

DISCUSSION

Use of the digital patient activation tool demonstrated significant savings in LOS and reduced ED visits among hip replacement patients. Although just under 50% of patients in the intervention group were enrolled to use the tool, these findings were still significant even when non-participants were included in the post-intervention group.

Interestingly, performing a sensitivity analysis comparing only intervention participants in 2018 to all non-participants (2018 patients who were not enrolled or opted out and all 2017 patients) revealed that LOS was significantly lower among intervention participants for both knee and hip patients. After adjusting for gender, age and insurance type, among hip patients LOS was 0.2 days shorter ($p=0.02$) on average for intervention participants and 0.13 days shorter ($p=0.011$) among knee intervention participants.

Although other outcomes didn't reach statistical significance in the primary analysis, results were promising and in the hypothesized direction with lower rates of surgery cancellation and readmissions, as well as higher likelihood of discharge to home for intervention participants.

Among patients who received the intervention, higher engagement was significantly associated with **positive changes** in almost all outcomes.

There are limitations to our findings. First, patients were not randomized to the intervention. However, by adjusting for patient factors and stratifying by joint replaced, we account for important differences between groups. While there was a pre-op class and a TJR patient guidebook in place before and during the intervention, this patient activation tool was the only major intervention of this type or breadth in place during the study time period that would have affected our outcomes.

Our findings suggest that use of a patient engagement tool such as the one we used could be helpful in improving outcomes for total joint replacements. Significant associations between engagement and improved outcomes for both hip and knee patients suggest the intervention had a positive effect. Although we expected higher uptake of the intervention, the lower enrollment rate would bias results toward the null. We are now examining ways to increase enrollment by capturing more patients' email addresses or mobile numbers so they too can be included in the intervention.

References

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Disclosure

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Improving Orthopedic Care Delivery Through Digital Engagement

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INTRODUCTION

Patient activation has been hypothesized to improve medical and surgical outcomes by increasing patient involvement in the care plan. We tested this hypothesis by utilizing a patient activation tool in a population of adults having total hip or total knee replacement. We hypothesized that patient activation would be associated with:

- Increased discharge to home as opposed to a skilled nursing facility (SNF)
- Reduced hospital length of stay (LOS)
- Decreased inpatient readmissions
- Decreased emergency department (ED) visits

Recent literature indicates discharge to SNFs is associated with increases in post-op complications, unplanned readmissions and overall costs. A large Agency for Healthcare Research and Quality (AHRQ) study reported that discharges to SNFs were longer and more expensive than those with routine discharges to home (7 days vs. 3.6 days; \$16,900 vs. \$8,300).¹ Another study estimated nearly 40% of the total cost for a total joint replacement (TJR) episode of care occurs after discharge.² A third study showed that discharge to SNF is the strongest predictor of complications within 30 days post-discharge.³

OBJECTIVES

Using an email patient activation tool, we sought to increase patients' involvement in their care before and after total joint replacement. We compared patients pre and post implementation of the tool.

Outcomes examined included:

- Day of surgery cancellation (DOSC)
- Length of hospital stay
- Discharge to home vs. discharge to SNF
- Any ED visit within 30 days of discharge
- Any inpatient readmission within 30 days of discharge

DESCRIPTION OF PROJECT

This was a quasi-experimental design comparing Jan-Jun 2017 to Jan-Jun 2018. We instituted an email patient activation tool for all patients with total knee or total hip replacement surgery beginning in January 2018. This tool was integrated with the electronic medical record (EMR) system during the six month study period and patients could opt out at anytime if they desired. The tool was designed to prepare patients both educationally and emotionally for their operation with multiple easy-to-read emails starting from the time they were scheduled for surgery through six months post-op. Percent of emails opened and clicked were used as measures of engagement for the intervention participants.

Percent opened was sorted into the following engagement categories: low (opened <25% of emails), medium (opened 25%-49% of emails) and high (opened ≥50% of emails).

Statistical Analysis:

Patients in the post-intervention period were compared to pre-intervention patients on demographics (age, gender), insurance type and joint replaced. Associations between outcomes and intervention period were examined using multiple logistic regression (surgery cancellation, discharge to home, any ED visit, any inpatient readmission) and multiple linear regression (LOS). All models were adjusted for gender, age category, insurance type and stratified by joint replaced. Among the patients who participated in the intervention, associations between measures of engagement and outcomes were also examined using logistic and linear regression.

RESULTS

2,027 TJR patients were included: 720 hip patients, 1,307 knee patients. Pre- and post-intervention groups were similar in gender and age (**Table 1**).

Post-intervention patients were more likely to have private insurance. Unadjusted and adjusted patient outcomes by intervention group and joint replaced can be found in **Table 2a** (hip patients) and **Table 2b** (knee patients).

Table 1. Patient characteristics by joint replaced and intervention group

Patient Characteristic	HIP Replacement Patients (N=720)			KNEE Replacement Patients (N=1,307)		
	n (%)		p-value ^a	n (%)		p-value ^a
	Pre-Intervention (n=383)	Post-Intervention (n=337)		Pre-Intervention (n=613)	Post-Intervention (n=694)	
Gender			0.30			0.34
Male	148 (39%)	143 (42%)		231 (38%)	244 (35%)	
Female	235 (61%)	197 (58%)		382 (62%)	450 (65%)	
Age (years), mean (SD)^b	68.7 (10.4)	69.1 (11.1)	0.57	67.9 (9.2)	68.6 (8.5)	0.18
Age Category			0.83			0.02
< 65 years	103 (27%)	87 (26%)		196 (32%)	82 (26%)	
65-79 years	229 (60%)	200 (59%)		353 (58%)	450 (65%)	
≥ 80 years	51 (13%)	50 (15%)		64 (10%)	61 (9%)	
Insurance			<0.001			<0.001
Medicaid	20 (5%)	18 (5%)		45 (7%)	38 (5%)	
Medicare	203 (53%)	105 (31%)		281 (46%)	214 (31%)	
Private	160 (42%)	204 (61%)		287 (47%)	434 (63%)	
Unknown	0 (0%)	10 (3%)		0 (0%)	8 (1%)	

^a P-value from chi-square testing for difference in demographic/clinical between intervention groups;

^b P-value from two-sample t-test testing for mean difference in patient age between intervention groups.

Table 2a. Unadjusted and adjusted HIP patient outcomes by intervention group

Patient Characteristic	HIP Replacement Patients (N=720)			
	n (%) or Mean (SD)		Adjusted Regression Model ^b	
	Pre-Intervention (n=383)	Post-Intervention (n=337)	OR (95% CI) or β (95% CI)	p-value
Day of Surgery Cancellation	16 (4%)	8 (2%)	0.67(0.26, 1.68)	0.39
Completed Surgeries	(n=362)	(n=301)		
Length of Stay^a	2.35 (0.89)	2.15 (0.96)	-0.23 (-0.37, -0.09)	0.001
Discharged Home	303 (84%)	261 (87%)	1.48 (0.91, 2.41)	0.12
Any ED Visit	22 (6%)	9 (3%)	0.45 (0.20, 1.00)	0.05
Any Inpatient Readmission	13 (4%)	13 (4%)	1.14 (0.49, 2.66)	0.76
Any Revisit (ED or Inpatient)	31 (9%)	21 (7%)	0.75 (0.41, 1.38)	0.35

For HIP replacement patients:

- LOS was nearly 1/4 day lower in the post-intervention group ($\beta=-0.23$; $p=0.001$) after adjusting for gender, age and insurance.
- ED visits were lower among the post-intervention group ($OR=0.45$; $p=0.05$) after adjusting for gender, age and insurance.
- Post-intervention patients were less likely to have DOSC, any revisit (ED or readmission), and were more likely to be discharged home; but these associations did not reach statistical significance.

Table 2b. Unadjusted and adjusted KNEE patient outcomes by intervention group

Patient Characteristic	KNEE Replacement Patients (N=1,307)			
	n (%) or Mean (SD)		Adjusted Regression Model ^b	
	Pre-Intervention (n=613)	Post-Intervention (n=694)	OR (95% CI) or β (95% CI)	p-value
Day of Surgery Cancellation	20 (3%)	15 (2%)	0.64 (0.32, 1.27)	0.20
Completed Surgeries	(n=585)	(n=630)		
Length of Stay^a	2.43 (0.76)	2.39 (0.82)	-0.3 (-0.12, 0.06)	0.52
Discharged Home	488 (83%)	538 (86%)	1.15 (0.83, 1.61)	0.39
Any ED Visit	25 (4%)	21 (3%)	0.92 (0.50, 1.70)	0.80
Any Inpatient Readmission	24 (4%)	26 (4%)	0.96 (0.53, 1.73)	0.89
Any Revisit (ED or Inpatient)	48 (8%)	44 (7%)	0.89 (0.58, 1.39)	0.61

For KNEE replacement patients:

- None of the associations between intervention group and outcomes reached statistical significance.
- However, post-intervention patients were less likely to have DOSC and more likely to be discharged to home.

Intervention Participants

- 474 patients participated in the intervention during the study period (43% of eligible hip patients; 47% of eligible knee patients). 70% of these patients were highly engaged in the intervention, opening >50% of the messages.
- For hip patients (**Table 3a**), high engagement was associated with significantly lower odds of surgery cancellation ($OR=0.18$; $p=0.016$), lower odds of readmission ($OR=0.10$; $p=0.047$) and increased odds of discharge to home ($OR=16.3$; $p<0.001$) compared to patients with low engagement.
- Among knee patients (**Table 3b**), high engagement was associated with significantly shorter LOS ($\beta=-0.36$; $p=0.003$) and increased odds of discharge to home ($OR=2.47$; $p=0.02$) compared to patients with low engagement.

Table 3a. Unadjusted association between patient engagement and outcomes among HIP replacement patients

Level of Engagement	Surgery Cancellation ^b (N=146)		Day of Surgery Cancellation ^b (N=146)		Length Of Stay ^c (N=133)		Discharged Home ^{b d e} (N=133)	
	OR (95% CI)	p-value	OR (95% CI)	p-value	β (95% CI)	p-value	OR (95% CI)	p-value
High	0.18 (0.05, 0.61)	0.016	-	0.99	-0.39 (-0.81, 0.04)	0.18	16.3 (4.05, 65.4)	<0.001
Medium	0.15 (0.02, 1.37)		1.16 (0.07, 19.8)		-0.42 (-0.96, 0.12)		3.73 (0.78, 17.9)	
Low	1.0 (Reference)		1.0 (Reference)		Reference		1.0 (Reference)	

Table 3b. Unadjusted association between patient engagement and outcomes among KNEE replacement patients

Level of Engagement	Surgery Cancellation ^b (N=328)		Day of Surgery Cancellation ^b (N=328)		Length Of Stay ^c (N=303)		Discharged Home ^{b d e} (N=302)	
	OR (95% CI)	p-value	OR (95% CI)	p-value	β (95% CI)	p-value	OR (95% CI)	p-value
High	0.88 (0.28, 2.77)	0.33	0.47 (0.04, 5.29)	0.70	-0.36 (-0.57, -0.15)	0.003	2.47 (1.08, 5.69)	0.02
Medium	1.88 (0.50, 7.10)		1.18 (0.07, 19.4)		-0.23 (-0.51, 0.05)		0.88 (0.32, 2.44)	
Low	1.0 (Reference)		1.0 (Reference)		Reference		1.0 (Reference)	

Table Key

Abbreviations – OR: odds ratio; 95% CI: 95% confidence interval.

^a Mean (SD) and β (95% CI) reported for LOS; n (%) and OR (95% CI) reported for all other outcomes.

^b Model adjusted for all variables in Table 1 – patient age category, gender, and insurance.

Post-intervention vs. pre-intervention patients.