



Published in final edited form as:

J Pediatr Orthop. 2017 December ; 37(8): e548–e551. doi:10.1097/BPO.0000000000000778.

Predicting post-surgical satisfaction in adolescents with idiopathic scoliosis: The role of pre-surgical functioning and expectations

Christine B. Sieberg, PhD^{1,2,3}, Juliana Manganello, BA^{1,2}, Gem Manalo, MMSc^{3,4}, Laura E. Simons, PhD^{1,2,3}, and M. Timothy Hresko, MD⁵

¹Division of Pain Medicine, Department of Anesthesiology, Perioperative and Pain Medicine, Boston Children's Hospital

²Department of Psychiatry, Harvard Medical School

³Biobehavioral Pediatric Pain Lab, Boston Children's Hospital

⁴Wayne State University School of Medicine

⁵Department of Orthopaedic Surgery, Boston Children's Hospital/Harvard Medical School

Abstract

Background—There is a need to better assess patient satisfaction and surgical outcomes. The purpose of the current study is to identify how preoperative expectations can impact post-surgical satisfaction among youth with Adolescent Idiopathic Scoliosis (AIS) undergoing spinal fusion surgery.

Methods—The present study includes patients with AIS undergoing spinal fusion surgery enrolled in a prospective, multi-centered registry examining post-surgical outcomes. The Scoliosis Research Society Questionnaire—Version 30, which assesses pain, self-image, mental health, and satisfaction with management, along with the Spinal Appearance Questionnaire (SAQ), which measures surgical expectations was administered to 190 patients prior to surgery and 1 and 2 years postoperatively. Regression analyses with bootstrapping (with $n=5,000$ bootstrap samples) were conducted with 99% bias-corrected confidence intervals (BCCI) to examine the extent to which pre-operative expectations for spinal appearance mediated the relationship between pre-surgical mental health and pain and two-year post-surgical satisfaction.

Results—Results indicate that preoperative mental health, pain, and expectations are predictive of post-surgical satisfaction.

Conclusions—With the shifting healthcare system, physicians may want to consider patient mental health, pain, and expectations prior to surgery to optimize satisfaction and ultimately improve clinical care and patient outcomes.

Level of Evidence—Level 1 Prognostic Study.

Correspondence to: Christine B. Sieberg, PhD Pain Treatment Service Boston Children's Hospital; 333 Longwood Avenue, 5th Floor; Boston, MA 02115; Tel: 617-355-7040; Fax: 617-355-7040; christine.sieberg@childrens.harvard.edu.

Disclosures: There are no conflicts of interest to report.

Keywords

spinal fusion surgery; adolescent idiopathic scoliosis; expectations; satisfaction

Introduction

Over 5 million children undergo surgery each year¹; however, pre-surgical factors that impact outcomes after surgery are not well understood. Existing research has largely focused on the impact of pre-surgical anxiety and coping on post-operative pain. Palermo and colleagues² found that anticipatory distress and child coping strategies were predictive of acute postoperative pain regardless of surgical and demographic variables. Among studies that have specifically evaluated adolescents with idiopathic scoliosis (AIS) undergoing spinal fusion surgery, one study found that pre-surgical self-image, mental health, and age contributed to a patient's longitudinal experience with postoperative pain³, while another study found that patients with more vigilant (*e.g.* seeking information about the surgery) pre-operative coping strategies experienced better recovery outcomes than those patients with more avoidant (*e.g.*, limiting detailed information about the surgery) pre-operative coping strategies.⁴ Although these studies provide important data regarding outcomes related to pain and functioning after surgery, another important dimension to consider is patient satisfaction. Given the evolving nature of healthcare within the US that places a premium on optimizing patients' experiences, there is a need to address how patient characteristics can impact post-surgical satisfaction. Over the past ten years, there has been an increase in the weight of patient satisfaction on physician compensation; however measures of patient satisfaction have been criticized for their ambiguity and lack of validity.⁵⁻⁷ The patient factors influencing surgical expectations is likely multi-factorial and likely include self-image and mental health status.

The purpose of the present study was to examine how preoperative mental health, self-image, pain, and expectations for spinal appearance predicted post-operative satisfaction in a large prospective cohort of youth with AIS who underwent spinal fusion surgery. Previous research on patient satisfaction has focused primarily on adult subjects or non-surgical models.^{8,9} We hypothesized that better pre-operative mental health and self-image and lower pre-surgical pain would be predictive of better satisfaction two years post-surgery with pre-surgical expectations for spinal appearance mediating this relationship.

Materials and Methods

Participants

Data was collected as part of the Prospective Pediatric Scoliosis Study (PPSS), a multisite, longitudinal study that evaluates existing practices in the surgical intervention for pediatric patients with AIS. Data was collected between 2003-2007 and only data from Boston Children's Hospital was used to have a consistent surgical treatment regimen. Inclusion criteria for this study included a diagnosis of thoracic, thoracolumbar, and/or lumbar idiopathic scoliosis and a spinal fusion with instrumentation. Patients were followed longitudinally at preoperative, one-year, and two-year postoperative time points. Of the 260

patients who completed baseline data, 190 patients completed follow-up data at 1 and 2 years. Parent informed consent and child assent for minor patients and consent for patients 18 and older was obtained. Participant responses to follow-up measures were completed either at follow-up appointment or by mail.

Measures

Expectations for Spinal Appearance—Using the four-item Expectations subscale of the Spinal Appearance Questionnaire (SAQ)-¹⁰ we evaluated patient pre-surgical expectations for the appearance of their spine, shoulders, hips, and waist. (*e.g.*, “I want to be more even”). A higher score indicates worse expectations and satisfaction. The SAQ has demonstrated reliability and validity.¹¹ The mean for this sample was 15.00, SD=0.69.

Mental Health—Derived from the *Scoliosis Research Society-30* (SRS-30)¹², the Mental Health subscale consists of five-items and assesses general wellbeing of participants over the course of the last 6-months with higher scores indicative of better outcomes. (*e.g.*, “During the past 6-month, have you been a very nervous person?”). The mean for this sample was 3.98, SD=0.60.

Self-Image—Derived from the SRS-30¹², the Self-Image subscale consists of six-items (preoperatively) and assesses health perceptions, social functioning and physical functioning with higher scores indicative of better outcomes. (*e.g.*, “How do you look in clothes?” “Do you feel that your back condition affects your personal relationships?”). The mean for this sample was 3.51, SD=0.60.

Pain—Derived from the SRS-30¹², the Pain subscale consists of five-items and assesses back pain and pain management over the past six months with a higher score indicating less pain, less medication use, and less missed work/school days due to pain. (*e.g.*, “Do you experience back pain at rest?”). The mean for this sample was 4.01, SD=0.54.

Satisfaction—Derived from the SRS-30¹², the Satisfaction subscale consists of 3-items (two that can be assessed prior to surgery and one that can also be assessed after surgery) that measure satisfaction with back management with a higher score indicating increased satisfaction (*e.g.*, “Would you have the same management again if you had the same condition?”). The mean for this sample was 1.64, SD=0.69.

Procedures

Data obtained for secondary data analysis for the present study was approved by the Institutional Review Board. Patients completed the questionnaire at the time of the pre-operative visit 1 to 3 weeks before the surgery. The questionnaires were completed with parental assistance as necessary for the younger patients or independently by the patient depending on the patients’ level of understanding of the questionnaire. Standard post-operative visits occurred at 1 and 2 years after surgery with completion of the questionnaires at the time of the office visit or via mail. All statistical analyses were carried out using SPSS Software Version 21.

Descriptive statistics were conducted for demographic and study variables. Regression analyses with bootstrapping as outlined by Preacher and Hayes¹³(with $n=5,000$ bootstrap samples (<http://analyses.com/spss-sas-andmplus-macros-and-code.html>) were conducted with 99% bias-corrected confidence intervals (BCCI) to examine the extent to which pre-operative expectations for spinal appearance mediated the relations between pre-surgical mental health and self-image and two-year post-surgical satisfaction with spinal appearance. In this model, the total effect (weight c , a regression coefficient) of an independent variable (IV) (*i.e.*, pre-surgical mental health & pain) on a dependent variable (DV) (*i.e.*, two-year post-surgical satisfaction with spinal appearance) is composed of a direct effect (weight c' , a regression coefficient) of the IV on the DV and an indirect effect (weight $a \times b$) of the IV on the DV through a proposed mediator (M) (*i.e.*, pre-surgical expectations for spinal appearance). Weight a signifies the effects of the IV on the M, whereas weight b reflects the effect of the M on the DV, controlling for the effects of the IV. Mediation is demonstrated if the BCCIs do not contain zero.

Results

Preliminary Analyses and Description of the Sample

Of the 260 patients included in this study, 190 patients completed follow-up data at 1 and 2 years post-surgery. We examined baseline differences between patients who completed follow-up data ($n=190$) and those who did not ($n=70$) to examine any response or participation bias. There were no significant differences found on age, sex, or race/ethnicity. However, there was a significant difference found on the pre-operative pain subscale scores for those who completed follow-up versus those who only had baseline data. Those with post-surgical data reported significantly less preoperative pain ($M=4.01$, $SD=0.54$) compared to the group who completed only baseline measures ($M=3.72$, $SD=0.77$) ($F(1, 246)=10.77$, $p<0.001$). For all subsequent analyses, we examined patients who had complete one and two year post-surgical data-points ($n=190$). Age at the time of surgery for this sample was between 8 and 21 years ($M=14$; $SD=2.29$). Patients were predominantly female (72%) and Caucasian (82%). The mean preoperative curve angle of the spine was 57.5 degrees ($SD=13.09^\circ$), which is considered a curve in the severe range. The majority of patients (90%) underwent a posterior surgical approach.

Correlations

In examining the bivariate correlations between demographic variables, pre-operative functioning, surgical variables (*e.g.*, major curve, Lenke classification, surgical approach, fusion length) and post-operative satisfaction, there were no significant correlations between any of the surgical variables, as well as for biological sex, age, or pre-surgical self-image. However, post-surgical satisfaction demonstrated significant modest correlations at $p<0.05$ with pre-surgical pain (-0.15), pre-surgical mental health (-0.18), and pre-surgical expectations (-0.19) for spinal appearance and thus was used to build the mediational models.

Mediational Analyses

Pre-surgical mental health was not significantly associated with pre-surgical expectations (*a* path) but pre-surgical expectations were significantly associated with satisfaction two years after surgery (*b* path). When examining the indirect effects, not surprisingly, pre-surgical mental health did not indirectly impact satisfaction two years after surgery through its influence on pre-surgical expectations ($\beta = 0.023$; $BCACI = -0.02 - 0.10$; $a \times b$ path). However, pre-surgical mental health significantly predicted satisfaction two years after surgery with poorer preoperative mental health predictive of better post-operative satisfaction (*c* path) and this relationship remained after controlling for pre-surgical expectations for spinal appearance (*c'* path). Interestingly, the relationship between pre-surgical pain and two-year post-surgical satisfaction was mediated by pre-surgical expectations for spinal appearance ($CI = 0.01-0.18$). All paths in the model were significant. Higher presurgical pain was predictive of higher expectations and better post-operative surgical satisfaction. Lower presurgical expectations was predictive of better post-surgical satisfaction.

Discussion

Given the evolving nature of health care in the United States, where patient satisfaction is becoming increasingly tied to physician reimbursement⁵, it is necessary to examine potential barriers to long-term satisfaction. By assessing pre-operative factors that could later contribute to satisfaction with surgical outcomes, surgeons can proactively target these issues in order to positively impact post-surgical care. The present study examined how pre-surgical mental health, pain, and self-image among adolescents with idiopathic scoliosis could impact satisfaction with management two years after undergoing spinal fusion surgery. The mediating role of pre-surgical expectations for spinal appearance was also examined. Unexpectedly, pre-surgical self-image was not related to post-surgical satisfaction. Further research should be conducted exploring the role self-image has on post-surgical outcomes. Findings indicate that both pre-surgical mental health and pain are predictive of post-surgical satisfaction scores. Contrary to our hypotheses, we found that worse pre-operative mental health and higher presurgical pain was predictive of better post-surgical satisfaction. While it was initially hypothesized that better presurgical functioning would serve as a buffer for better surgical outcomes, it seems that patients with poorer preoperative mental health prior to surgery may have been more negatively impacted by their curve and therefore were more highly satisfied when it was corrected. Similarly, patients with higher presurgical pain may have had more to gain from surgery, thus improving their satisfaction. However, when examining the mediating role of pre-surgical expectations for spinal appearance, this variable only mediated the relationship between pre-surgical pain and post-surgical satisfaction; it did not mediate the relationship between pre-surgical mental health and post-surgical satisfaction, indicating that both mental health and pre-surgical expectations exert their own influence on post-surgical satisfaction with management. However, it was found that patients with follow-up data versus those with only baseline had significantly lower pain prior to surgery. It is possible that this model may operate differently among patients who report higher levels of preoperative pain and future research should examine that.

Findings suggest that it is important for surgeons performing spinal fusion surgery to monitor pre-surgical mental health and pain along with identifying those patients who have exceedingly high expectations for their appearance. Interdisciplinary collaboration with a mental health provider could prove quite useful to screen patients and implement intervention efforts tailored at targeting pain and mental health as well as realistic expectations prior to undergoing spinal fusion surgery.

This study should be viewed in light of its limitations. First, data collection for this study ended in 2007. As pre-surgical education, surgical techniques, and post-operative care may have changed since that time, it is unclear how potential differences in care may impact post-surgical satisfaction. Data from more recent datasets should be analyzed. However, given that for this sample, there were no significant correlations between surgical variables and predictors and outcomes, it is likely that mental health and high expectations for surgical outcomes will still be important to consider as these are traits intrinsic to the individual patient and may not necessarily be impacted by surgical variables. This study only examined patients with idiopathic scoliosis undergoing spinal fusion surgery, so it will be useful to examine this model with other diverse surgical samples in the future. The SRS 22 pre operative measures used in this study were available via the Prospective Pediatric Scoliosis Study (PPSS) and do not reflect the most comprehensive means of assessing pre-operative mental health, pain, self-image, expectations, and satisfaction; however, it may be an effective screening tool. We would suggest that a score of less than 4 on the SRS subscales may indicate less than optimal functioning and referral to a staff psychologist or social worker. The current findings suggest that further evaluation of these factors is warranted and they do appear to potentially influence post-surgical satisfaction. Additionally, research has suggested that youth ages 8-16 demonstrated difficulty understanding the questions in the SAQ¹⁴. Given that the mean age of our sample was 14 and that parents of younger patients assisted with completion of the data, we do not think that the validity of this measure was a concern; however, it is possible that some patients may have had difficulty answering these questions.

In an era of healthcare reimbursement that is shifting toward payment for performance, defining successful surgical outcomes hinges not only on traditional biometrics but also patient satisfaction. Optimizing patient satisfaction after surgery involves consideration of pre-operative pain, mental health status, and managing appearance expectations.

Acknowledgments

This investigation was supported by a Boston Children's Hospital Career Development Fellowship Award to CBS, an NIH Grant to LES (NICHD K23HD067202), and the Sara Page Mayo Endowment for Pediatric Pain Research and Treatment and the Department of Anesthesiology, Perioperative and Pain Medicine at Boston Children's Hospital. Data storage for the Spinal Deformity Study Group was funded by a grant from Medtronic. This data was retrieved from the SDSG warehouse.

References

1. Ahn JC, Fortier MA, Kain ZN. Acute to chronic postoperative pain in children: Does it exist? Pain Management. 2012; 2(5):421-3. [PubMed: 24645855]

2. Palermo TM, Eccleston C, Lewandowski AS, Williams AC, Morley S. Randomized controlled trials of psychological therapies for management of chronic pain in children and adolescents: An updated meta-analytic review. *Pain*. 2010; 148(3):387–97. [PubMed: 19910118]
3. Sieberg CB, Simons LE, Edelstein MR, DeAngelis MR, Sethna N, Hresko MT. Pain prevalence and trajectories following pediatric spinal fusion surgery. *JPain*. 2013; 14:1694–1702. [PubMed: 24290449]
4. LaMontagne LL, Hepworth JT, Cohen F, Salisbury MH. Adolescents' coping with surgery for scoliosis: Effects on recovery outcomes over time. *Res Nurs Health*. 2004; 27(4):237–253. [PubMed: 15264263]
5. Finkelstein J, Lifton J, Capone C. Redesigning physician compensation and improving ED performance: Emergency department physician compensation plans should be designed to improve quality, productivity, and patient satisfaction. *Healthcare Financial Management*. 2011; 65(6):114.
6. Manary MP, Boulding W, Staelin R, Glickman SW. The patient experience and health outcomes. *N Engl J Med*. 2013; 368(3):201–203. [PubMed: 23268647]
7. Shirley ED, Sanders JO. Patient satisfaction: Implications and predictors of success. *The Journal of bone and joint surgery. American volume*. 2013; 95(10):e69. [PubMed: 23677370]
8. Jackson JL, Chamberlin J, Kroenke K. Predictors of patient satisfaction. *Soc Sci Med*. 2001; 52(4):609–620. [PubMed: 11206657]
9. Ricketts DM. Satisfaction levels in orthopaedic out-patients. *Ann R Coll Surg Engl*. 2005; 87(2):106–108. [PubMed: 15826419]
10. Carreon LY, Sanders JO, Polly DW, et al. Spinal appearance questionnaire: Factor analysis, scoring, reliability, and validity testing. *Spine*. 2011; 36
11. Sanders JO, Harrast JJ, Kuklo TR, et al. The spinal appearance questionnaire: Results of reliability, validity, and responsiveness testing in patients with idiopathic scoliosis. *Spine*. 2007; 32:2719–22. [PubMed: 18007251]
12. Scoliosis research society. <http://www.srs.org/>. Updated 2011
13. Preacher K, Hayes A. Asymptotic and resampling strategies for assessing and comparing indirect effects in multiple mediator models. *Behavior Research Methods*. 2008; 40(3):879–891. [PubMed: 18697684]
14. Mulcahey MJ, Chafetz RS, Santangelo AM, et al. Cognitive testing of the spinal appearance questionnaire with typically developing youth and youth with idiopathic scoliosis. *JPO*. 2011; 31

Table 1

Participant Characteristics (n=190)

Variable	Frequency
Age	Range= 8-21 Mean=14.35 (2.23)
Gender	
Females	72.3%
Males	22.0%
Race	
Caucasian	81.7%
Black or African American	8.4%
Asian or Asian American	3.1%
Hispanic	1.6%
Other	1.6%
Surgical Approach	
Posterior	89.9%
Anterior	10.1%
Absolute value of Major Curve	Range= 22-111° Mean= 57.5° (13.09°)
Location of maximum curve (Lenke Classification)	
Major thoracic	48.7%
Double thoracic	23.8%
Thoracolumbar/Lumbar	12.7%
Thoracolumbar/Lumbar/Main Thoracic	5.8%
Triple major	4.8%
Double major	4.2%
Fusion length	Range= 0-14
Posterior	Mean= 8.65 (4.15) vertebrae fused
Anterior	Mean= 0.89 (2.12)