers indicating better physical health.