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Patient Engagement and Prescription Opioid Use in Perioperative Pain Management

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Abstract

Objective: To examine (1) patient perceptions regarding their engagement and the engagement of their families in perioperative pain management, (2) demographic and clinical characteristics associated with perceived patient and family engagement, and (3) the association between perceived patient and family engagement and patient outcomes

Design: A prospective, observational study

Setting: The Personalized Pain Program (PPP) at the Johns Hopkins Hospital in Baltimore, MD

Participants: Patients having more than one visit to the PPP

Interventions: n/a

Main Outcome Measures: Since the inception of the PPP, patients were surveyed prior to each clinic visit to assess their pain severity and interference using the Brief Pain Inventory. Starting August 22, 2018, two additional questions were added to the survey to assess patient perceptions of their engagement and the engagement of their families in perioperative pain management. In

addition, electronic medical records were reviewed to collect data on daily opioid consumption during the first and last PPP visits pre-surgery and post-surgery.

Results.—The final analysis included 511 survey responses from 155 patients. Perceived engagement of the patient in perioperative pain management improved over time ($p<.001$) and was significantly associated with reduction in prescription opioid consumption after surgery (coef=12.7, SE=5.8, $p=.031$).

Conclusions.—Surgical patients and their family members should be actively engaged in perioperative pain management to improve prescription opioid use and the quality and safety of perioperative care.

Keywords

patient and family engagement; prescription opioid use; perioperative pain management; survey

INTRODUCTION

Reliance on prescription opioids for acute and chronic pain management has created a public health crisis, with alarming rates of opioid dependence, diversion, and opioid-related deaths.^{1, 2} In surgical settings, postoperative opioid overprescribing has served as a gateway to persistent postoperative opioid use and subsequent opioid-related harms.^{3–5} To mitigate the risks of chronic pain and persistent opioid use following surgery, various perioperative pain programs (i.e., transitional pain services) have been developed to provide coordinated multidisciplinary care and offer multimodal analgesia, non-pharmacological interventions, and opioid weaning strategies along the continuum of perioperative recovery.^{6–9} Numerous guidelines, including those specific to the management of postoperative pain, recommend that multidisciplinary programs use a patient- and family-centered, individually tailored approach to educate and engage patients and families in clinical decision making.^{10–13} For instance, the Centers for Disease Control and Prevention (CDC) guidelines for opioid prescribing for chronic pain recommend that clinicians engage patients in the clinical decision-making process to ensure that opioid tapers include a shared understanding between patients and providers.¹⁴

Patient and family engagement fall under the purview of patient- and family-centered care, which correlates with a patient's ability to engage in maintenance of self-care and adhere to complex treatment regimens. Mounting evidence suggests that patient and family engagement have a potential role in improving health outcomes.¹⁵ Qualitative studies underscore the importance of engaging patients in the opioid tapering process to minimize communication challenges.¹⁶ However, despite the contemporaneous focus on patient- and family-centered care, interventions aimed at prescription opioid tapering for outpatients with chronic pain have not specifically measured patient and family engagement, and limited empirical data exists on factors influencing patient and family engagement and impacts of patient and family engagement on the quality and safety of perioperative care.^{17–19}

In 2017, the Johns Hopkins Hospital (JHH) recognized the need to coordinate care for surgical patients and developed the Personalized Pain Program (PPP), formerly called

the Perioperative Pain Program. The PPP is a transitional pain service that aims to transition patients' pain management from surgical providers to a group of pain and opioid specialists who shepherd the patients through the perioperative period (i.e., outpatient period before surgery, hospitalization during and after surgery, outpatient follow-up after surgery) to minimize opioid exposure and related risks while managing pain.⁶ We have previously demonstrated that PPP patients with varying demographics significantly reduced postoperative prescription opioid consumption and concurrently reported improvements in pain and physical function.²⁰ To address the gaps in the literature mentioned above, the current study aims to examine (1) the extent to which patients perceive their engagement and the engagement of their families in perioperative pain management, (2) demographic and clinical characteristics associated with perceived patient and family engagement, and (3) the association between perceived patient and family engagement and patient outcomes (e.g., prescription opioid use, pain).

METHODS

Study Design and Setting

We conducted a prospective, observational study with longitudinal patient surveys and electronic medical records (EMR) chart review at the JHH in Baltimore, MD, which is an urban academic institution with more than 60,000 surgical procedures performed each year. The PPP is physically located at the Johns Hopkins Outpatient Center adjacent to the hospital and operated by a multidisciplinary team comprising 2 anesthesiologists with acute and chronic pain expertise, 1 psychiatrist, 2 pain nurse practitioners, and several anesthesiology residents. In addition, the PPP team can access integrative medicine, physical medicine and rehabilitation services, and addiction rehabilitation services based on a patient's need. In the first year of operation, about 200 new surgical patients participated in the PPP, resulting in over 550 clinic visits. The number of referrals has continually increased to 650–750 new patients per year. The main surgical specialties of patients participating in the PPP are spine, gastrointestinal, trauma, and orthopedics. The Johns Hopkins Medicine Institutional Review Board approved this study and patients consented to survey completion.

Participants and Personalized Pain Program Process

The PPP is an ongoing program and the details previously published.⁶ In brief, eligible patients are: 18 years of age, on chronic opioids and undergoing a surgical procedure, or opioid-naïve patients at risk of persistent opioid therapy following surgery. Patient referrals come from their surgical teams, primary care physicians, pain specialists, other providers, or a self-referral. Though the PPP offers pain management throughout the perioperative period, a patient may only attend the PPP clinic before surgery (pre-surgery only visits) or after surgery (post-surgery only visits), or may attend the PPP before and after surgery (pre- and post-surgery visits). To participate, patients sign a patient-provider contract while receiving care in the PPP agreeing to: only receive opioids from PPP clinicians, not misuse or divert opioids, not use illegal drugs, and undergo random urine toxicology screens throughout treatment. Based on clinical judgment at the time of PPP clinic visits, patients not complying with the contract may have more frequent visits and toxicology screens, attend the PPP clinic and an addiction medicine program concurrently, or be discharged from clinic.

Data Collection

Since the inception of the PPP, patients have completed the Brief Pain Inventory (BPI) prior to each clinic visit to assess their pain over the past 24 hours.²¹ The BPI consists of 11 items: 4 items measuring pain severity (i.e., worst, least, average, now) and 7 items measuring pain interference (i.e., relations with others, enjoyment of life, mood, sleep, walking, general activity, working). All items are rated on 0 – 10 scales with 0 = no pain or no interference and 10 = pain as bad as you can imagine or interferes completely. As recommended by the BPI user guide,²² pain severity and interference scores were calculated by averaging the responses to the 4 BPI items on pain severity and the 7 BPI items on pain interferences, respectively. The survey was administered through Qualtrics until mid-September 2019, then REDCap. Patients were emailed a link to the electronic survey one day before their clinic visit. If they could not complete the survey in advance, they completed it after check-in for their PPP appointment. In addition, demographic and clinical characteristics, including age, gender, race, marital status, education, employment, insurance, type of surgery, and history of opioid use, were collected at the initial clinic visit and/or from the EMR.

Starting August 22, 2018, two additional questions were added to the survey to assess patient perceptions regarding their engagement (To what extent are you engaged in your perioperative pain management?) and the engagement of their families (To what extent is your family engaged in your perioperative pain management?) in perioperative pain management. Both questions had a 5-point Likert response scale, 1=not engaged at all, 2=slightly engaged, 3=moderately engaged, 4=very well engaged, and 5=extremely engaged.

As part of each clinic visit, a PPP clinician reviewed the patient's opioid prescriptions from the EMR and the Maryland prescription drug monitoring program and did a pill count when available. Daily opioid consumption was converted to Morphine Milligram Equivalent (MME) using an opioid conversion app and recorded in the EMR.²⁰ We reviewed the EMR for PPP patients and manually extracted and verified their daily MME for the first and last PPP clinic visits before surgery and the same for after surgery.

Data Analysis

We included patients with more than one PPP visit in the analysis. Because, anecdotally, patients who enter PPP before surgery may have different reasons for PPP referral and treatment goals compared with those who enter PPP after surgery, we grouped them by their timeline of clinic visits: pre-surgery only visits, post-surgery only visits, or pre- and post-surgery visits. Demographic and clinical characteristics of different patient visits groups were summarized using frequencies and percentages. Chi-square tests or Fisher's exact tests were conducted for group comparisons.

To examine patient perceptions regarding their engagement and the engagement of their families in perioperative pain management, engagement survey responses were summarized using mean and standard deviation (SD) for different patient visits groups and for the following time points: <15 days, 15–30 days, 31–60 days, 61–90 days, 91–180 days, 181–365 days, and >365 days from the first PPP visit. Wilcoxon signed-rank tests were

used to examine differences between perceived patient engagement and perceived family engagement. Mixed effect linear regression models were used to examine changes in perceived patient and family engagement over time. The models regressed time periods on patient and family engagement scores with random intercepts to account for repeated measures from the same patient. The interaction terms of patient visit groups and time periods were then added to the models to examine differences in trends of perceived patient and family engagement across patient visit groups.

To identify demographic and clinical characteristics associated with perceived patient and family engagement, we first conducted bi-variate analyses to associate each collected demographic or clinical characteristic (see Data Collection) with patient and family engagement scores. Given the exploratory nature of the analyses, we then included all demographic and clinical characteristics in backward stepwise regression models to identify factors predicting the most variations in perceived patient and family engagement. Backward stepwise regression is a variable selection approach, which begins with a model containing all variables under consideration and removes the least significant variables one after the other until a pre-specified stopping rule is reached. In this study, demographic and clinical characteristics were removed from the models if their significant level (p value) was >0.2 .²³

Finally, multiple linear regression models were used to examine associations between post-surgical reduction in prescription opioid consumption (i.e., MME during first visit after surgery – MME during last visit after surgery) and mean score of perceived patient engagement after surgery. The regression models considered prescription opioid consumption during the first visit after surgery and all demographic and clinical characteristics as covariates. We used Akaike's information criterion (AIC) and Bayesian information criterion (BIC) to determine the final model, which suggested inclusion of only opioid consumption during first visit after surgery. Similar approaches were used to examine the associations between post-surgical reduction in pain severity and interference scores and the mean score of perceived patient engagement. Statistical significance was set as $p < 0.05$. All analyses were performed using STATA version 15.1 (College Station, TX).

RESULTS

Figure 1 shows the flow chart of patient inclusion and exclusion. The final analysis included 155 patients, in which 23 patients had pre-surgery only visits (57 survey responses), 97 patients had post-surgery only visits (300 survey responses), and 35 patients had pre- and post-surgery visits (44 pre-surgery survey responses and 110 post-surgery survey responses). Table 1 shows the demographic and clinical characteristics of the three patient visits groups. Significant differences were observed in age, gender, marital status, surgery type, and opioid use history between patient visits groups.

Perceived Patient and Family Engagement in Perioperative Pain Management

Table 2 summarizes survey responses for the three patient visits groups (i.e., pre-surgery only visits, post-surgery only visits, pre- and post-surgery visits). According to the Likert scale used to assess perceived patient and family engagement, PPP patients perceived themselves to be “very well” engaged (Mean=3.99, SD=0.94) and their families to be

“moderately” to “very well” engaged (Mean=3.50, SD=1.22) in the management of their perioperative pain. Perceived patient engagement was significantly higher than perceived family engagement ($p<.001$). Mixed effect linear regression models showed that perceived patient engagement in perioperative pain management increased over time ($p<.001$), but not perceived family engagement in perioperative pain management ($p=.387$) (Figure 2). No significant difference was observed in the trends of perceived patient and family engagement between patient visits groups.

Association between Demographic and Clinical Characteristics and Perceived Patient and Family Engagement

The backward stepwise regression analyses showed that gender and marital status were associated with perceived family engagement in perioperative pain management (Appendix 1). Specifically, higher perceived engagement of family members in perioperative pain management was identified in male patients compared to female patients (coef.=0.55, SE=0.19, $p=.004$), as well as in single patients compared to married patients (coef.=0.80, SE=0.21, $p<.001$). No demographic or clinical characteristic was significantly associated with perceived patient engagement in perioperative pain management. The bi-variate analyses to associate each demographic or clinical characteristic with patient and family engagement scores showed consistent results (Appendix 2).

Association between Perceived Patient and Family Engagement and Patient Outcomes

For patients who had post-surgery PPP visits (i.e., pre- and post-surgery visits group, post-surgery only visits group), significant reductions in prescription opioid consumption (mean [SD] reduction=96 [136] MME, from 134 [153] MME to 39 [64] MME, $p<0.001$), pain severity score (0.59 [1.80] points, from 6.52 [1.75] points to 5.93 [2.31] points, $p<0.001$), and pain interference score (1.33 [2.62] points, from 7.44 [1.88] points to 6.11 [2.66] points, $p<0.001$) were identified between the first and last clinic visit after surgery. Linear regression models showed that perceived patient engagement in perioperative pain management was significantly associated with reduction in prescription opioid consumption after surgery ($p = 0.031$) (Table 3). Specifically, a one-point increase in patient engagement score, on average, was independently associated with additional reduction of 12.7 MME. Perceived family engagement in perioperative pain management was marginally significantly associated with reduction in prescription opioid consumption after surgery ($p = 0.055$). Specifically, a one-point increase in family engagement score, on average, was independently associated with additional reduction of approximately 8 MME. The association between perceived patient and family engagement in perioperative pain management and pain severity and pain interference were not statistically significant (Table 3).

DISCUSSION

Our results showed that patients participating in the PPP perceived themselves to be highly engaged in their perioperative pain management and that their perceived engagement in perioperative pain management improved over time. Importantly, while PPP patients were able to considerably reduce their use of prescription opioids after surgery, perceived

patient engagement in perioperative pain management significantly correlated with reduced prescription opioid use after surgery. These findings were consistent with the results of a previous study showing decreased prescription opioid use resulting from improved patient engagement in pain management following knee replacement surgery.²⁴ Our study did not identify disparities in perceived patient engagement between PPP patients with different demographic characteristics (e.g., age, gender, race, marital status, education, employment) or clinical characteristics (e.g., insurance type, surgical type, history of opioid use, timeline of PPP visits). While these results may seem surprising, scant literature has examined demographic or clinical factors associated with patient engagement.

Robust literature does highlight the important role of families in patients' adaptation to acute and chronic pain.²⁵ To our knowledge, this is the first paper to examine patients' perspectives on family engagement in perioperative pain management. We found that PPP patients considered their family members to be engaged in their perioperative pain management, although less engaged compared with perceived self-engagement; and that perceived family engagement in perioperative pain management marginally correlated with reduced prescription opioid use after surgery. Demographic characteristics associated with perceived family engagement in perioperative pain management included gender and marital status. Our finding that male patients perceived greater family engagement than female patients aligns with the extant literature that women are more often the caregivers for individuals with chronic pain²⁶ and those undergoing surgery.²⁷ Single individuals also reported more perceived engagement of their families in their perioperative pain management compared with their married counterparts. This finding may be supported by evidence that patients' pain behaviors are highly influenced by the responses of marital partners compared with other caregivers.^{28, 29} Yet, since we did not collect data on social support, it is difficult to draw conclusions. We can merely speculate that differences in perceived family engagement based on marital status are driven by the complex social context of the pain experience on family dynamics (e.g., altered family roles, financial problems, distress in family members).^{30, 31} While it is generally understood that social supports lead to improved health outcomes, the operant conditioning and cognitive behavioral models of pain demonstrate that spouses may also reinforce patients' maladaptive responses to pain and patients' appraisals and expectancies of spousal support may influence their pain and functioning.³² In short, the role of family engagement in pain management is complex and further examination of the role of spousal and other familial support in perioperative pain management is needed.

This study adds to a growing body of literature showing that opioid tapering is feasible when patients and family members are engaged in their therapy.^{18, 33} Our findings warrant research to better understand the larger work system influencing patient and family engagement in perioperative pain management and to explore strategies for improving patient and family engagement in perioperative pain management. Indeed, qualitative studies among surgical populations highlight that patients want to be involved and caregivers want to assist in the care of their significant others following surgery.^{27, 34} A human factors engineering approach, which emphasizes the participation of health care stakeholders in the (re)design of health care work systems and processes to improve quality of care and safety, may be applied to improve postoperative outcomes.³⁵

Interestingly, we found that patient and family engagement were not associated with improvements in pain intensity or pain interference. In contrast, a study of patients with upper limb fractures found that the combination of patient engagement and psychosocial factors have an association with chronic postoperative outcomes.³⁶ However this study assessed the relationship between engagement and physical functioning, not pain outcomes. While this study was not designed to examine physical functioning outcomes, it is possible that patient engagement has a greater association with functional outcomes than pain severity and interference. Collectively, these studies provide support for more rigorous assessments of patient engagement and further investigations on interventions to bolster patient engagement in perioperative pain management.

Limitations

This study had several limitations. First, our study design limited us to examining an association between engagement in perioperative pain management and prescription opioid use. To determine a causal relationship between engagement and prescription opioid use will require a more rigorous study design (e.g., before-and-after design with or without control group, randomized control design). Second, we used two general questions to assess patient perceptions of their engagement and the engagement of their families in perioperative pain management because no known validated measures or instruments currently exist. Additional studies are needed to better understand the concept of patient and family engagement in pain management and develop more rigorous tools for measuring patient and family engagement in pain management. Third, a more rigorous assessment of patients' social support networks is needed to better understand the role of family in perioperative pain management. Fourth, we included a limited number of surgical patients at one academic hospital and our results may not be generalizable to other settings. Fifth, this study included only in-person visits. Further studies are warranted to determine how the rapid transition to telemedicine in response to the COVID-19 pandemic has impacted patient and family engagement and its association with postoperative outcomes. In addition, compared to patients not participating in the PPP, PPP patients may naturally be more motivated and engaged in their perioperative pain management. Therefore, additional studies are needed to examine the broader impact of patient and family engagement on perioperative pain management with different patient populations in various health care settings.

CONCLUSION

An individualized, patient-centered approach to pain management is endorsed to optimize prescription opioid use and improve patient outcomes.³⁷ This study highlighted the significance of engaging patients and family members in perioperative pain management for tapering opioid consumption. Future research is needed to provide additional evidence on the impact of patient and family engagement on prescription opioid use and the quality and safety of perioperative care.

Supplementary Material

Refer to Web version on PubMed Central for supplementary material.

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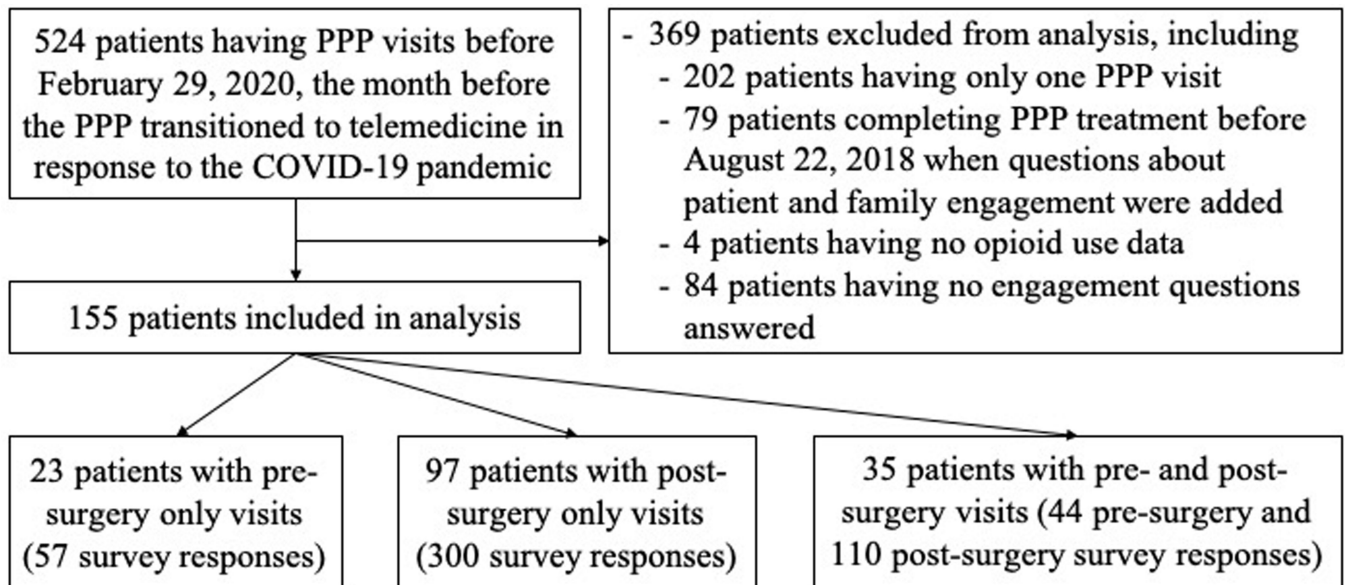


Figure 1.
Study flow chart of inclusion and exclusion

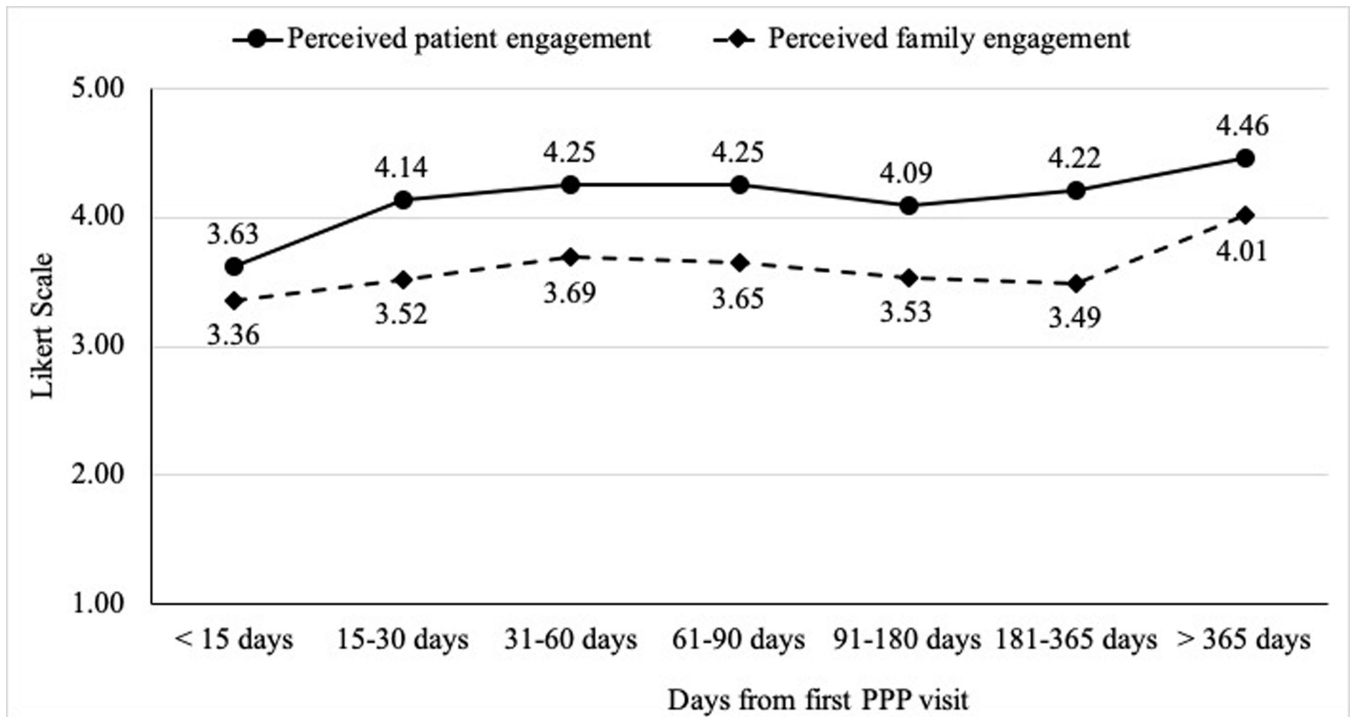


Figure 2.
Changes in responses to engagement questions over time

Table 1.

Demographic and clinical characteristics of Personalized Pain Program patients

	Total (n =155) No. (%)	Pre-surgery only visits (n=23) No. (%)	Post-surgery only visits (n=97) No. (%)	Pre- and post-surgery visits (n=35) No. (%)	p value [#]
Age					.006*
18 – 45	81 (52)	9 (39)	61 (63)	11 (31)	
45 – 65	65 (42)	13 (57)	30 (31)	22 (63)	
> 65	9 (6)	1 (4)	6 (6)	2 (6)	
Gender					.017*
Female	79 (51)	14 (61)	41 (42)	24 (69)	
Male	76 (49)	9 (39)	56 (58)	11 (31)	
Race					.534
Caucasian	89 (58)	16 (70)	53 (55)	20 (57)	
African American	58 (37)	6 (26)	40 (41)	12 (34)	
Other	8 (5)	1 (4)	4 (4)	3 (9)	
Marital status					.001*
Married	56 (36)	4 (18)	47 (48)	5 (14)	
Never married	61 (39)	12 (52)	31 (32)	18 (52)	
Separated/divorced/widowed	37 (24)	7 (30)	18 (19)	12 (34)	
Unknown	1 (1)	0 (0)	1 (1)	0 (0)	
Education					.344
High school or below	50 (32)	5 (22)	35 (36)	10 (29)	
College	63 (41)	10 (44)	41 (42)	12 (34)	
Professional degree	19 (12)	3 (13)	10 (10)	6 (17)	
Doctorate	5 (3)	0 (0)	2 (2)	3 (9)	
Unknown	18 (12)	5 (22)	9 (10)	4 (11)	
Employment					.299
Employed	45 (29)	7 (30)	30 (31)	8 (23)	
Unemployed	79 (51)	11 (48)	52 (54)	16 (46)	
Student	11 (7)	0 (0)	6 (6)	5 (14)	
Disabled/retired	14 (9)	3 (13)	7 (7)	4 (11)	
Unknown	6 (4)	2 (9)	2 (2)	2 (6)	
Insurance					.057
Private	94 (61)	13 (57)	63 (65)	18 (51)	
Public	56 (36)	7 (30)	32 (33)	17 (49)	
Self-paid	5 (3)	3 (13)	2 (2)	0 (0)	
Type of surgery					<.001*
Cardiac/thoracic	14 (9)	1 (4)	13 (13)	0 (0)	
Gastrointestinal/abdominal	28 (18)	1 (4)	15 (16)	12 (34)	
Neuro/otolaryngology	12 (8)	2 (9)	5 (5)	5 (14)	
Orthopedic/trauma	74 (48)	2 (9)	56 (58)	16 (46)	

	Total (n =155) No. (%)	Pre-surgery only visits (n=23) No. (%)	Post-surgery only visits (n=97) No. (%)	Pre- and post- surgery visits (n=35) No. (%)	<i>p</i> value [#]
Plastic/vascular	13 (8)	3 (13)	8 (8)	2 (6)	
No surgery	14 (9)	14 (61)	0 (0)	0 (0)	
History of opioid use					.009*
1 month	41 (27)	3 (13)	35 (36)	3 (9)	
2– 12 months	29 (19)	4 (18)	21 (22)	4 (11)	
1–5 years	19 (12)	3 (13)	9 (9)	7 (20)	
>5 years	33 (21)	6 (26)	17 (18)	10 (29)	
Unknown	33 (21)	7 (30)	15 (15)	11 (31)	

[#]From chi-square tests or Fisher's exact tests.

*Statistically significant, $p < 0.05$.

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Table 2.

Response scores to engagement questions compared by time of Personalized Pain Program clinic visit

Questions	Total		Pre-surgery only visits		Post-surgery only visits		Pre- and post-surgery visits			
							Pre-surgery data		Post-surgery data	
	n	Mean (SD)	n	Mean (SD)	n	Mean (SD)	n	Mean (SD)	n	Mean (SD)
Q1. To what extent are you engaged in your perioperative pain management?	155	3.99 (0.94)	23	3.90 (1.08)	97	4.01 (0.92)	23	3.83 (1.14)	29	4.25 (0.72)
Q2. To what extent is your family engaged in your perioperative pain management?	154	3.50 (1.22)	22	3.67 (1.15)	97	3.48 (1.19)	24	3.50 (1.49)	29	3.46 (1.35)

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Table 3.Regression results on association between perceived patient and family engagement and patient outcomes[#]

	Reduction in prescription opioid consumption			Reduction in pain severity score			Reduction in pain interference score		
	coef.	SE	p value	coef.	SE	p value	coef.	SE	p value
Patient engagement	12.7	5.8	.031 [*]	0.24	0.18	0.199	0.24	0.18	0.199
Baseline	0.8	0.0	<.001	0.16	0.09	0.073	0.16	0.09	0.073
Constant	62.0	23.7	.010	1.44	0.99	0.151	1.44	0.99	0.151
Family engagement	8.1	4.2	.055	0.12	0.13	0.367	0.12	0.13	0.367
Baseline	0.8	0.0	<.001	0.16	0.09	0.080	0.16	0.09	0.080
Constant	39.0	15.2	.011	0.87	0.79	0.271	0.87	0.79	0.271

[#] Linear regression models regressed each outcome measure on patient engagement or family engagement, adjusted for baseline measure of the outcome (i.e., first measure after surgery). Separate regression models were performed for each pair of patient engagement or family engagement with one of the outcome measures. The coefficients of patient engagement, family engagement, and baseline measure indicate the amount of additional reduction or improvement in the outcome measure associated with a one-point increase in these independent variable. The coefficient of the constant is the level of the reduction when the value of the baseline measure and patient or family engagement were zero.

^{*} Statistically significant, $p < 0.05$.