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HEALTH SERVICES RESEARCH

Determinants of Patient Satisfaction 2 Years After Spinal Deformity Surgery

A Latent Class Analysis

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Study Design. Retrospective review of prospective multicenter database.

Objective. To investigate the determinants of patient satisfaction with respect to changes in functional limitations 2 years after spinal deformity surgery.

Summary of Background Data. For operatively treated adult spine deformity (ASD), patient satisfaction has become an important component of evaluating quality of care.

Methods. A total of 430 operative patients with ASD with 2-year follow-up were analyzed. Patient satisfaction was assessed using the Scoliosis Research Society 22-item. Latent class analysis was performed to assign individuals to classes based on the changes in pre- and 2-year postoperative functions, assessed using the Oswestry Disability Index (ODI). An ordered logistic regression was conducted to assess the association of class membership and satisfaction.

Results. Latent class analysis identified four classes. The worsened-condition class (WC: 1.4%) consisted of patients who were likely to experience worsened function, particularly in lifting and pain intensity. The remained-same class (RS: 13.0%) included patients who remained the same, because the majority reported approximately no change in walking, standing, and sitting. The mild-improved class (mild-I: 40.2%) included patients with mildly enhanced conditions, specifically, in standing, social life, and employment. The most-improved class (most-I: 45.3%) included patients with great improvement after surgery mainly in standing, followed by social life and employment. The odds of being satisfied were significantly increased by 3.91- ($P < 0.001$) and 16.99-fold ($P < 0.001$), comparing patients in mild-I and most-I to the RS/WC class, respectively, after controlling for confounders.

Conclusion. Improvement in standing, social life, and employment are the most important determinants of patient satisfaction postsurgery. Reduced pain intensity and enhanced walking ability also help to elevate patient satisfaction. However, lifting, personal care, sitting, sleeping, and travelling may be of less importance. Examining the heterogeneity of patient-reported outcome in patients with ASD allows the identification of classes with different patient characteristics and satisfaction, and thus, help to guide tailored provision of care.

Key words: adult spinal deformity, functional limitation, health-related quality of life, improvement, latent class, Oswestry Disability Index, postoperative function, quality, satisfaction, tailored care.

Level of Evidence: 4

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Patient-centered care as measured by patient satisfaction has become an important component of evaluating quality of care.[1] Poor patient satisfaction will pose a potential financial risk for hospitals.[2,3] For patients receiving operative management for adult spine deformity (ASD), the complexity of decision making[4,5] has emphasized the need to adopt patient-centered approaches. Patients with ASD typically have pain, functional limitations in activities of daily living, and social function,[6–9] which are the primary

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reasons that patients with ASD seek treatment.[10,11] Studies have found that patients with ASD were more likely to have depression, financial difficulties, and family problems compared to healthy or asymptomatic controls.[12,13] Hence, taking into account the impact of ASD upon physical and mental health will help achieve patients' treatment goal and therefore improve satisfaction. The determinants of patient satisfaction with respect to changes in functional limitations due to surgery have, however, not been addressed in the literature.

The Oswestry Disability Index (ODI), which is a spine disease–specific health-related quality of life (HRQOL) measure, has been widely used to evaluate functional limitations.[14] Changes in ODI scores postsurgery are monitored to evaluate the appropriateness of treatment strategies. The issue with the overall score is, however, that it may mask important ODI heterogeneity among patients or the existence of classes of patients who self-report different types of limitations and long-term outcomes, despite having the same overall ODI scores. For instance, a group may be characterized by social-related limitations, whereas another with the same overall ODI score may be characterized by pain-related limitations. Examining ODI at the individual level will lead to a better understanding of self-reported limitations and heterogeneity in patients with ASD. Moreover, examining the specific limitations in patients and the implications for long-term outcomes is a fundamental step toward improving patient satisfaction.

The purpose of the present study was to identify the underlying classes of patients that existed based on changes in specific ODI domains measured preoperatively and 2 years postoperatively. If heterogeneity exists as described above, then it may shed light on the determinants of patient satisfaction with respect to changes in functional limitations due to operative care.

METHODS

Patient Population

The present study is a retrospective analysis of a multicenter database, which consists of 11 sites across the United States. Inclusion criteria of the database were age greater than or equal to 18 years and presence of spinal deformity, which is defined by at least one of the following conditions: scoliosis with a Cobb angle of 20° or more, sagittal vertical axis length of 5 cm or more, pelvic tilt angle of 25° or more, and/or thoracic kyphosis angle of 60° or more. Patients who had active infection, malignancy, or whose spinal deformity was due to neuromuscular conditions were excluded. Patients' demographics, medical history, and surgical characteristics were collected. Standing posteroanterior and lateral spine radiographs were analyzed at baseline and 2 year after surgery using validated software[15,16] (Spineview; Laboratory of Biomechanics, ParisTech, Paris, France) to measure the pelvic incidence minus the lumbar lordosis, sagittal vertical axis, T1 pelvic angle, pelvic tilt, and pelvic incidence. The study protocol was approved by the institutional review board at each site. Informed consent was obtained from all patients.

According to the initial management approach, patients were divided into operative and nonoperative groups at the time of enrollment. The present study included only operatively treated patients with a minimum of 2-year follow-up after spinal surgery.

Health-Related Quality of Life Measure

Standardized HRQOL measures included the ODI and Scoliosis Research Society-22r questionnaire (SRS-22r). Although the SRS-22r was originally developed for patients with scoliosis,[17] it has been found to be psychometrically valid in the ASD population as well.[18] The SRS Satisfaction domain was used as the outcome measure for patient satisfaction in the present study, which is calculated from two items: items 21 and 22.[19] A higher score indicates better performance. The SRS patient satisfaction measured at the 2 years after spinal surgery was included for analysis.

The ODI examines perceived level of disability in 10 activities of daily living, including pain intensity, personal care, lifting, walking, sitting, standing, sleeping, sex life, social life, and travelling, to assign a score of the level of function. Worsening of the ODI scores was defined as a positive net change in score at 2-year follow-up.

Statistical Analysis

Latent class analysis (LCA) was employed for identification of homogeneous clusters (model-based groupings) in the sample based on measured characteristics, which in our case, were changes in the ODI at baseline *versus* 2 years after surgery.[20] LCA allowed us to distinguish the heterogeneity among patients with ASD with respect to function changes and to subsequently identify the determinants of patients satisfaction associated with the heterogeneous classes of patients. Different numbers of classes were run sequentially and compared using statistical fit indices of the Akaike information criteria (AIC), the Bayesian information criterion (BIC), the adjusted Bayesian information criteria (aBIC), and the descriptive fit index of entropy.[21] The best-fitting model was selected qualitatively and quantitatively (the smallest AIC and aBIC, significant Lo-Medell-Rubin test [$P < 0.05$], and the highest entropy). Patients were then assigned to classes based on their most likely class membership. Descriptive statistics were summarized for the study cohort, stratifying by class membership. Differences in demographics, radiographic parameters, and surgical characteristics across class memberships were compared using Fisher exact chi-square test for categorical variables and one-way analysis of variance for continuous variables. An ordered logistic regression model was then fitted with the ODI class membership as the independent variable and patient satisfaction as the dependent variable to examine the association between ODI heterogeneity and satisfaction while adjusting for demographics, changes in radiographic parameters, and surgical characteristics. The LCA was conducted in Mplus version 7.0 (Muthen & Muthen

TABLE 1. Demographic Characteristics of the Study Population at Baseline and 2-Year Follow-up

	Baseline	2-Year Follow-up	
	Median (IQR)	Median (IQR)	*P*
Pain intensity	3 (1, 4)	2 (0, 3)	<0.001
Personal care	1 (0, 2)	0 (0, 1)	<0.001
Lifting	3 (2, 4)	3 (1, 4)	<0.001
Walking	3 (1, 3)	1 (0, 3)	<0.001
Sitting	2 (1, 3)	1 (0, 2)	<0.001
Standing	3 (2, 4)	2 (0, 3)	<0.001
Sleeping	1 (0, 3)	0 (0, 2)	<0.001
Social life	2 (1, 3)	1 (0, 3)	<0.001
Travelling	1 (1, 3)	1 (0, 2)	<0.001
Employment	2 (1, 3)	1 (0, 2)	<0.001

IQR indicates interquartile range.

1998, 2012). The descriptive statistics and regression analysis were performed in Stata 14.0 SE (StataCorp, College Station, TX).

RESULTS

The present study included 430 patients out of a total of 694 operatively treated patients with ASD, who had complete measures of HRQOL both at baseline and 2-year follow-up. The majority of the patients had enhanced performance in their activities of daily living at 2 years after the spinal surgery compared to the baseline (Table 1). The mean age of the study sample was 59 ± 14 years and 78.8% were women. Approximately two thirds of the patients were either overweight or obese and 46% had prior spinal surgeries. On average, the study participants had 4.4 years of spine problems. The majority had more than two comorbidities and moderate to severe leg and back pain. Also, 47% had levels of fusion more than 10.

LCA that compared the baseline and 2-year postoperative ODI identified four classes of distinct functional status according to the model fit criteria (Table 2). Although the four-class model had slightly higher AIC and aBIC compared to the three-class model, the entropy of the four-class model was the highest, indicating the best separate of the latent classes.[22] Along with the interpretation of each class, the four-class model was chosen.

- The worsened-condition class (1.4%) consisted of patients who were likely to experience worsened functions after surgery, particularly in lifting and pain intensity.
- The remained-same class (13.0%) consisted of patients likely to remain the same after the surgery; the majority reported approximately no change in their walking, standing, and sitting.
- The mild-improved class (40.2%) was composed of patients who had mildly enhanced conditions after surgery, specifically, in standing, social life, and employment.
- The most-improved class included (45.3%) patients who have experienced great improvement due to surgery. Largest improvement was seen in standing, followed by social life, employment, and walking.

The demographics, radiographic parameters, and surgical characteristics of the study population were then examined across class membership. Patients who had improvements were more likely to be older, had more comorbidities, and greater severity of leg pain compared to patients who experienced worsened functions or remained the same after surgery. No statistically significant difference was found in sex, body mass index, prior surgery, years of spine problems, levels fused, or back pain severity across class membership. The radiographic parameters have also shown that patients with improvement tended to have greater severity of spinal deformity at baseline than patients with worsened functions or remained the same after surgery (Table 3).

The association of class membership with respect to functional changes and patient satisfaction was assessed. The patients in the worsened-condition class had the lowest probability of being satisfied, whereas the patients in the

TABLE 2. Latent Class Model Accuracy and Fit Parameters

Model Classes	AIC	BIC	aBIC	Entropy
2	11204.970	11538.201	11277.981	0.813
3	11074.729	11578.639	11185.135	0.813
4	11107.472	11782.060	11255.274	0.852

aBIC indicates adjusted Bayesian information criteria; AIC, Akaike's information criteria; BIC, Bayesian information criterion.

TABLE 3. Baseline Characteristics of the Study Population by Class Membership

Characteristics	Overall N = 430	The Worsened-Condition Class N = 6	The Remained-Same Class N = 56	The Mild-Improved Class N = 173	The Most-Improved Class N = 195	*P*
Demographics						
Age (yr), Mean (SD)	59 (14.2)	49 (18.3)	54 (14.4)	58 (15.6)	61 (12.4)	0.004
Sex, N (%)						
Male	91 (21.2)	1 (16.7)	16 (28.6)	42 (24.3)	32 (16.4)	
Female	339 (78.8)	5 (83.3)	40 (71.4)	131 (75.7)	163 (83.6)	0.113
BMI, N (%)						
Underweight/normal	149 (34.6)	1 (16.7)	18 (32.1)	66 (38.1)	64 (32.8)	
Overweight	162 (37.7)	3 (50.0)	22 (39.3)	59 (34.1)	78 (40.0)	
Obese	119 (27.7)	2 (33.3)	16 (28.6)	48 (27.8)	53 (27.2)	0.842
Prior surgery, N (%)	198 (46.1)	3 (50.0)	26 (46.4)	83 (48.0)	86 (44.1)	0.887
Years of spine problems, mean (SD)	4.4 (0.9)	4 (1.3)	4.3 (0.9)	4.5 (0.9)	4.4 (0.9)	0.396
Charlson comorbidity, N (%)						
0	140 (32.6)	3 (50.0)	22 (39.3)	66 (38.2)	49 (25.1)	
1	98 (22.8)	2 (33.3)	8 (14.3)	35 (20.2)	53 (27.2)	
≥2	192 (44.6)	1 (16.7)	26 (46.4)	72 (41.6)	93 (47.7)	0.035
Leg pain, median (IQR)	5 (1, 8)	3.5 (0, 7)	4 (0.5, 8)	5 (1, 7)	6 (2, 8)	0.019
Back pain, median (IQR)	8 (6, 9)	7.5 (4, 9)	8 (6, 9)	8 (6, 9)	8 (6, 9)	0.865
Surgical parameters						
>10 Levels fused, N (%)	202 (47.3)	2 (33.3)	30 (53.6)	81 (47.1)	89 (46.1)	0.700
UIV-T10, N (%)	206 (48.2)	4 (66.7)	21 (37.5)	83 (48.3)	98 (50.8)	0.297
LIV-sacrum, N (%)	333 (78.0)	4 (66.7)	37 (66.1)	131 (76.2)	161 (83.4)	0.025
Radiographic parameters						
S1PT, median (IQR)	23.4 (16.3, 30.6)	18.3 (14.9, 27.5)	20.8 (14.1, 30.9)	22.6 (15.2, 29.4)	24.5 (17.9, 31.1)	0.270
S1PI, median (IQR)	53.8 (45.4, 61.9)	41.9 (39.4, 51.1)	54.4 (46.2, 65.2)	53.8 (45.9, 62.2)	54.4 (44.9, 61.6)	<0.001
PI-LL, median (IQR)	14.5 (0.2, 29.6)	8.1 (−12.9, 16.0)	10.7 (−5.1, 29.5)	13.0 (0.0, 26.4)	16.9 (2.6, 33.3)	0.007
SVA, median (IQR)	53.1 (10.2, 107.5)	31.8 (−4.4, 70.4)	25.8 (−8.5, 89.7)	47.7 (10.6, 106.2)	68.0 (17.3, 113.8)	0.099
T1PA, median (IQR)	21.6 (12.6, 31.1)	15.2 (8.2, 26.9)	19.6 (8.4, 26.7)	20.5 (12.5, 30.6)	22.7 (14.7, 32.5)	0.137
2-Year change in radiographic parameters from baseline						
S1PT, median (IQR)	−2.0 (−7.1, 2.4)	0.8 (−1.5, 1.7)	0.1 (−5.5, 6.3)	−2.0 (−7.0, 2.4)	−2.3 (−8.0, 1.6)	0.371
S1PI, median (IQR)	−0.0 (−1.4, 1.5)	−0.5 (−1.1, 2.6)	0.4 (−1.3, 1.9)	−0.2 (−1.5, 1.3)	0.0 (−1.4, 1.7)	0.862
PI-LL, median (IQR)	−12.3 (−25.4, 0.4)	−11.7 (−22.9, −9.7)	−5.1 (−18.5, 3.1)	−11.6 (−25.4, −2.1)	−15.2 (−26.4, 1.1)	0.376
SVA, median (IQR)	−26.4 (−73.6, 4.3)	−13.7 (−14.9, −9.6)	−12.9 (−33.8, 19.4)	−25.6 (−71.5, 6.4)	−32.3 (−80.6, −0.3)	0.021
T1PA, median (IQR)	−4.4 (−11.6, 1.6)	0.5 (−3.8, 0.6)	−1.7 (−7.7, 4.6)	−4.5 (−10.5, 1.5)	−5.7 (−13.6, 1.1)	0.037

BMI indicates body mass index; IQR, interquartile range; LIV, lowest instrumented vertebra; PI-LL, pelvic incidence minus the lumbar lordosis; PT, pelvic tilt; SVA sagittal vertical axis; T1PA, T1 pelvic angle; UIV, upper instrumented vertebra.

most-improved class had the highest probability of achieving the greatest level of satisfaction (on a scale of 1–5, the higher score indicating greater level of satisfaction; Figure 1). Figure 1 is consistent with the results from an ordered regression, which was used to quantify the association between ODI class membership (the worsened-condition and remained-same classes were combined due to sample size) and patient satisfaction, while adjusting for demographics, changes in radiographic parameters, and surgical parameters. The odds of being satisfied were significantly increased by 3.91 (95% confidence interval: 2.09–7.33, $P < 0.001$) and 16.99 (95% confidence interval: 8.58–33.64, $P < 0.001$) times, comparing patients in mild-improved class and the most-improved class to the worsened-condition/remained-same class, respectively (Table 4). Also, female patients were more likely to be satisfied (odds ratio [OR] = 1.77, $P = 0.029$), whereas those with more severe leg (OR = 0.9, $P = 0.002$) and back pain (OR = 0.91, $P = 0.044$) before surgery were less likely to be satisfied.

DISCUSSION

We identified four distinct classes of patients with ASD based on their changes in ODI-specific domains comparing

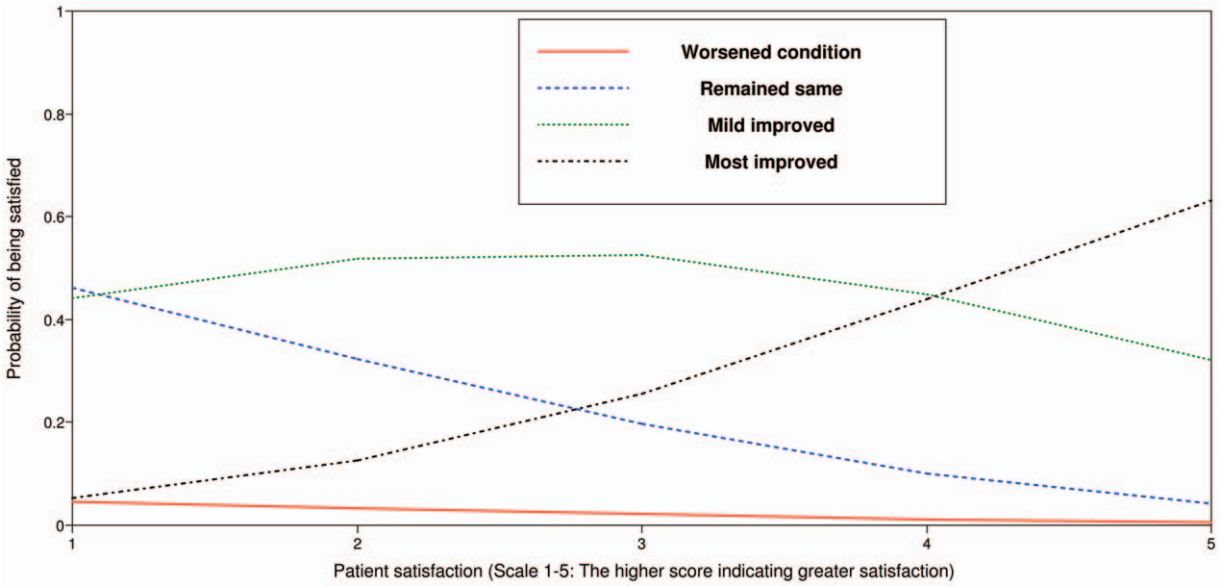

Figure 1. The probability of being satisfied for each class membership with respect to the changes in functional limitations at 2 years after surgery.

baseline and 2-year follow-up. Approximately 85% of the patients experienced improvement in their activities of daily living after surgery. The distinct classes of changes in functional limitations due to surgery support the hypothesis that using ODI overall scores is not sufficient. Our results revealed that improvement in standing, social life, and employment may enhance patient satisfaction most after surgery. To our knowledge, this is the first study examining the determinants of patient satisfaction with respect to function status in patients with ASD receiving operative treatment.

Our data have shown that improvements in social life were significantly associated with patient satisfaction after surgery, which is consistent with the literature. Laxton and Perrin[23] conducted a retrospective study that consisted of 19 degenerative spine disease patients and reported that patients who had more social support and less life stress tended to report greater satisfaction with regard to medical outcome and overall HRQOL after spinal decompression surgery than those with less social support and more life stress. Sorensen *et al*[24] prospectively examined 57 patients at 6 months after spine surgery and demonstrated that patients with severe psychological and social strain were more likely to have poor postoperative outcomes. In fact, studies have shown that social life may predict postoperative clinical outcomes better than clinical or radiographic parameters in the spine.[12,25] It was reported in a prospective study that the social and psychological factors outweighed preoperative physical function or the severity of operative findings in postoperative outcomes.[25] Hence, if improvement in social life is targeted, such as support from family, friends, and caregivers, during consultation with the patient before or after surgery, it may help satisfy the treatment goals of the patient.

Employment was also found to be related to patient satisfaction in the present study. According to a review, common barriers to employment for those patients were issues with transportation, physical limitations, lack of work experience, discrimination by employers, and loss of benefits.[26] Schade *et al*,[12] however, found that return to work (RTW) was not influenced by any clinical findings or morphological alterations, but solely by psychological factors. Moreover, it was reported that, for the first year after spinal fracture, unemployment is common, and even for those who RTW, they usually modify the amount and type of work they do.[27] Moreover, patients who were not employed at the time of surgery were more likely to experience poor clinical outcomes compared to those who were employed.[24,28] Given the substantial financial burden those patients and their families have,[29] it is not surprising that improvement in their abilities to RTW plays an important role in their treatment satisfaction.

In addition to psychosocial and work-related factors, we found that pain relief may also enhance patient satisfaction. Patients with ASD typically have pain that affects the back, legs, or both.[7,8,30] Studies have shown that compared with nonoperative treatment, operatively treated patients had significantly improved HRQOL, less leg pain, and disability at 2-year follow-up.[30,31] Chotai *et al*[32] enrolled 1645 patients in a longitudinal registry who underwent elective spine surgery and found that patient satisfaction may predict the effectiveness of surgical care with respect to 1-year improvement in pain and disability. Furthermore, a multicenter retrospective study has shown that improvement of back pain influenced a patient's satisfaction of back management more than did an improvement in leg pain.[33]

TABLE 4. Association of Patient Satisfaction and Oswestry Disability Index Class Membership

	Odds Ratio (95% CI)	*P*
Class membership		
Remained-same/worsened class	Ref	
Mild-improved class	3.91 (2.09, 7.33)	<0.001
Most-improved class	16.99 (8.58, 33.64)	<0.001
Demographics		
Age (yr)		
<40	Ref	
40–<60	1.46 (0.68, 3.12)	0.333
≥60	1.32 (0.58, 3.01)	0.506
Sex		
Male	Ref	
Female	1.77 (1.06, 2.96)	0.029
BMI		
Underweight/normal	Ref	
Overweight	1.22 (0.76, 1.98)	0.411
Obese	1.06 (0.62, 1.82)	0.829
Prior surgery	1.05 (0.68, 1.62)	0.819
Years of spine problems	0.91 (0.73, 1.14)	0.424
Charlson comorbidity		
0	Ref	
1	1.76 (0.99, 3.14)	0.055
≥2	1.30 (0.77, 2.19)	0.325
Leg pain	0.90 (0.83, 0.96)	0.002
Back pain	0.91 (0.83, 0.99)	0.044
Surgical parameters		
>10 Levels fused	1.35 (0.47, 3.90)	0.574
UIV-T10	1.45 (0.49, 4.28)	0.501
LIV-sacrum	0.68 (0.34, 1.34)	0.264
Radiographic parameters		
2-Year change in radiographic parameters from baseline		
S1PT	0.89 (0.75, 1.05)	0.157
S1PI	1.00 (0.97, 1.03)	0.857
PI-LL	1.00 (0.98, 1.03)	0.897
SVA	0.99 (0.97, 1.01)	0.252
T1PA	1.15 (0.93, 1.43)	0.191

BMI indicates body mass index; CI, confidence interval; LIV, lowest instrumented vertebra; PI-LL, pelvic incidence minus the lumbar lordosis; PT, pelvic tilt; SVA sagittal vertical axis; T1PA, T1 pelvic angle; UIV, upper instrumented vertebra.

Other daily activities, particularly, standing and walking, which are some of the most basic movements for patients, were also observed to be related to patient satisfaction in the present study. However, the correlation of patient satisfaction with walking/standing ability was inconsistent in the literature depending on the surgical procedures. For example, in a cross-sectional study, Nakahara *et al*[34] found that all patient-derived functional activities, such as ''walking and standing,'' were significantly associated with the patient satisfaction after total knee arthroplasty. In contrast, postoperative walking ability was only weakly correlated with patient satisfaction in surgical patients with degenerative lumbar spinal stenosis.[35] It is possible that patients with knee problems are more likely to expect a specific improvement in their walking ability, whereas patients with spine disease have more expectation with their standing ability. Future studies of patients with ASD may be required to better understand their specific needs. Other ODI specific domains, such as personal care, sex life, travelling, and lifting were not found to affect patient satisfaction. One possible explanation could be that those activities may be less demanding and are generally not as prioritized among patients with ASD.

The present study was also able to identify patient characteristics associated with improvement, although no statistical association was observed between those characteristics and patient satisfaction. For example, our results have shown that patients with severe disability at baseline, including sagittal malalignment and pain intensity, were more likely to experience improvement after surgery than

patients with less disability, which is consistent with previous reports.[36,37] Older age was also associated with greater improvement in the present study. Although the evidences for the outcomes after spinal deformity surgery in the elderly were inconsistent, the majority have reported better clinical outcomes in the elderly.[38] For example, Hassanzadeh *et al*[39] retrospectively reviewed 109 patients with ASD who underwent revision surgery and found that older patients achieved functional outcome benefits comparable to those in younger adults. Lastly, regarding the surgical characteristics, long spinal deformity fusions to the sacrum were observed to benefit patients in the present study, although this continues to be a controversial area.[40–43] According to a retrospective cohort study with 5-year follow-up postoperatively, extension of long fusions to the sacrum resulted in significant and sustained improvements in ODI and SRS scores and alignment.[40]

The major strength of the present study is that it is the first study that, to the best of our knowledge, identified determinants of patient satisfaction with respect to functional limitations in surgically treated patients with ASD. The longitudinal follow-up allowed us to monitor their changes in physical, mental, and psychosocial status due to surgery. The current study, however, has several limitations. First, conclusions may be specific to the study cohort and analyses should be repeated in other samples to validate our findings. Second, the study population was limited to patients who completed both baseline and 2-year follow-up questionnaires. It is possible that those who were lost to follow-up had worse functional limitations or dissatisfaction than those who remained in the study. If this is the case, our results may not reflect the broader population of patients with ASD. Lastly, we only focused on surgically treated patients with ASD. Further studies may be required to investigate the determinants of patient satisfaction in nonoperative ASD patients.

Our analytic approach demonstrates an important methodological alternative to describe ODI scores by highlighting the heterogeneity and its implications in terms of patient satisfaction among patients with ASD. Our study has emphasized the clinical significance of early identification of the variety of ODI-derived functional limitations rather than using overall scores to guide treatment decision making. Understanding the heterogeneity of functional limitations at the time of surgery, regardless of clinical parameters or radiographic findings, may provide insights to develop patient-centered care and thus improve patient satisfaction.

➢ Key Points

- ❑ Patient satisfaction is an important component of evaluating quality of care.
- ❑ Improvement in standing, social life, and employment are the most important determinants of patient satisfaction among patients with ASD after surgery.
- ❑ Understanding the heterogeneity of functional limitations may provide insights to develop patient-centered care and thus improve patient satisfaction.

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