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Clinical Studies

Correlation of Patient Reported Satisfaction With Adverse Events Following Elective Posterior Lumbar Fusion Surgery: A Single Institution Analysis☆

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ABSTRACT

Background: With increasing emphasis on patient satisfaction metrics, such as the Hospital Consumer Assessment of Healthcare Providers and Systems (HCAHPS) survey, hospital reputations and reimbursements are being affected by their results. The purpose of the current study is to determine if post-operative self-reported patient satisfaction differed among patients who experienced any adverse event (AAE) following elective posterior lumbar fusion (PLF) surgery compared to those who did not.

Methods: Patients who underwent elective PLF surgery performed at a single institution between February 2013 and May 2020 and returned an HCAHPS survey following discharge were included in the retrospective cohort analysis. Demographic, comorbidity, and HCAHPS survey data were compared between patients who did and did not experience any adverse event (AAE) in the 30-days postoperatively.

Results: Of 5,117 PLF patients, the HCAHPS survey was returned by 1,071 patients, of which 30-day AAE was experienced by 40 (3.73%). Of those that experienced AAE, the survey response rate was significantly lower (13.94% versus 21.35%, p=0.003). Those responding reported lower scores pertaining to if medication side-effects were adequately explained (22.22% versus 52.56%, p=0.002) and if post-discharge care was adequately explained (79.17% versus 93.76%, p=0.005), as well as overall top-box responses (67.62% versus 75.93% survey average, p<0.001).

Conclusions: Patients experiencing AAE after elective PLF surgery are less likely to respond to surveys about their hospital experience. For those who did respond, they report less satisfaction with multiple aspects of their hospital care measured by the HCAHPS survey. Understanding how postoperative adverse events impact patients' perception of healthcare quality provides insight into what patients value and has implications for optimizing their care.

Background

Self-reported patient satisfaction has become a central metric in the evaluation of health care quality [1–3]. Because of this focus on patient satisfaction, the Hospital Consumer Assessment of Healthcare Providers and Systems (HCAHPS) was created as a national, standardized survey for recording patient perceptions of hospital care, and currently more than 4000 hospitals participate in HCAHPS. [4,5] The HCAHPS survey can affect a hospital's reputation due to mandatory public reporting of scores, and part of hospitals' Medicare compensation is now linked to HCAHPS performance. [6,7]

Prior spine studies have noted several factors to be predictive of patient satisfaction as measured by the HCAHPS survey [8]. For example, one study demonstrated that preoperative depression was negatively associated with several domains of patient satisfaction in cervical and lumbar spine populations. [9,10] Another study of 391 lumbar spine patients identified prolonged length of hospital stay to be associated with decreased likelihood of top-box responses on several HCAHPS domains [11]. Yet another study identified overall health, undergoing non-elective procedures, and cervical (compared to lumbar) spine surgeries to be associated with lower rates of top-box HCAHPS scores [12].

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Despite the above studies, the potential association of postoperative adverse events for association with HCAHPS scores have not been evaluated. Complications, as well as other related measures such as discharge disposition, readmissions, and reoperations, have been widely used to evaluate quality of health care [13–15]. Despite the frequent of use of both complications and HCAHPS in measurement of health care quality, the relationship between HCAHPS scores and occurrence of complications in spine surgery is not yet fully understood.

Based on the above-identified knowledge gap for elective posterior lumbar fusions (PLF), the current study sought to provide insight into this relationship between any adverse event (AAE) and postoperative HCAHPS scores. Understanding this relationship is hoped to provide guidance in optimizing clinical care processes to optimize satisfaction in those at greatest risk for lesser satisfaction.

Methods

Study Population

Following approval by our Institutional Review Board, patients who underwent inpatient, elective posterior lumbar surgery at a single tertiary Northeast academic hospital between February 2013 and May 2020 were selected for retrospective analysis. All patients during this time period had been sent the HCAHPS questionnaire.

Patients were identified using Current Procedural Terminology (CPT) codes consistent with prior studies [16]. Specifically, posterior decompression only (posterior lumbar laminectomy/ laminotomy) cases were identified using CPT codes 63005, 63017, 63012, 63030, 63035, 63042, 63044, 63047, and 63048. Posterolateral fusion (±decompression) without interbody cases were identified and included using CPT codes 22612 and 22614. Posterior interbody posterior lumbar fusion (±decompression) cases were identified and included using CPT codes 22630, 22632, 22633, and 22634.

Cases involving concomitant anterior fusion or deformity procedures were excluded based on CPT codes. Patients who underwent surgery for non-elective indications, less than 18 years old, outpatient surgery, or failed to return an HCAHPS survey were also excluded from subsequent analysis.

Patient characteristics that were collected included: age, sex, height and weight, American Society of Anesthesiologists (ASA) class, preoperative functional status, and race. Height and weight were used to calculated body mass index (BMI).

Perioperative Outcomes

Patients were stratified into two groups: those who experienced any adverse event (AAE) in the 30-day postoperative period following posterior lumbar spine surgery, and those that did not. Adverse event data was recorded by our institution's National Surgical Quality Improvement Program (NSQIP) team, which is composed by a team of nurses specifically trained in collecting perioperative data on patients [17].

Adverse events analyzed included those that are routinely collected for NSQIP, and were aggregated into serious adverse event (SAE) and minor adverse event (MAE) based on schemas used previously in the literature [18–20]. AAE was noted if any of these occurred.

Additional thirty-day perioperative outcomes analyzed included: hospital length of stay, discharge disposition (home versus other location), hospital readmission, and reoperation. These perioperative outcomes were analyzed separately and did not count towards the aforementioned adverse events.

HCAHPS Survey Responses

At our institution, patients who have an inpatient stay are sent an HCAHPS survey following discharge. The HCAHPS survey includes a series of Likert-style questions that probe different aspects of the patient's hospital care. Returned surveys were collected and patient response data was extracted by the hospital's HCAHPS staff.

Aspects of care included on the survey include: care from nurses, care from doctors, the hospital environment, experiences in the hospital, leaving the hospital, understanding care once discharged, and the patient's overall rating of the hospital.

Data Analysis

Preoperative and perioperative data, in addition to HCAHPS survey response scores were statistically compared between the two groups. For univariate analyses, chi-squared tests were used for categorical variables, and independent t-tests were used for continuous variables.

Consistent with CMS reporting [5,21], the percentage of "top-box" scores were determined for each HCAHPS question. A "top-box" response represents the most positive response to a particular HCAHPS question on the survey. CMS tabulates "top-box" HCAHPS responses for reimbursement purposes [22].

More specifically, the "top-box" response is "Always" for four HCAHPS composite subsections (Communication with Nurses, Communication with Doctors, Responsiveness of Hospital Staff, and Communication about Medicines) and two individual items (Cleanliness of Hospital Environment and Quietness of Hospital Environment), "Yes" for the Discharge Information composite subsection, "'9' or '10' (high)" for the Overall Hospital Rating item, "Definitely yes" for the Recommend the Hospital item, and "Strongly agree" for the Care Transition composite subsection.

Total number of top-box response rates were determined for individual HCAHPS survey questions. Instances where patients did not fill out a particular question were considered missing data, and excluded from statistical analysis. Top-box response rates for composite sections of the survey were calculated by summing the total number of top-box responses for all questions in a given subsection of the survey, and dividing the sum by the number of questions filled out in that survey subsection. Aggregated subsection top-box scored were compared patients who experienced an adverse event versus those that did not.

Statistical significance for all analyses was set at α=0.05. Analysis was performed using IBM SPSS Statistics, version 26 (IBM Corp., Armonk, N.Y., USA).

Results

Population Demographics

5,117 posterior lumbar surgeries were performed during the study period. In total, 1,071 posterior lumbar patients met inclusion criteria for the study and returned the HCAHPS survey (20.93%). Of these 1,071 HCAHPS responders, 40 (3.73%) experienced an adverse event. Compared to those that did not experience an AAE, AAE patients were older (67.73 years versus 63.59 years, p=0.041), had a higher comorbidity burden (62.50% had ASA class III versus 39.09%; p=0.009), and had a greater proportion of patients who were partially or fully functionally dependent (12.50% versus 1.07%, p<0.001). No differences were observed between the two cohorts based on sex, BMI, or race (Table 1). Demographics were further compared between patients who experienced a SAE versus a MAE. ASA distribution and pre-operative functional status was significantly different between the two groups (p=0.023 and p<0.001 respectively, Supplemental Table 1).

Perioperative Outcome Analyses

The rate of occurrence of individual and aggregated adverse outcomes are presented in Table 2. In total, there were 21 patients who experienced an SAE and 22 who experienced an MAE in the 30-day postoperative period, which equated to 40 unique patients who experienced any adverse event among the 1,071 patients (3.73%).

Table 1
Demographics of HCAHPS patients undergoing elective posterior lumbar surgery organized by adverse event occurrence.

	Total N = 1,071 (100%)	No Adverse Event N = 1,031 (96.27%)	Any Adverse Event N = 40 (3.73%)	Univariate P-value
Age: Mean [SD]	63.75 [12.56]	63.59 [12.60]	67.73 [10.91]	**0.041**
18 - 34	31 (2.89%)	30 (2.91%)	1 (2.50%)	
35 - 54	207 (19.33%)	203 (19.69%)	4 (10.00%)	
55 - 74	638 (59.57%)	611 (59.26%)	27 (67.50%)	
≥ 75	195 (18.21%)	187 (18.14%)	8 (20.00%)	
Sex				0.085
Male	571 (53.31%)	555 (53.83%)	16 (40.00%)	
Female	500 (46.69%)	476 (46.17%)	24 (60.00%)	
BMI: Mean [SD]	29.44 [5.75]	29.37 [5.61]	31.21 [8.54]	0.182
< 25	234 (21.85%)	223 (21.63%)	11 (27.50%)	
25 - 30	390 (36.41%)	382 (37.05%)	8 (20.00%)	
30 - 35	279 (26.05%)	269 (26.09%)	10 (25.00%)	
> 35	166 (15.50%)	155 (15.03%)	11 (27.50%)	
ASA				**0.009**
. 1	56 (5.23%)	56 (5.43%)	0 (0.00%)	
. 2	578 (53.97%)	564 (54.70%)	14 (35.00%)	
. 3	428 (39.96%)	403 (39.09%)	25 (62.50%)	
4+	9 (0.84%)	8 (0.78%)	1 (2.50%)	
Functional Status (prior to surgery):				**< 0.001**
Independent	1,055 (98.51%)	1,020 (98.93%)	35 (87.50%)	
Partially/Totally dependent	16 (1.49%)	11 (1.07%)	5 (12.50%)	
Race				0.092
White	969 (90.48%)	934 (90.59%)	35 (87.50%)	
Black/African American	36 (3.36%)	32 (3.10%)	4 (10.00%)	
Asian	8 (0.75%)	8 (0.78%)	0 (0.00%)	
Unknown/Not Reported	58 (5.42%)	57 (5.53%)	1 (2.50%)	

Bolding indicates statistical significance at p<0.05
ASA = American Society of Anesthesiologists classification

Table 2
Adverse event profiles among all patients following elective posterior lumbar surgery, organized by adverse event occurrence.

	Total N = 1,071 (100%)	No Adverse Event N = 1,031 (96.27%)	Any Adverse Event N = 40 (3.73%)	Univariate P-Value
Serious Adverse Events	21 (1.96%)	0 (0.00%)	21 (52.50%)	–
Deep Infection	2 (0.19%)	0 (0.00%)	2 (5.00%)	–
Sepsis/Septic shock	3 (0.28%)	0 (0.00%)	3 (7.50%)	–
Ventilator >48 hrs	2 (0.19%)	0 (0.00%)	2 (5.00%)	–
Unplanned Intubation	0 (0.00%)	0 (0.00%)	0 (0.00%)	–
Acute Renal Failure	1 (0.09%)	0 (0.00%)	1 (2.50%)	–
Deep Vein Thrombosis	5 (0.47%)	0 (0.00%)	5 (12.50%)	–
Pulmonary Embolism	9 (0.84%)	0 (0.00%)	9 (22.50%)	–
Cardiac Arrest	0 (0.00%)	0 (0.00%)	0 (0.00%)	–
MI	1 (0.09%)	0 (0.00%)	1 (2.50%)	–
Stroke	1 (0.09%)	0 (0.00%)	1 (2.50%)	–
Minor Adverse Events	22 (2.05%)	0 (0.00%)	22 (55.00%)	–
Superficial Infection	3 (0.28%)	0 (0.00%)	3 (7.50%)	–
Wound Disruption	1 (0.09%)	0 (0.00%)	1 (2.50%)	–
Pneumonia	5 (0.47%)	0 (0.00%)	5 (12.50%)	–
UTI	13 (1.21%)	0 (0.00%)	13 (32.50%)	–
Progressive Renal Insufficiency	0 (0.00%)	0 (0.00%)	0 (0.00%)	–
Hospital length of stay, days [SD]	2.85 [1.95]	2.73 [1.70]	5.93 [4.20]	**< 0.001**
Discharge Disposition				**< 0.001**
Home	852 (79.55%)	835 (80.99%)	17 (42.50%)	
Other	219 (20.45%)	196 (19.01%)	23 (57.50%)	
Readmissions	46 (4.30%)	32 (3.10%)	14 (35.00%)	**< 0.001**
Reoperation	21 (1.96%)	13 (1.26%)	8 (20.00%)	**< 0.001**

*Case percentages will not sum to 100% because patients may have experienced more than one of the above

Patients who experienced AAE had a higher incidence of 30-day readmission (35.00% versus 3.10%; p<0.001), reoperation (20.00% versus 1.26%; p<0.001), higher rates of discharge to places other than home (57.50% versus 19.01%; p<0.001), and longer hospital lengths of stay (mean 5.93 days versus 2.73 days; p<0.001).

HCAHPS Survey Results

Of the 5,117 PLF patients eligible for study analysis, 1,071 had returned the HCAHPS for an overall response rate of (20.93%). The overall HCAHPS survey return rate among PLF was significantly lower for those who had AAE (13.9% response rate in the AAE group versus 21.3% in the non-AAE group, p=0.003). Responses were evaluated between patients who experienced AAE versus those who did not for the 21 Likert-style HCAHPS questions on the survey. Among HCAHPS responders, completion of the entire survey ranged from 64% – 100% of the analyzed questions. 90% of the respondents completed 80% or more of their returned survey, and the mean survey completion among HCAHPS responders was 89.96% ± 12.06%.

Top-box HCAHPS response rates for those who did not and did have AAE are shown by question in Table 3 and Figure 1. Those without

Table 3
Number of top-box responses on each question of the HCAHPS survey for patients undergoing elective posterior lumbar surgery, organized by occurrence of adverse events.

Survey Question	Total N = 1,071 (100%)	No Adverse Event N = 1,031 (96.27%)	Any Adverse Event N = 40 (3.73%)	P-value
Care from Nurses				
Q1: How often did nurses treat you with courtesy and respect?	968 (91.67%)	934 (91.93%)	34 (85.00%)	0.120
Q2: How often did nurses listen carefully to you?	858 (81.64%)	830 (82.02%)	28 (71.79%)	0.106
Q3: How often did nurses explain things in a way you could understand?	841 (80.10%)	812 (80.40%)	29 (72.50%)	0.220
Q4: After you pressed the call button, how often did you get help as soon as you wanted it?	666 (69.81%)	643 (70.04%)	23 (63.89%)	0.430
Care From Doctors				
Q5: How often did doctors treat you with courtesy and respect?	945 (90.09%)	912 (90.39%)	33 (82.50%)	0.102
Q6: How often did doctors listen carefully to you?	876 (83.91%)	845 (84.16%)	31 (77.50%)	0.261
Q7: How often did doctors explain things in a way you could understand?	851 (81.98%)	822 (82.36%)	29 (72.50%)	0.111
The Hospital Environment				
Q8: How often were your room and bathroom kept clean?	791 (75.48%)	762 (75.60%)	29 (72.50%)	0.655
Q9: How often was the area around your room quiet at night?	592 (56.76%)	570 (56.83%)	22 (55.00%)	0.819
Experiences in the Hospital				
Q10: How often did you get help in getting to the bathroom or in using a bedpan as soon as you wanted?	571 (73.49%)	548 (73.85%)	23 (65.71%)	0.286
Q11: How often was your pain well controlled?	507 (62.13%)	489 (62.13%)	18 (62.07%)	0.994
Q12: How often did the hospital staff do everything they could to help you with your pain?	674 (82.50%)	651 (82.61%)	23 (79.31%)	0.646
Q13: How often did hospital staff tell you what new medicine was for?	602 (81.46%)	583 (81.88%)	19 (70.37%)	0.131
Q14: How often did hospital staff describe possible side effects in a way you could understand?	375 (51.44%)	369 (52.56%)	6 (22.22%)	**0.002**
Leaving the Hospital				
Q15: Did doctors, nurses or other hospital staff talk with you about whether you would have the help you needed when you left?	837 (92.69%)	813 (92.60%)	24 (96.00%)	0.519
Q16: Did you get information in writing about what symptoms or health problems to look out for after you left the hospital?	831 (93.37%)	812 (93.76%)	19 (79.17%)	**0.005**
Understanding Care Once Discharged				
Q17: Staff took my preferences and those of my family or caregiver into account in deciding what my health care needs would be when I left.	568 (54.67%)	549 (54.85%)	19 (50.00%)	0.556
Q18: When I left the hospital, I had a good understanding of the things I was responsible for in managing my health.	606 (58.16%)	589 (58.72%)	17 (43.59%)	0.060
Q19: When I left the hospital, I clearly understood the purpose for taking each of my medications.	610 (64.48%)	592 (64.70%)	18 (58.06%)	0.448
Overall Rating of Hospital				
Q20: Using any number from 0 to 10, what number would you use to rate this hospital during your stay?	802 (76.45%)	775 (76.73%)	27 (69.23%)	0.279
Q21: Would you recommend this hospital to your friends and family?	854 (81.26%)	826 (81.70%)	28 (70.00%)	0.063

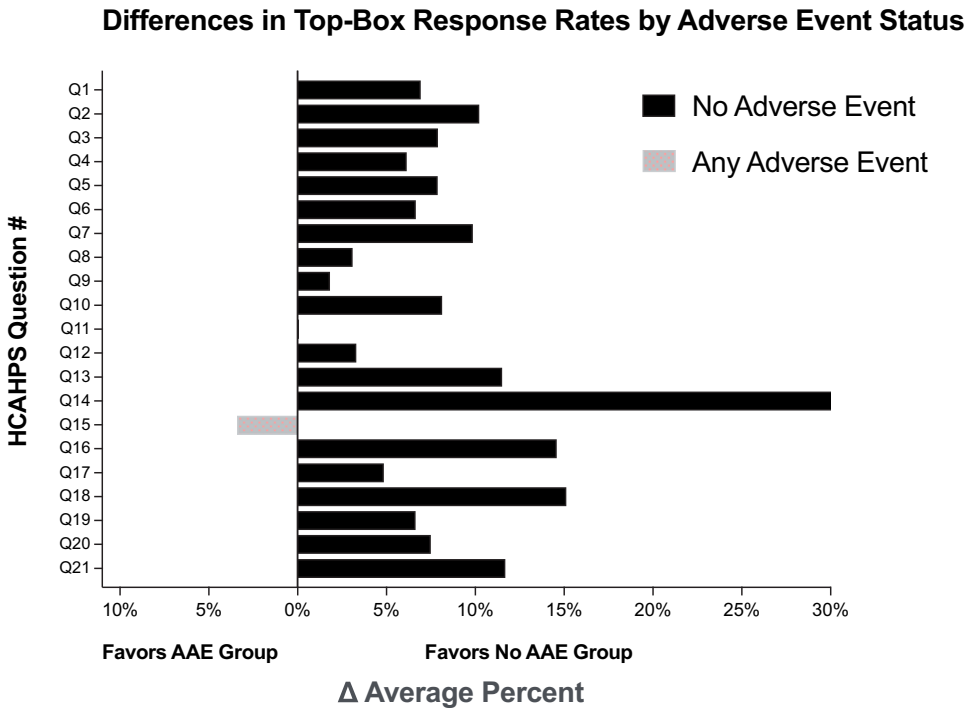

Figure 1. Compared to patients who did not experience AAE, those that experienced AAE generally resulted in more negative HCAHPS responses. Patients who experienced AAE gave lower rates of top-box responses to 20 of 21 questions.

Table 4
Number of top-box responses on each section of the HCAHPS survey for patients undergoing elective posterior lumbar surgery.

Section of Survey N = 1,071 (100%)	No Adverse Event N = 1,031 (96.27%)	Any Adverse Event N = 40 (3.73%)	P-value
Total HCAHPS Survey	**14,726 (75.93%)**	**499 (67.62%)**	**< 0.001**
Care from Nurses	3,219 (81.37%)	114 (73.55%)	**0.015**
Care From Doctors	2,579 (85.65%)	93 (77.50%)	**0.013**
The Hospital Environment	1,332 (66.24%)	51 (63.75%)	0.645
Experiences in the Hospital	2,640 (70.76%)	89 (60.54%)	**0.008**
Leaving the Hospital	1,625 (93.18%)	43 (87.76%)	0.142
Understanding Care Once Discharged	1,730 (59.27%)	54 (50.00%)	0.055
Overall Rating of Hospital	1,601 (79.22%)	55 (69.62%)	**0.040**

AAE scored higher top-box percentages on 20 of 21 (95.24%) HCAHPS questions analyzed (Figure 1).

Of the above differences, two of the questions had significantly higher top-box responses for those without AAE: “How often did hospital staff describe possible side effects in a way you could understand?”, (22.22% versus 52.56%; p=0.002), and “Did you get information in writing about what symptoms or health problems to look out for after you left the hospital?”, (79.17% versus 93.76%; p=0.005). Survey questions analyzed and top-box response rates can be seen in Table 3.

Survey question responses were grouped according to their survey section and aggregated top-box response scores were compared between the two patient cohorts (Table 4). Top-box response rates across the entire HCAHPS survey were statistically significantly lower among AAE patients (67.62% versus 75.93%, p<0.001). Top-box response rates were lower among AAE patients in each of the survey subsections of the survey, three of which achieved statistical significance: “Care from Nurses” (73.55% versus 81.37%, p=0.015), “Care from Doctors” (77.50% versus 85.65%, p=0.013), “Experiences in the Hospital” (60.54% versus 70.76%, p=0.008), and “Overall Rating of the Hospital” (69.62% versus 79.22%, p=0.040).

Discussion

There are continued efforts to optimize patient outcomes and satisfaction following elective posterior lumbar surgery [23–26]. In an effort to better understand how clinical outcomes are associated with patient satisfaction as measured by HCAHPS scores, the present study evaluated HCAHPS scores in the context of those who did and did not have any adverse event (AAE) following elective posterior lumbar surgery.

Of the 1,071 patients that responded to the HCAHPS survey, the response rate was significantly lower among patients that experienced AAE, with a 13.9% response rate in the AAE group versus 21.3% in the non-AAE group. This non-response bias for those who have AAE is consistent with a prior related study [18]. In fact, the overall national HCAHPS response rate has been quoted to be 24% and this has been documented to be declining over the years [27,28].

The current study used established techniques of analyzing the HCAHPS surveys based on top-box scores and grouping of questions into subsections. [29,30] Overall, those that had AAE had lower total HCAHPS scores (approximately an 8% lower top-box responses, p < 0.001). Two studies involving general adult inpatient populations demonstrated significantly lower HCAHPS scores among patients who experienced postoperative adverse events. [31,32] To our knowledge, this study is the first to determine a correlation between self-reported postoperative patient satisfaction and adverse events following spine surgery. Day et al. sought to examine the effect of hospital-acquired conditions on HCAHPS scores amongst a heterogenous group of orthopedic surgery patients [33]. Interestingly, Day et al. did not demonstrate any statistically significant difference in patient satisfaction scores amongst patients experiencing adverse events that occurred during their hospital stay.

Two specific questions on the survey had statistically significant differences in top-box responses: “How often did hospital staff describe possible side effects in a way you could understand?” and “Did you get information in writing about the symptoms or health problems to look out for after you left the hospital?” Low top-box response rate in both questions suggest that communication issues warrant further attention and represent potentially modifiable areas to improve patient satisfaction. Effective communication between patient and provider has been shown to improve health outcomes and patient satisfaction in several studies [34–36].

With regards to medication side effects, a prior study by Forster et al. analyzed top-box survey response rates to demonstrate an association between patient experience and adverse drug events following posthospital discharge [37]. Similarly, the current study suggests that providers’ explanations of medication side effects, in addition to communication regarding expectations after discharge may be a source of dissatisfaction among patients who experience a postoperative event. These concordant themes highlight the importance of properly preparing patients in anticipation of discharge in achieving satisfaction following spine surgery.

There are limitations associated with the current study. Most notably, the response rates are low for the HCAHPS surveys, but that is an issue discussed above and inherent to HCAHPS survey data in general. Further, the relatively low rate of adverse events observed (3.73%) limited the power for related analyses. Although this rate is lower than is sometimes reported, [38] it is important to note that the current study involves only spine surgery patients who completed and returned the HCAHPS survey. Prior work has noted that patients who experience adverse events are less likely to return the HCAHPS survey, which likely contributes to the lower than expected adverse event rate in the current study population [18]. Given the low rate of adverse events among survey responders, the current study was not adequately powered to assess for an independent association between adverse event occurrence and HCAHPS score. However, the analysis of survey response data presented here is in-line and conducted in a similar fashion to prior studies examining HCAHPS survey data. [30,39] Lastly, as a single institution study at a tertiary academic hospital, the results may not be fully generalizable to a national spine surgery population. Prior research has demonstrated differences in demographics, insurance types, and comorbidity burden among patients being treated at academic medical centers versus nonteaching hospitals [40].

Nonetheless, the current study has important implications for addressing patient satisfaction following posterior lumbar fusion. While communication is important for all patients, those who sustain an adverse event seem to need even further attention in this area. There are no doubts that with limitations in the administration, collection, and analysis of HCAHPS surveys, understanding how postoperative adverse events impact patients’ perception of healthcare quality may help optimize care plans and healthcare delivery.

Declaration of Competing Interest

One or more authors declare potential competing financial interests or personal relationships as specified on required ICMJE-NASSJ Disclosure Forms. (J.N.G.) discloses that he has a publishing role with NASS with compensation and is a board member of both NASS and LSRS. For the remaining authors none were declared.

Summary Sentence

Patients who experienced an adverse event after posterior lumbar fusion surgery were less likely to return the survey and reported less satisfaction with multiple aspects of their care.

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Supplementary materials

Supplementary material associated with this article can be found, in the online version, at doi:10.1016/j.ejps.2020.105216.

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