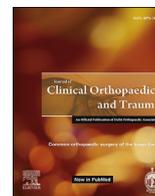




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Factors associated with early postoperative survey completion in orthopaedic surgery patients



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ABSTRACT

Purpose: To determine factors associated with survey compliance 2-weeks postoperatively.

Methods: 1269 patients age 17-years and older participating in the Maryland Orthopaedic Registry from August 2015–March 2018 were administered a baseline questionnaire preoperatively and emailed a follow-up questionnaire 10-days postoperatively. Demographics were self-reported and medical records reviewed for relevant medical history.

Results: 609 patients (48.0%) completed both the baseline and 2-week surveys. A decreased likelihood of 2-week survey completion was seen in patients who identified as black, smokers, patients without a college education, patients who were unmarried, unemployed, had a lower income, or covered by government-sponsored insurance ($p < 0.05$). Other preoperative variables significantly associated with decreased likelihood of completion included surgery on the right side, upper extremity surgery, pre-operative opioid use, no specific injury leading to surgery, lower preoperative expectations, depression and fatigue symptoms, and worse pain, function, and activity scores ($p < 0.05$). Multivariable analysis confirmed race, operative extremity, education, insurance status, smoking, activity level, and pain scores were independent predictors of survey completion.

Conclusion: Several demographic and preoperative variables are associated with survey completion 2-weeks post-orthopaedic surgery. The results provide insight into patient populations that may be targeted in order to assure higher survey compliance and improve analysis of patient-reported outcomes.

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1. Introduction

As we shift towards a more patient-centric model of delivering healthcare, incorporating patient perception into quantifying clinical success has been a recent theme in all aspects of medicine. Within orthopaedic surgery, the increase in elective procedures in the US over the last 20 years¹ has led to a shift from the use of traditional outcome measures to patient-reported outcomes.² This emphasis on patient-reported outcome measures has increased our understanding of how patients determine their surgical success.³ In addition, physician payer models that incorporate patient perception during the postoperative time period have changed the landscape of how orthopaedic surgeons are reimbursed.⁴ In light of these changes, orthopaedic surgeons and researchers are becoming

increasingly interested in factors that may affect patient survey completion.

Although increasingly utilized, there are certain limitations in the use of patient-reported outcome measures in orthopaedic research and practice. A low survey compliance rate and discrepancies in patient populations can make interpreting survey results challenging. These discrepancies can be due to both baseline population differences, as well as non-response bias, where the makeup of the group that completes their follow-up surveys is different than the makeup of the non-responders. These drawbacks in patient-reported outcomes can lead to misinterpretations of short and long-term surgical success. Recognition of the factors associated with non-compliance can allow researchers to target these individuals specifically, thus potentially impacting completion rates.

Although there is very limited data on patient-reported survey completion rate, other studies have shown that there are demographic differences when it comes to actual clinical follow-up. Whiting et al. found that tobacco use and insurance status—both factors we found to be associated with survey completion

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rate—were significantly associated with decreased likelihood of following up for the first clinic visit after orthopaedic trauma surgery.⁵ Tobacco was also a significant factor in a study done by Coleman et al., showing that current tobacco users were less likely to attend scheduled orthopaedic outpatient management following presentation to the emergency department with an orthopaedic injury.⁶ However, there is currently no data regarding what determines survey compliance in the early postoperative period in orthopaedic surgery patients. Our study aims to address this problem by determining if there are specific demographic and/or surgical factors associated with survey compliance at 2 weeks postoperatively. Based on the limited existing literature, we hypothesized that compliance would be associated with socioeconomic status and smoking.

2. METHODS

2.1. Patients and patient-reported outcomes

The Maryland Orthopaedic Registry (MOR) is an IRB-approved, web-based registry that includes patients 12 years and older undergoing extremity orthopaedic surgery at a single institution.⁷ All patients provided informed consent to participate. Patients registered in MOR between August 2015 and March 2018 were included in our study. Patients were excluded from our study if they were less than 17 years-old, unable to read or write English, or if they were incarcerated. All study data was collected using the Research Electronic Data Capture (REDCap™) data collection system. Enrolled patients' demographic data was self-reported and each medical record was reviewed for relevant medical history.

The questionnaires were designed as described by Henn et al.⁷ Enrolled patients were preoperatively administered six Patient-Reported Outcomes Measurement Information System (PROMIS) computer adaptive testing questionnaires, including Physical Function, Pain Interference, Fatigue, Social Satisfaction, Anxiety, and Depression. Patients were also given a joint-specific PRO tool depending on their operative site. These included the International Knee Documentation Committee (IKDC) Subjective Knee Evaluation Form, American Shoulder and Elbow Surgeons (ASES) Shoulder Assessment Form, and the Brief Michigan Hand Questionnaire (BMHQ).

Pain level was assessed through two Numeric Pain Scales (NPS), one for pain level in the body overall and one for pain level in the specific surgical site. The Musculoskeletal Outcomes Data Evaluation and Management System (MODEMS) expectations questionnaire was used to evaluate patients' pre-treatment expectations on a scale of 0–100. Patient activity levels were measured using the International Physical Activity Questionnaire (IPAQ), Tegner Activity Scale (TAS), and Marx Activity Rating Scales (ARS). Patients reported their TAS score for pre-injury, as well as preoperatively at baseline. ARS scores were reported for both the lower and upper extremity. Overall survey completion time usually ranged from 10 to 30 min per patient.⁷

Patients were emailed 10 days after surgery with a unique link to complete the follow-up questionnaires. Two additional reminder emails were sent to patients who did not respond to the initial survey invitation email. In addition to the same questionnaires administered preoperatively, patients were asked about met expectations, satisfaction, and improvement. The link for the survey remained open until 21 days after surgery.

2.2. Statistical analysis

Chi-squared tests were run to analyze categorical demographic variables and their effect on response rate. Equality of variances

were assessed for continuous variables using the Folded-F test. Pooled T tests were used to analyze continuous variables with equal variances and Satterthwaite T tests were used to analyze continuous variables with unequal variances. A stepwise logistic regression multivariable analysis was performed to identify independent predictors of 2-week survey completion. All independent variables with $p < 0.10$ on univariate analysis were included in the initial model. The analyses were done using SAS Version 9.4 (SAS Institute Inc., Cary, NC).

3. RESULTS

3.1. Comparison of categorical patient demographic variables

Our study population included a total of 1269 patients (Fig. 1). Of those, 660 (52.0%) completed only their baseline surveys (baseline-only group), while 609 (48.0%) completed both the baseline and 2-week surveys (completion group). Table 1 describes differences in follow-up based on demographic variables. Race was significantly associated with 2-week completion ($p < 0.0001$). Patients who identified as white were more likely to complete their 2-week surveys. 68.4% of patients who completed both the baseline and 2-week surveys identified as white, while only 49.7% of those who

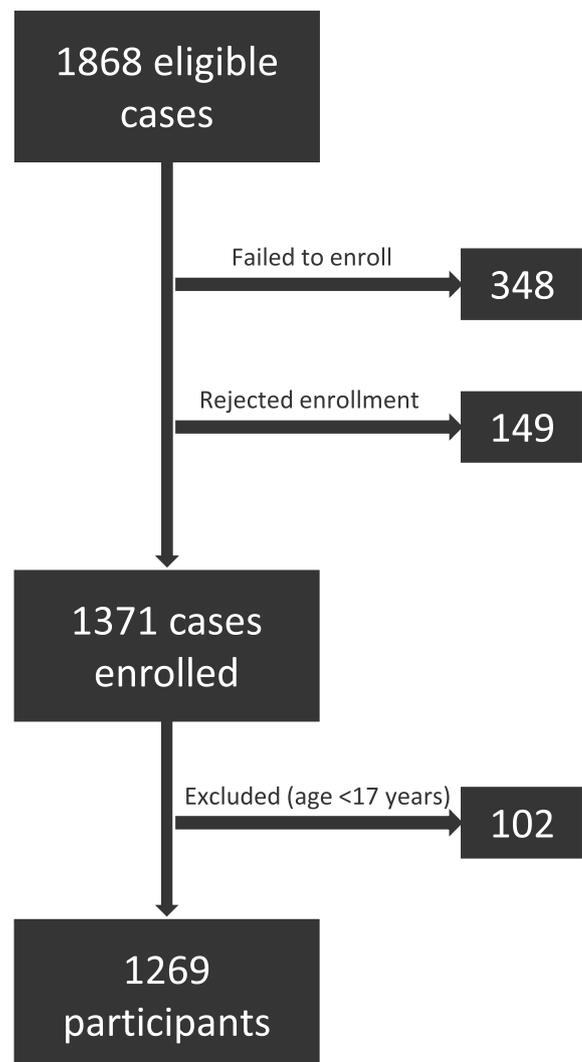


Fig. 1. Participant Flow Diagram, August 2015 –March 2018.

Table 1
Comparison of categorical patient demographic variables in patients undergoing orthopaedic surgery.

	Baseline-Only Group	Completion Group	χ^2 p-value
Gender (n = 1269)			
Female	297 (45.0%)	279 (45.8%)	0.77
Male	363 (55.0%)	330 (54.2%)	
Ethnicity (n = 1237)			
Hispanic or Latino	30 (4.7%)	33 (5.5%)	0.49
NOT Hispanic or Latino	611 (95.3%)	563 (94.5%)	
Race (n = 1238)			
Black	259 (40.5%)	135 (22.6%)	<0.0001
White	318 (49.7%)	409 (68.4%)	
Other	63 (9.8%)	54 (9.0%)	
Operative Extremity^a (n = 1269)			
Lower Extremity	335 (50.8%)	343 (56.3%)	0.047
Upper Extremity	325 (49.2%)	266 (43.7%)	
Laterality^b (n = 1265)			
Left	293 (44.5%)	315 (52.0%)	0.008
Right	360 (54.6%)	290 (47.9%)	
Bilateral	6 (0.9%)	1 (0.2%)	
Previous Surgeries on Operative Joint (n = 1258)			
No	480 (73.5%)	458 (75.7%)	0.37
Yes	173 (26.5%)	147 (24.3%)	
ASA Score (n = 1242)			
1	224 (34.6%)	228 (38.3%)	0.14
2	379 (58.6%)	328 (55.1%)	
3	40 (6.2%)	39 (6.6%)	
4	4 (0.6%)	0 (0.0%)	
Education (n = 1248)			
Not a College Graduate	395 (61.1%)	278 (46.3%)	<0.0001
College Graduate	252 (39.0%)	323 (53.7%)	
Marital Status (n = 1251)			
Not Married	384 (59.1%)	314 (52.3%)	0.015
Married or Domestic Partnership	266 (40.9%)	287 (47.8%)	
Caregiver Availability (n = 1262)			
Not Available	18 (2.7%)	11 (1.8%)	0.28
Available	639 (97.3%)	594 (98.2%)	
Employment Status (n = 1269)			
Currently Employed or Military	350 (53.0%)	382 (62.7%)	<0.0001
Student	96 (14.6%)	96 (15.8%)	
Not Currently Employed	214 (32.4%)	131 (21.5%)	
Income (n = 1024)			
Less than \$70,000	291 (59.2%)	226 (42.5%)	<0.0001
More than \$70,000	201 (40.9%)	306 (57.5%)	
Injury Led to Surgery (n = 1269)			
No	287 (43.5%)	221 (36.3%)	0.009
Yes	373 (56.5%)	388 (63.7%)	
Legal Claim (n = 1269)			
No	608 (92.1%)	567 (93.1%)	0.50
Yes	52 (7.9%)	42 (6.9%)	
Legal Claim: WC (n = 1269)			
No	635 (96.2%)	585 (96.1%)	0.89
Yes	25 (3.8%)	24 (3.9%)	
Legal Claim: MVC (n = 1269)			
No	649 (98.3%)	597 (98.0%)	0.69
Yes	11 (1.7%)	12 (2.0%)	
Legal Claim: PI (n = 1269)			
No	643 (97.4%)	593 (97.4%)	0.95
Yes	17 (2.6%)	16 (2.6%)	
Insurance Status (n = 1269)			
Private or Employer Sponsored	447 (67.7%)	439 (72.1%)	<0.0001
Government Sponsored	165 (25.0%)	96 (15.8%)	
Uninsured or Not Reported	48 (7.3%)	74 (12.2%)	
Smoking Status (n = 1251)			
Never Smoked	397 (61.0%)	428 (71.3%)	<0.0001
Quit Smoking	147 (22.6%)	119 (19.8%)	
Current Smoker	107 (16.4%)	53 (8.8%)	
Alcohol Consumption (n = 1247)			
Never	202 (31.1%)	168 (28.1%)	0.19
4 Times Monthly or Fewer	306 (47.2%)	275 (46.0%)	
More than 4 Times Monthly	141 (21.7%)	155 (25.9%)	
Preoperative Opioid Use (n = 1260)			
No	451 (68.8%)	455 (75.3%)	0.009
Yes	205 (31.3%)	149 (24.7%)	
Recreational Drug Use (n = 1269)			

Table 1 (continued)

	Baseline-Only Group	Completion Group	χ^2 p-value
No	622 (94.2%)	568 (93.3%)	0.47
Yes	38 (5.8%)	41 (6.7%)	
Depression Symptoms (n = 1264)			0.13
No	561 (85.4%)	536 (88.3%)	
Yes	96 (14.6%)	71 (11.7%)	

^a Hand surgery patients had the lowest overall percentage of 2-week survey completion.

^b Right shoulder surgery patients were significantly less likely to complete the 2-week survey than left shoulder surgery patients.

completed only the baseline survey identified as white. Patients who identified as black were less likely to complete both surveys, comprising 40.5% of the baseline-only group but only 22.6% of the cohort who completed both surveys.

Smoking status was significant ($p < 0.0001$), with an increased likelihood of completion in patients who had never smoked (71.3% of follow-up vs 61.0% of baseline). Patients who graduated college were more likely to complete both surveys ($p < 0.0001$). These patients comprised only 39.0% of the baseline-only group, but 53.7% of the completion group. Patients who did not graduate college made up the other 61.1% of the baseline-only group and 46.3% of the completion group. Marital status was found to be significant ($p = 0.015$), as patients married or in a domestic partnership were more likely to complete the follow-up survey (47.8% of completion group vs 40.9% of baseline-only group). Employment ($p < 0.0001$), higher income ($p < 0.0001$), and non-government insurance status ($p < 0.0001$) were also significant factors associated with completion of the 2-week survey (Table 1).

Surgical and other health-related variables significantly associated with likelihood of survey completion included laterality ($p = 0.008$), operative extremity ($p = 0.047$), whether a specific injury led to the surgery ($p = 0.009$), and preoperative opioid use ($p = 0.009$). The majority of patients in the baseline-only group had surgery on their right side (54.6%), but the completion group included a majority of patients who had surgery on their left side (52.0%). Patients who had surgery on their lower extremity were more likely to complete their 2-week survey, making up 50.8% of the baseline-only group, but 56.3% of the completion group. Patients undergoing shoulder surgery showed the largest discrepancy between left and right-sided completion rates. Right shoulder patients made up 66.7% of the baseline-only group, but only 54.9% of the completion group ($p = 0.039$). Patients who suffered an injury that led to their surgery and patients who had not used opioids preoperatively were also more likely to complete their 2-week follow-up survey (Table 1).

3.2. Analysis of PROMIS and other patient-reported outcomes

Table 2 describes differences in survey follow-up based on preoperative patient-reported outcome measures, as well as age and BMI. Three PROMIS domains were found to be significant, as patients with lower PROMIS Pain Interference scores (mean 60.0 in completion group vs 61.1 in baseline-only group, $p = 0.008$), lower PROMIS Fatigue scores (mean 51.5 vs 53.2, $p = 0.004$), and lower PROMIS Depression scores (mean 48.7 vs 49.8, $p = 0.042$) were all more likely to complete their 2-week survey. Patients with lower Numeric Pain Scale (NPS) scores in both surgical joint-specific pain (mean 4.8 vs 5.2, $p = 0.011$) and total bodily pain (mean 1.3 vs 1.9, $p < 0.0001$) were significantly more likely to complete the follow-up survey. Patients in the completion group had higher pre-treatment expectations compared to patients in the baseline-only group (mean 87.2 vs 83.5, $p = 0.0003$). Also found in the completion group were patients with higher upper extremity Marx ARS scores (mean 58.2 vs 54.0, $p = 0.015$). Baseline IKDC scores among

those who underwent knee surgery showed that patients who completed the 2-week survey reported higher knee function compared to the baseline-only group (mean 50.7 vs 46.8, $p = 0.007$).

3.3. Multivariate regression analysis

Multivariate regression analysis showed that race, operative extremity, education, insurance status, smoking status, pre-injury Tegner activity levels, and total body NPS scores were all independent predictors of survey completion.

4. Discussion

Patient-reported outcome measures have become increasingly important in clinical medicine in recent years as researchers, clinicians, and patients all try to learn about what constitutes personal postoperative satisfaction.⁸ These outcome measure surveys are being used in a greater capacity within orthopaedics, even comprising a portion of physician reimbursement in the United States.⁴ As with many such surveys, completion rate impacts the ability to draw reliable conclusions. As such, physicians and researchers may not have an accurate depiction of patient outcomes postoperatively, which may misguide management. In our study, we found that there are multiple demographic and surgical factors associated with the likelihood of completing a 2-week follow-up survey after an orthopaedic procedure. An important aspect of future studies will be to explore how to best target populations of patients in order to increase completion rates. Researchers could consider options such as in-person survey completion at post-operative visits, follow-up phone calls, or possibly shortening the time needed to complete the surveys, while weighing the time and costs associated with these efforts.

The results support our hypothesis as less income and smoking were associated with lower likelihood of 2-week survey completion. An increased likelihood of completing the surveys was seen in married patients, white patients, and patients with a college degree. Having a spouse or partner present in a marriage or domestic partnership who can help and encourage the patient to complete the survey could explain the significance of marital status found in our study. The impact of race as well as college education on likelihood of survey completion could in part be confounded by socioeconomic status; however, we controlled for income and insurance status in our multivariable analysis. The diverse patient population is one of the greatest strengths of the Maryland Orthopaedic Registry, and minority patients have been widely underrepresented in orthopaedic literature.⁹ This study and our registry as a whole allows for deeper insight into a more racially and socioeconomically diverse patient population.

Surgical and other health-related factors significantly associated with 2-week survey completion that have not been previously described in the literature included laterality, operative extremity, whether the patient suffered a specific injury that led to his or her surgery, and preoperative opioid use. Hand dominance and use of

Table 2
Analysis of PROMIS and other patient reported outcome measures at baseline in patients undergoing orthopaedic surgery.

Baseline Variable	Baseline-Only Group		Completion Group		p-value
	N	Mean (St. Dev.)	N	Mean (St. Dev.)	
Age	660	41.8 (16.6)	609	42.0 (15.9)	0.80
Body Mass Index (BMI)	641	29.3 (6.7)	582	29.2 (6.6)	0.67
Charlson Comorbidity Index	379	2.2 (1.4)	335	2.1 (1.4)	0.41
PROMIS: Physical Function	660	42.5 (9.2)	609	42.3 (8.4)	0.62
PROMIS: Social Satisfaction		41.8 (9.7)		42.7 (9.2)	0.07
PROMIS: Pain Interference		61.1 (7.6)		60.0 (7.0)	0.008
PROMIS: Fatigue		53.2 (10.2)		51.5 (10.4)	0.004
PROMIS: Anxiety		55.5 (9.6)		54.8 (8.6)	0.17
PROMIS: Depression		49.8 (9.6)		48.7 (9.3)	0.042
IKDC	289	46.8 (17.9)	278	50.7 (16.1)	0.007
ASES	169	41.4 (23.2)	169	41.9 (20.6)	0.83
BMHQ	132	45.7 (21.5)	86	48.8 (19.5)	0.27
NPS Joint	651	5.2 (2.9)	602	4.8 (2.8)	0.011
NPS Body	651	1.9 (2.6)	604	1.3 (2.0)	<0.0001
Pre-treatment Expectations	657	83.5 (19.4)	606	87.2 (16.3)	0.0003
IPAQ - MET	499	7475 (6193)	493	7343 (5955)	0.73
Tegner Activity, Pre-Injury	644	6.3 (2.7)	601	6.0 (2.6)	0.07
Tegner Activity, Baseline	639	2.4 (2.2)	600	2.3 (1.9)	0.35
Marx Lower Extremity ARS	653	37.2 (37.2)	606	39.4 (37.0)	0.30
Marx Upper Extremity ARS	658	54.0 (32.7)	607	58.2 (29.4)	0.015

the upper extremity in general could be a plausible explanation for laterality and operative extremity, as patients who had surgery on their right side and on their upper extremity were less likely to complete their 2-week surveys. The chronic nature of patients' injuries may be associated with our findings as well. Not suffering a specific injury leading to the surgery and using preoperative opioids both may indicate a more chronic problem. These two groups of patients were less likely to complete their follow-up surveys.

In addition to these demographic and surgical factors, this study also found association between 2-week survey completion and patient-reported measures. Significant PROMIS domains included lower pain interference, fatigue, and depression scores seen in the completion group. Also in the completion group were lower NPS Joint scores, lower NPS Body scores, higher Pre-treatment Expectations, and higher upper extremity Marx ARS scores. Higher pre-operative patient expectations are associated with better outcomes after surgery.^{10–12} Better postoperative satisfaction has been seen in patients with higher preoperative knee function scores,¹³ which may corroborate our findings of a higher mean IKDC score in the group that completed their 2-week surveys. Although the validity of some patient-reported outcome measurements has been questioned,³ many tools, specifically PROMIS, have been shown to be highly reliable¹⁴ and are being studied in many other aspects of medicine as well.^{15–19}

Our study is not without limitations. MOR is a prospectively collected database and is subject to limitations of such a study design. Our study population was made up of patients undergoing a variety of orthopaedic surgeries, limiting our ability to provide survey completion data for specific types of procedures. And, although our registry represents a diverse patient population, our results may not be generalizable to all populations. It is also possible that there are important factors that were not accounted for in our study such as postoperative pain management, discharge status, and adverse events. Overall, our study provides detail into patient populations who may be targeted in order to increase survey follow up.

5. CONCLUSION

There has been such an increased emphasis on patient-reported outcomes in recent years that survey compliance has become even

more important. Multiple demographic factors were found to be associated with survey response, including race, education, and smoking status. We believe the results from our study provide insight into patients that can be more heavily targeted during the early postoperative period in order to improve analysis of patient-reported outcomes. Future studies performed in different population groups can be used to improve the generalizability of our results. Researchers can also try to determine what may be the best techniques in terms of targeting these groups of patients to assure a higher postoperative survey compliance rate.

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Declarations of interest

None.

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