

Patient-reported Allergies are Associated With Preoperative Psychological Distress and Less Satisfying Patient Experience in a Lumbar Spine Surgery Population

Jay M. Levin, BA,*†‡§ Spencer Boyle, MFA,*†‡§ Robert D. Winkelman, BA,*†‡§
Joseph E. Tanenbaum, BA,*†§|| Kalil G. Abdullah, MD,¶|| Michael P. Steinmetz, MD,*†
and Thomas E. Mroz, MD*†§

Study Design: This was a retrospective cohort study.

Objective: The main objectives of this study were: (1) to determine whether patient-reported allergies (PRAs) are associated with patient satisfaction scores, and (2) to clarify the association between PRAs and preoperative anxiety and depression in a lumbar spine surgery population.

Summary of Background Data: Hospital Consumer Assessment of Healthcare Providers and Systems (HCAHPS) survey is currently used to measure the patient experience and there is concern that psychosocial factors are unaccounted for. Interestingly, PRAs have been linked to concurrent mood and other psychiatric disorders, as well as poor clinical outcomes in the orthopedic surgery setting.

Methods: HCAHPS survey data, patient demographics, surgical characteristics, and preoperative health status were obtained for each patient. Allergies were categorized as medical (ie, medications) and environmental (ie, food, animals). Univariable and multivariable logistic regression models were used to determine whether the number of medical and environmental PRAs are associated with HCAHPS scores. In addition, multivariable logistic regression was used to analyze the association between PRAs and psychological distress.

Results: In 421 patients included, PRAs were associated with lower HCAHPS scores under several dimensions of the patient experience of care, including: nursing communication, pain management, communication about medicines, and transition of care. Medical PRAs was an independent predictor of low satisfaction with communication about a medication's side effects

[odds ratio (OR), 0.88; $P=0.03$] and understanding the purpose for new medications (OR, 0.90; $P=0.03$). Environmental PRAs was an independent predictor of low satisfaction with both communication about a medication's side effects (OR, 0.68; $P=0.03$), and pain control (OR, 0.67; $P=0.01$). Moreover, having a PRA (OR, 1.64; $P=0.04$) was associated with EuroQol-5 Dimensions anxiety/depression and having an environmental PRA (OR, 2.13; $P=0.03$) was associated with depression.

Conclusions: These findings highlight the potential utility of PRAs to help identify patients with psychological distress who are at risk for a poor experience of lumbar spine surgery.

Key Words: allergy, patient satisfaction, depression, anxiety, pain control, lumbar spine, lumbar fusion

(*Clin Spine Surg* 2018;31:E368–E374)

Value-based purchasing was established by the Centers for Medicare and Medicaid Services (CMS) in an effort to shift the traditional fee-for-service model to one that emphasizes the quality of services provided. Currently, the Hospital Consumer Assessment of Healthcare Providers and Systems (HCAHPS) survey scores are publically reported and used to redistribute hospital reimbursement from low-performing to high-performing hospitals.¹ As the HCAHPS survey is a subjective measure of patient experience, CMS attempts to adjust for patient characteristics that are not under the control of the hospital. There is concern, however, that the complex interaction between psychosocial factors and patient satisfaction are difficult to wholly account for.^{2,3}

Although lumbar spine surgery is an effective treatment for numerous lumbar spine pathologies, there exists a wide disparity in clinical outcomes following surgery.⁴ Depression—among other psychosocial factors—is associated with both poorer clinical outcomes^{5–8} and patient satisfaction following lumbar spine surgery.^{2,9,10} Patient-reported allergies (PRAs) have also been linked to concurrent mood and other psychiatric disorders^{11,12} and PRAs have recently been found to be a predictor of poor patient-reported outcomes following orthopedic surgery.^{13–17} However, no study has investigated the association between PRAs and the patient experience of spine surgery.

Received for publication February 10, 2018; accepted May 9, 2018.

From the *Center for Spine Health, Cleveland Clinic; †Case Western Reserve University School of Medicine; Departments of ‡Neurosurgery; §Orthopaedic Surgery, Cleveland Clinic; ||Department of Epidemiology and Biostatistics, Case Western Reserve University, Cleveland, OH; and ¶Department of Neurosurgery, University of Pennsylvania, Philadelphia, PA.

Institutional Review Board approval was obtained at Cleveland Clinic Foundation.

The authors declare no conflict of interest.

Reprints: Jay M. Levin, BA, Department of Neurosurgery, Neurological Institute, Cleveland Clinic Center for Spine Health, The Cleveland Clinic, 9500 Euclid Avenue, S-40, Cleveland, OH 44195 (e-mail: jml247@case.edu).

Copyright © 2018 Wolters Kluwer Health, Inc. All rights reserved.

As hospitals and spine surgeons across the United States are increasingly held accountable for providing a satisfying hospital experience to patients, it is important to identify patient factors that can reflect poorly on the perceived patient experience. Identifying these patient factors may be useful for spine surgeons managing patient selection and expectations of lumbar spine surgery. Therefore, the goal of our study was to (1) determine whether patients with multiple PRAs are associated with patient experience measured by HCAHPS scores and (2) clarify the association between PRAs and preoperative anxiety and depression in a lumbar spine surgery.

METHODS

Study Design

We conducted an observational cohort study at a single academic tertiary care institution, including all patients who underwent lumbar spine surgery and completed an HCAHPS survey between 2013 and 2015. Following institutional review board approval, HCAHPS survey data were obtained by querying our institution's Patient Experience database for patient surveys associated with a primary diagnosis of lumbar stenosis, spondylolisthesis, spondylosis, degenerative disc disease, or disc displacement. Patient demographic and surgical characteristics were obtained via a combination of chart review and our Inpatient and Surgery Data Marts, and included: age, sex, body mass index, ethnicity, median income, tobacco smoking status, survey response time, length of stay (LOS), primary lumbar diagnosis, medical comorbidities, prior lumbar surgery status, and procedure type (fusion or decompression). Preoperative health status measures including the Visual Analog Scale (VAS) for back pain, EuroQol-5 Dimensions (EQ-5D) anxiety/depression score, and Pain Disability Questionnaire (PDQ) were collected prospectively via our institution's Knowledge Program database. All PRAs were collected from each patient's medical record, which were then classified into "medical" and "environmental" allergies. Medications and medical supplies (ie, latex, adhesives) were considered "medical" allergies, while food, pets, and environmental allergens were considered "environmental" allergies. Patients were excluded from the study if they had been diagnosed with spinal malignancy, scoliosis, had a history of traumatic spinal injury, or were younger than 18 years.

Primary Outcome

Our primary outcome included 21 individual questions from the HCAHPS survey, with each question corresponding to one of the following 9 dimensions: communication with doctors, communication with nurses, responsiveness of hospital staff, pain management, communication about medicines, discharge information, cleanliness and quietness of the hospital environment, transition of care, and overall rating of a hospital. The percentage of survey recipients who select a "top-box" response, the most positive response to an HCAHPS survey question, is used for reimbursement calculations

and is publicly reported online. Overall rating of a hospital is measured on a 0 to 10 scale, where 0 is the worst hospital possible and 10 is the best hospital possible. A score of 9 or 10 is considered "top-box" for overall rating of a hospital. All other HCAHPS survey items included in our analysis are scored on a Likert scale, where the most positive response is considered "top-box."

Secondary Outcome

In addition to determining the association between PRAs and HCAHPS scores, we sought to determine whether PRAs are associated with coexisting affective disorders such as depression or anxiety in this patient population. The EQ-5D anxiety/depression subcomponent and a prior clinical diagnosis of major depressive disorder were used to investigate the association between allergies and psychological distress. Patients who selected that they were "moderately" or "extremely" anxious or depressed on the EQ-5D were considered to have problems with anxiety/depression, and the remaining patients were considered to have no problems.

Statistical Analysis

All data were analyzed using IBM SPSS Statistics, version 25.0 (IBM Corp.; Armonk, NY). Patient characteristics were summarized using descriptive statistics, with: categorical variables reported as a fraction and a percentage; normally distributed continuous variables reported as a mean $\pm$ SD; nonparametric variables reported as the median and interquartile range. For HCAHPS questions found to have a statistically significant association with total number of PRAs on univariable logistic regression analysis, we stratified our analysis by number of medical and environmental PRAs. Thereafter, multivariable logistic regression models were used to determine whether the number of medical and environmental PRAs are associated with HCAHPS scores after adjusting for potential confounders. Age, sex, LOS, PDQ, EQ-5D anxiety/depression, and work status were individually analyzed via univariable logistic regression models to measure their association with top-box responses on select HCAHPS.^{2,18–21} Variables which met our *P*-value cutoff of 0.20 were considered relevant covariates and were included in our multivariable logistic regression models. In addition, multivariable logistic regression models were used to analyze which patient factors are associated with preoperative depression, anxiety, and an active antidepressant prescription.

RESULTS

In total, 421 patients were included in our final study cohort, with a mean age of 63.9 ± 11.1 years, 55.6% male, and 93.8% white ethnicity. As regards PRAs, 66.4% of patients reported an allergy, with 60.4% reporting a medical allergy and 17.3% reporting an environmental allergy. The most common primary diagnosis at the time of surgery was lumbar spinal stenosis (41.3%), followed by spondylosis (23.3%), spondylolisthesis (17.6%), disc displacement (17.3%), and spondylolysis (0.5%). Clinically

TABLE 1. Patient Characteristics

Characteristic	Value
No. Patients	421
Age (y)	63.9 ± 11.1
Sex [n (%)]	234:187
Male	234 (55.6)
Female	187 (44.4)
Body mass index (IQR)*	29.0 (26.0–33.0)
Ethnicity [n (%)]	
White	391 (93.8)
Other	30 (6.2)
Income [median (IQR)]	\$54,396 (\$44,609–\$67,889)
Tobacco use [n (%)]	45 (10.7)
Allergy [n (%)]	277 (66.4)
Total number of allergies	2.0 ± 3.4
Medical allergy [n (%)]	252 (60.4)
No. medical allergies	1.7 ± 3.2
Environmental allergy	72 (17.3)
No. environmental allergies	0.3 ± 0.8
Primary lumbar diagnosis [n (%)]	
Stenosis	174 (41.3)
Spondylosis/degenerative disc disease	98 (23.3)
Spondylolisthesis	74 (17.6)
Disc displacement	73 (17.3)
Spondylolysis	2 (0.5)
Comorbidities [N/n (%)]	
Diabetes	86/383 (22.5)
Hypertension	193/383 (45.8)
Coronary artery disease	48/383 (12.5)
Chronic renal failure	6/383 (1.4)
Stroke	18/383 (4.7)
Prior lumbar surgery [n (%)]	151 (35.9)
Depression [N/n (%)]*	58/383 (15.1)
Antidepressant [N/n (%)]	108/383 (28.2)
EQ-5D anxiety/depression [N/n (%)]†	181/372 (48.7)
VAS back pain‡	6.69 ± 2.13 (n = 355)
PDQ§	73.8 ± 28.7 (n = 358)
Procedure [n (%)]	
Lumbar fusion	180 (42.8)
Lumbar decompression	241 (57.2)
Length of stay (IQR)	3 (2–4)
Survey response time (IQR)	22 (16–36)

*Clinically diagnosed depression.

†Patient selecting either “moderately anxious or depressed” or “extremely anxious or depressed” as their response on the EuroQol-5 Dimensions anxiety/depression component.

‡Visual analog scale for back pain, rated on a scale from 0–10, with 10 signifying the worst pain.

§Pain Disability Questionnaire, rated on a scale from 0–150, with 150 signifying worst pain and disability.

EQ-5D indicates EuroQol-5 Dimensions Index Score; IQR, interquartile range; PDQ, Pain Disability Questionnaire; VAS, Visual Analog Scale.

diagnosed depression was present in 15.1% of our cohort, whereas active antidepressant prescription was present in 28.2% of our cohort. Moreover, 48.7% patients informed that they were either “moderately” or “extremely” anxious or depressed before surgery (Table 1).

HCAHPS

Of the 60% of eligible inpatients sampled by the HCAHPS survey, our institution’s response rate was between 35% and 40% over the time period of our study. Increasing number of total PRAs was associated with significantly lower odds of selecting a top-box response for 5 of 21 survey questions analyzed (Table 2). Increasing number of total

allergies was negatively associated with patients feeling as if nurses always listened to them carefully [odds ratio (OR), 0.92; 95% confidence interval (CI), 0.85–0.99; $P=0.042$]. However, when stratifying this analysis based on number of medical PRAs and number of environmental PRAs, no significant association was found.

Under the pain management dimension, total number of PRAs was negatively associated with patients feeling as if their pain was always well controlled (OR, 0.91; 95% CI, 0.84–0.99; $P=0.032$), as well as feeling that staff always did everything they could to help with pain (OR, 0.91; 95% CI, 0.83–0.99; $P=0.033$). Upon stratifying this analysis by medical and environmental PRAs, increasing number of medical PRAs was a significant negative predictor of feeling as if staff always did everything they could to help with pain (OR, 0.90, 95% CI, 0.81–0.99; $P=0.035$), while increasing number of environmental PRAs was a significant negative predictor of pain always being well controlled (OR, 0.74; 95% CI, 0.57–0.97; $P=0.026$). After adjusting for potential confounders in our multivariable analyses, increasing number of environmental PRAs remained a significant negative predictor of patients’ feeling as if pain was always well controlled (OR, 0.67; 95% CI, 0.50–0.90, $P=0.009$) (Tables 3, 4).

Under the communication about medications dimension, total number of PRAs was significantly associated with lower odds of patients selecting that hospital staff always described possible side effects in a way you could understand (OR, 0.83; 95% CI, 0.74–0.93; $P=0.001$). Number of medical PRAs (OR, 0.84; 95% CI, 0.75–0.95; $P=0.005$) and environmental allergies (OR, 0.71; 95% CI, 0.51–0.97; $P=0.031$) were also significantly associated with a top-box response to this HCAHPS survey question on univariable analysis. Furthermore, after adjusting for potential confounders in our multivariable logistic regression analyses, number of medical PRAs (OR, 0.88; 95% CI, 0.78–0.99; $P=0.049$) and environmental allergies (OR, 0.70; 95% CI, 0.50–0.99; $P=0.046$) remained significantly associated with a lower odds of feeling as if staff always described possible medication side effects (Tables 3, 4).

Under the transition of care dimension, increasing number of total PRAs was negatively associated with patients feeling as if they clearly understood the purpose for taking each medication (OR, 0.91; 95% CI, 0.84–0.99, $P=0.029$). Upon stratifying the analysis based on medical and environmental PRAs, total number of medical PRAs was significantly associated with a lower odds of patients reporting that they clearly understand the purpose for each medication (OR, 0.90; 95% CI, 0.82–0.99; $P=0.030$), while number of environmental PRAs demonstrated no significant association with this question. However, after adjusting for patient-level confounders in our multivariable logistic regression analysis, number of medical PRAs was not found to be an independent significant predictor of patients feeling as if they understand the purpose for taking each medication.

Anxiety and Depression

After adjusting for potential confounders on multivariable logistic regression analysis, increasing back pain (OR, 1.19; 95% CI, 1.08–1.33; $P<0.001$), decreasing age (OR, 0.97; 95% CI, 0.94–0.99; $P=0.001$) and having a

TABLE 2. Results From Logistic Regression Models Measuring the Association Between Number of Patient-reported Allergies and Top-box HCAHPS Scores

HCAHPS Item	Total Number of Allergies OR (95% CI)	No. Medical Allergies OR (95% CI)	No. Environmental Allergies OR (95% CI)
Communication with nurses			
Nurses “always” treated you with courtesy and respect	0.93 (0.87–1.01)		
Nurses “always” listened carefully to you	0.92 (0.85–0.99)*	0.92 (0.84–1.01)	0.87 (0.68–1.12)
Nurses “always” explained things in a way you could understand	0.94 (0.87–1.01)		
Communication with doctors			
Doctors “always” treated you with courtesy and respect	0.99 (0.91–1.08)		
Doctors “always” listened carefully to you	0.95 (0.89–1.02)		
Doctors “always” explained things in a way you could understand	0.96 (0.90–1.02)		
Cleanliness and quietness of the hospital environment			
Your room and bathroom were “always” kept clean	0.95 (0.89–1.02)		
The area around your room was “always” quiet at night	0.99 (0.93–1.05)		
Responsiveness of hospital staff			
You “always” got help in getting to the bathroom or using a bedpan as soon as you wanted it	0.97 (0.88–1.07)		
After you pressed the call button, you “always” got help as soon as you wanted it	0.97 (0.91–1.03)		
Pain management			
Your pain was “always” well controlled	0.91 (0.84–0.99)*	0.93 (0.86–1.01)	0.74 (0.57–0.97)*
The hospital staff “always” did everything they could to help you with your pain	0.91 (0.83–0.99)*	0.90 (0.81–0.99)*	0.95 (0.70–1.27)
Communication about medicines			
Before giving you any new medicine, hospital staff “always” described possible side effects in a way you could understand	0.83 (0.74–0.93)*	0.84 (0.75–0.95)*	0.71 (0.51–0.97)*
Before giving you any new medicine, hospital staff “always” told you what the medicine was for	0.96 (0.92–1.05)		
Discharge information			
Hospital staff talked with you about whether you would have the help you needed when you left the hospital	0.99 (0.89–1.11)		
You got information in writing about what symptoms or health problems to look out for after you left the hospital	1.02 (0.88–1.18)		
Staff took your preferences and those of your family into account in deciding what your health care needs would be when you left the hospital	0.99 (0.94–1.05)		
Transition of care			
You had a good understanding of the things you were responsible for in managing your health	0.98 (0.92–1.03)		
You clearly understood the purpose for taking each of your medications	0.91 (0.84–0.99)*	0.90 (0.82–0.99)*	0.94 (0.74–1.19)
Overall rating of a hospital			
Rated this hospital as a 9 or 10 of 10 overall	0.96 (0.90–1.02)		
Would “definitely” recommend this hospital to friends and family	0.98 (0.92–1.05)		

CI indicates confidence interval; OR, odds ratio.

*All *P*-values <0.05 were considered statistically significant.

PRA (OR, 1.64; 95% CI, 1.01–2.63; *P*=0.044) were all significantly associated with anxiety/depression as measured by EQ-5D (Table 5). In addition, multivariable analysis demonstrated that female sex (OR, 0.56; 95% CI, 0.31–0.99; *P*=0.048) and having an environmental PRA (OR, 2.13; 95% CI, 1.10–4.14, *P*=0.025) were significantly associated with coexisting clinically diagnosed depression (Table 5). As regards active antidepressant prescriptions, female sex (OR, 0.46; 95% CI, 0.28–0.75; *P*=0.002) was the only significant predictor after adjusting for patient-level covariates (Table 5).

DISCUSSION

As the cost and incidence of spine surgery in the United States continues to rise,^{22–24} it is important to

consider the implications of the patient experience as an integral component of value-based care. These considerations can have implications beyond hospital reimbursement alone, as HCAHPS scores are publically reported. Furthermore, a systematic review of 55 studies by Doyle et al²⁵ found that patient experience is associated with patient safety and clinical effectiveness, with specific outcomes including mortality, physical symptoms, LOS, and adherence to treatment. We investigated whether PRAs could be used to predict patient experience in the lumbar spine surgery setting because PRAs are a universally assessed preoperative measure.

Our results demonstrate that increasing number of PRAs are negatively associated with several HCAHPS questions under the following dimensions: nursing communication, pain management, communication about medicines,

TABLE 3. Multivariable Logistic Regression Models Used to Determine the Association Between Patient-reported Medical Allergies and Individual Hospital Consumer Assessment of Healthcare Providers and Systems Survey Items

Characteristics	New Medication Side Effects†		Purpose for Medication‡		Pain Help§	
	Unadjusted OR (95% CI)	Adjusted OR (95% CI)	Unadjusted OR (95% CI)	Adjusted OR (95% CI)	Unadjusted OR (95% CI)	Adjusted OR (95% CI)
No. patient-reported medical allergies	0.84 (0.75–0.95)*	0.88 (0.78–0.99)*	0.90 (0.82–0.99)*	0.90 (0.81–0.99)*	0.90 (0.81–0.99)*	0.92 (0.83–1.02) P=0.095
Age	0.98 (0.96–1.00)	0.98 (0.96–1.01)	0.98 (0.96–0.99)*	0.98 (0.96–1.00)	1.01 (0.99–1.03)	
Sex (male/female)	1.76 (1.12–2.76)*	1.61 (0.99–2.61)	1.25 (0.83–1.88)		0.99 (0.60–1.63)	
Length of stay	1.01 (0.91–1.12)		0.96 (0.87–1.06)		0.90 (0.81–1.00)	0.88 (0.78–0.99)*
Preoperative PDQ score	1.00 (0.99–1.01)		1.00 (0.99–1.01)		0.99 (0.98–0.99)*	0.99 (0.98–1.00)
EQ-5D anxiety/depression	0.81 (0.54–1.20)		0.80 (0.56–1.14)		0.62 (0.41–0.94)*	0.74 (0.45–1.21)
Full time work status	1.38 (0.79–2.41)		1.53 (0.89–2.63)	1.25 (0.71–2.21)	0.88 (0.47–1.62)	

†Before giving you any new medicine, hospital staff “always” described possible side effects in a way you could understand.

‡Before giving you any new medicine, hospital staff “always” told you what the medicine was for.

§The hospital staff “always” did everything they could to help you with your pain.

CI indicates confidence interval; OR, odds ratio; EQ-5D, EuroQol-5 Dimensions; PDQ, Pain Disability Questionnaire.

*P-values <0.05, which was considered statistically significant.

and transition of care. After using a multivariable logistic regression model to assess independent predictors of patient experience, increasing number of medical allergies was associated with a significantly lower odds of patients being satisfied with the communication about a medication's side effects (OR, 0.84; 95% CI, 0.75–0.95). In addition, increasing number of environmental allergies was independently associated with significantly lower odds of patients being satisfied with communication about a medication's side effects (OR, 0.70; 95% CI, 0.50–0.99), as well as being satisfied with pain control (OR, 0.67; 95% CI, 0.50–0.90). Patients with increasing number of PRAs therefore may be less likely to be satisfied with their hospital experience as measured by HCAHPS, even after adjusting for clinically relevant patient-level covariates.

Kennedy et al²⁶ investigated the relationship between surgical outcomes and HCAHPS scores at 171 hospitals and found that top-box HCAHPS scores related to communication about medicine were associated with lower early mortality, mortality rate, and mortality index. These results highlight the importance of communicating

details of medications effectively, which may be particularly important to patients who have numerous PRAs, and thus have experienced multiple previous undesirable effects from medications or other allergens.

Although our study is the first to analyze the association between allergies and patient experience, several prior studies investigated the association between PRAs and patient-reported clinical outcomes following orthopedic surgery.^{13–17} Graves et al¹³ evaluated 459 patients undergoing total hip or total knee arthroplasty and found that patients with ≥ 4 reported allergies had less improvement on the Short Form Health Survey Physical Component Score and the Western Ontario & McMaster Universities Osteoarthritis Index (WOMAC) function score. Similarly, Hinarejos et al¹⁴ observed worse post-operative outcomes with regard to WOMAC (23.6 vs. 20.4; $P=0.037$) and Knee Society Score-Knee scores (91.1 vs. 87.6; $P=0.027$) in patients who reported at least one allergy. These previous findings support our results in that patients with allergies are seemingly less likely to achieve satisfactory outcomes.

TABLE 4. Multivariable Logistic Regression Models Used to Determine the Association Between Patient-reported Environmental Allergies and Individual Hospital Consumer Assessment of Healthcare Providers and Systems Survey Items

Characteristics	New Medication Side Effects†		Pain Control‡	
	Unadjusted OR (95% CI)	Adjusted OR (95% CI)	Unadjusted OR (95% CI)	Adjusted OR (95% CI)
No. patient-reported environmental allergies	0.71 (0.51–0.97)*	0.68 (0.49–0.96)*	0.74 (0.57–0.97)*	0.67 (0.50–0.90)*
Age (y)	0.98 (0.96–1.00)	0.98 (0.96–1.00)	1.00 (0.98–1.02)	
Sex (male/female)	1.76 (1.12–2.76)*	1.96 (1.22–3.14)*	1.28 (0.86–1.90)	
Length of stay	1.01 (0.91–1.12)		0.83 (0.75–0.92)**	0.83 (0.73–0.93)*
Preoperative PDQ score	1.00 (0.99–1.01)		0.99 (0.98–1.00)*	0.99 (0.98–1.00)
EQ-5D anxiety/depression	0.81 (0.54–1.20)		0.67 (0.47–0.94)*	0.81 (0.53–1.23)
Full time work status	1.38 (0.79–2.41)		1.18 (0.71–1.95)	

†Before giving you any new medicine, hospital staff “always” described possible side effects in a way you could understand.

‡Your pain was “always” well controlled.

CI indicates confidence interval; EQ-5D, EuroQol-5 Dimensions; PDQ, Pain Disability Questionnaire; OR, odds ratio.

*P-values <0.05, which was considered statistically significant.

**P-values <0.001.

TABLE 5. Simple Unadjusted and Multivariable Adjusted Logistic Regression Analysis to Determine Patient Factors Associated With Preoperative Anxiety, Depression, and Antidepressant Use

	EQ-5D Anxiety/Depression†		Depression		Antidepressant Use‡	
	Unadjusted Odds Ratio (95% CI)	Adjusted Odds Ratio (95% CI)	Unadjusted Odds Ratio (95% CI)	Adjusted Odds Ratio (95% CI)	Unadjusted Odds Ratio (95% CI)	Adjusted Odds Ratio (95% CI)
VAS back pain	1.19 (1.08–1.33)**	1.15 (1.02–1.28)*	1.02 (0.89–1.17)		1.10 (0.98–1.23)	1.06 (0.94–1.20)
Age (y)	0.97 (0.94–0.99)*	0.97 (0.95–0.99)*	0.98 (0.96–1.00)	0.98 (0.95–1.00)	0.99 (0.97–1.01)	
Allergy	1.54 (0.99–2.38)	1.64 (1.01–2.63)*	1.59 (0.83–3.03)		1.56 (0.95–2.56)	
Environmental allergy	1.16 (0.68–2.00)		2.03 (1.06–3.89)*	2.13 (1.10–4.14)*	1.06 (0.60–1.89)	
Medical allergy	1.39 (0.92–2.13)		1.21 (0.68–2.19)		1.67 (1.04–2.68)*	1.60 (0.96–2.68)
Sex (male/female)	0.57 (0.38–0.86)*	0.66 (0.42–1.03)	0.51 (0.29–0.90)*	0.56 (0.31–0.99)*	0.39 (0.25–0.61)**	0.46 (0.28–0.75)*
Race (white/other)	0.41 (0.15–1.11)	0.45 (0.15–1.35)	0.46 (0.17–1.22)	0.44 (0.16–1.21)	0.83 (0.33–2.11)	
History of stroke	1.03 (0.99–1.06)	0.56 (0.18–1.72)	1.65 (0.52–5.19)		1.66 (0.63–4.41)	
Body mass index	1.62 (0.58–4.56)		1.01 (0.96–1.06)		1.03 (0.99–1.08)	1.04 (1.00–1.08)

†Anxiety/depression was defined as a patient selecting either “moderately anxious or depressed” or “extremely anxious or depressed” as their response on the EuroQol-5 Dimensions anxiety/depression component.

‡Active prescription for an antidepressant.

CI indicates confidence interval; Depression, clinically diagnosed depression; OR, odds ratio; VAS, Visual Analog Scale.

*P-values <0.05, which was considered statistically significant.

**P-values <0.001.

The secondary aim of our study investigated the relationship between PRAs and psychological distress in the lumbar spine surgery population. We found that patients with a PRA were significantly more likely to have anxiety and depression as measured by the EQ-5D anxiety/depression (OR, 1.64; 95% CI, 1.01–2.63). In addition, patients with environmental PRAs were more likely to have coexisting clinically diagnosed depression (OR, 2.13; 95% CI, 1.10–4.14). The association between PRAs and psychiatric disorders is well-established in the literature.^{11,12} Our multivariable logistic regression analyses also found that decreasing age and increasing VAS back pain were both associated with anxiety and depression as measured by EQ-5D, while female sex was an independent positive predictor of clinically diagnosed depression. Although the nature of depression in the aging process is multifactorial and difficult to conclusively measure, systematic review by Jorm²⁷ found that 8 of 12 studies recorded a decrease in the prevalence of major depressive disorder in the later stages of life. In addition, back pain has been strongly and consistently associated with depression.²⁸ These patient-level correlations to depression have been supported previously in the literature, validating the findings of our current study with regard to the relationship of PRAs to anxiety and depression.

It has been well-documented that preoperative depression is negatively associated with spine surgery outcomes,^{5,8} but depression has the potential to impact several other domains of the clinical experience as well.² When controlling for potential confounders, this study found that PRAs were associated with both lower patient experience measured by HCAHPS scores and greater anxiety and depression as measured by EQ-5D scores, and clinically diagnosed depression. Our results suggest that PRAs may be a complex patient characteristic with multiple potential clinical consequences that are not fully explained by their relation to affective disorders such as depression and anxiety.

Strengths and Limitations

Although this study is the first to analyze the association between PRAs and the patient perception of hospital care received as an inpatient for lumbar spine surgery, our findings must be considered in light of several limitations. First, this is a retrospective study and the 2 cohorts may have differed in unobservable ways. Second, lack of patient-reported health status measures at long-term follow-up prevented our ability to analyze whether patients with multiple allergies achieve less improvement in patient-reported clinical outcomes. Despite these limitations, this is the first study to analyze the association between PRAs and the perceived patient experience of lumbar spine surgery care and can help surgeons select for and manage patient expectations of care via a universally assessed patient characteristic.

CONCLUSIONS

We found that PRAs were associated with lower HCAHPS scores under several dimensions of the patient experience of care, including: nursing communication, pain management, communication about medicines, and transition of care. After adjusting for important patient-level covariates, patients with increasing number of medical PRAs remained less likely to be satisfied with the communication about a medication's purpose, while patient with increasing number of environmental allergies remained less likely to be satisfied with communication about a medication's purpose and satisfaction with pain control. In addition, PRAs were strongly associated with anxiety and depression as measured by both EQ-5D anxiety/depression and clinically diagnosed depression. These findings highlight the potential utility of PRAs to help spine surgeons identify patients at risk for a hospital experience that does not fully meet their needs.

REFERENCES

1. VanLare JM, Conway PH. Value-based purchasing—national programs to move from volume to value. *N Engl J Med*. 2012;367:292–295.

2. Levin JM, Winkelman RD, Smith GA, et al. The impact of preoperative Depression on Hospital Consumer Assessment of Healthcare Providers and Systems (HCAHPS) survey results in a lumbar fusion population. *Spine*. 2017;42:675–681.
3. Thiels CA, Hanson KT, Yost KJ, et al. Effect of hospital case mix on the hospital consumer assessment of healthcare providers and systems star scores: are all stars the same? *Ann Surg*. 2016;264:666–673.
4. Gaudin J, Krafcik BM, Mansour TR, et al. Considerations in spinal fusion surgery for chronic lumbar pain: psychosocial factors, rating scales, and perioperative patient education—a review of the literature. *World Neurosurg*. 2017;98:21–27.
5. Celestin J, Edwards RR, Jamison RN. Pretreatment psychosocial variables as predictors of outcomes following lumbar surgery and spinal cord stimulation: a systematic review and literature synthesis. *Pain Med Malden Mass*. 2009;10:639–653.
6. LaCaille RA, DeBerard MS, Masters KS, et al. Presurgical biopsychosocial factors predict multidimensional patient: outcomes of interbody cage lumbar fusion. *Spine J*. 2005;5:71–78.
7. Miller JA, Derakhshan A, Lubelski D, et al. The impact of preoperative depression on quality of life outcomes after lumbar surgery. *Spine J Off J North Am Spine Soc*. 2015;15:58–64.
8. Trief PM, Grant W, Fredrickson B. A prospective study of psychological predictors of lumbar surgery outcome. *Spine*. 2000;25:2616–2621.
9. Adogwa O, Parker SL, Shau DN, et al. Preoperative Zung depression scale predicts patient satisfaction independent of the extent of improvement after revision lumbar surgery. *Spine J Off J North Am Spine Soc*. 2013;13:501–506.
10. Chapin L, Ward K, Ryken T. Preoperative depression, smoking, and employment status are significant factors in patient satisfaction after lumbar spine surgery. *Clin Spine Surg*. 2016;30:E725–E732.
11. Hurwitz EL, Morgenstern H. Cross-sectional associations of asthma, hay fever, and other allergies with major depression and low-back pain among adults aged 20–39 years in the United States. *Am J Epidemiol*. 1999;150:1107–1116.
12. Patten SB, Williams JVA. Self-reported allergies and their relationship to several axis I disorders in a community sample. *Int J Psychiatry Med*. 2007;37:11–22.
13. Graves CM, Otero JE, Gao Y, et al. Patient reported allergies are a risk factor for poor outcomes in total hip and knee arthroplasty. *J Arthroplasty*. 2014;29:147–149.
14. Hinarejos P, Ferrer T, Leal J, et al. Patient-reported allergies cause inferior outcomes after total knee arthroplasty. *Knee Surg Sports Traumatol Arthrosc Off J ESSKA*. 2016;24:3242–3246.
15. McLawhorn AS, Bjerke-Kroll BT, Blevins JL, et al. Patient-reported allergies are associated with poorer patient satisfaction and outcomes after lower extremity arthroplasty: a retrospective cohort study. *J Arthroplasty*. 2015;30:1132–1136.
16. Otero JE, Graves CM, Gao Y, et al. Patient-reported allergies predict worse outcomes after hip and knee arthroplasty: results from a prospective cohort study. *J Arthroplasty*. 2016;31:2746–2749.
17. Rosenthal BD, Knesek MJ, Kahlenberg CA, et al. Shoulder arthroplasty outcomes in patients with multiple reported drug allergies. *Orthop J Sports Med*. 2016;4:2325967116671501.
18. Delanois RE, Gwam C, Mistry JB, et al. Does length of stay influence how patients rate their hospitalization after total hip arthroplasty? *Surg Technol Int*. 2017;30:393–398.
19. Delanois RE, Gwam CU, Mistry JB, et al. Does gender influence how patients rate their patient experience after total hip arthroplasty? *Hip Int J Clin Exp Res Hip Pathol Ther*. 2017;28:40–43.
20. Gwam CU, Mistry JB, Mohamed N, et al. Does age influence how patients rate their experience of care after total knee arthroplasty? *J Knee Surg*. 2017;30:647–651.
21. Centers for Medicare & Medicaid Services. HCAHPS Patient Level Correlations: 2015. Available at: www.hcahpsonline.org. Accessed November 1, 2016.
22. Bae HW, Rajae SS, Kanim LE. Nationwide trends in the surgical management of lumbar spinal stenosis. *Spine*. 2013;38:916–926.
23. Rajae SS, Bae HW, Kanim LEA, et al. Spinal fusion in the United States: analysis of trends from 1998 to 2008. *Spine*. 2012;37:67–76.
24. Yoshihara H, Yoneoka D. National trends in the surgical treatment for lumbar degenerative disc disease: United States, 2000 to 2009. *Spine J Off J North Am Spine Soc*. 2015;15:265–271.
25. Doyle C, Lennox L, Bell D. A systematic review of evidence on the links between patient experience and clinical safety and effectiveness. *BMJ Open*. 2013;3:e001570.
26. Kennedy GD, Tevis SE, Kent KC. Is there a relationship between patient satisfaction and favorable outcomes? *Ann Surg*. 2014;260:592–600.
27. Jorm AF. Does old age reduce the risk of anxiety and depression? A review of epidemiological studies across the adult life span. *Psychol Med*. 2000;30:11–22.
28. Currie SR, Wang J. Chronic back pain and major depression in the general Canadian population. *Pain*. 2004;107:54–60.