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Original Research

Postoperative Communication Volume Following Total Joint Arthroplasty Can Be a Precursor for Emergency Department Visits

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A B S T R A C T

Background: Unplanned calls, messages, and visits to the clinic can occur at a higher rate as newer technologies allow patients more accessibility and connectivity to clinicians. By reviewing postoperative patient phone calls and electronic portal messages, we compared the methods and frequency of communications between conventional and robotic joint arthroplasty cases.
Methods: A retrospective review of total hip, total knee, and unicompartmental knee arthroplasty procedures by fellowship-trained adult reconstruction surgeons at our hospitals between 2017 and 2022 was performed. Any unplanned postoperative communication within 30 days of the postoperative period and unplanned emergency department visits were collected.
Results: There were 12,300 robotic and manual consecutive primary total hip, total knee, and unicompartmental knee arthroplasty procedures performed on 10,908 patients over the study period. A total of 905 (40.4%) patients and 2012 (23.2%) patients sent an electronic text message (ETM) in the robotic and manual arthroplasty cohorts ($P < .0001$), respectively. Overall, 1942 (86.6%) patients in the robotic arthroplasty group and 6417 (74%) patients in the manual arthroplasty group had at least one phone call within the first month after their joint arthroplasty.
Conclusions: Robotic arthroplasty patients place an increased demand on the orthopaedic surgery department in terms of unplanned patient contacts. Robotic arthroplasty patients had a significantly increased rate of unplanned postoperative ETMs and phone calls when compared to manual arthroplasty patients. An increased number of postoperative phone calls, but not ETMs, can also be indicative of an emergency department visit. These findings can be used in the perioperative setting to counsel and educate patients about expectations.

Introduction

Arthritis is an increasingly prevalent disease in our aging population, and there remains a growing demand for total joint arthroplasty (TJA). Total hip arthroplasty (THA) and total knee arthroplasty (TKA) procedures are projected to increase in volume by 659% and 469%, respectively, by the year 2060 [1]. Technological advances, ranging from robotic-assisted TJA to electronic portals or text messages, have been integrated into the practice of medicine with goals to improve healthcare efficiency, surgical precision, safety, and quality [2-6]. As surgical case volume increases, so does the absolute communication volume from patients to physicians and support staff. Arthroplasty practices have developed standardized preoperative education programs to prepare patients for surgery and anticipate postoperative events. Despite this groundwork, patient messages are not eliminated and need timely responses, especially during the early postoperative period. Patient communications in response to concerns or unexpected issues related to recent surgery may lead to an adverse event if not addressed promptly. The rate of postoperative complications has been reported to be as high as 18% in certain populations [7]. Patient concerns may lead to an unplanned emergency room (ER) visit generating unnecessary healthcare expenses.

Complications, although rare, can occur in joint arthroplasty and burden the patient, healthcare system, and ultimately society [8].

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Muffly et al. reported that 5% of patients visit the ER within 30 days of their primary total hip or total knee procedure [9]. Unplanned calls, messages, and visits can occur at a higher rate as newer technologies allow patients more accessibility and connectivity to clinicians [10]. Although it is difficult to quantify the impact of unplanned patient contacts and visits, these events, while the responsibility of the treating physician, can be time-consuming for both orthopaedic surgeons and supporting clinical staff [11].

In recognition of rising electronic interactions between patients and clinicians, national health-finance policies have shifted, and some insurance companies now recognize these medical advice messages as billable services [12]. Moreover, with institutional emphasis on "patient satisfaction," delayed responses by the care team in returning communications from patients may be misinterpreted as disinterest and result in lower patient satisfaction metrics. Provider tardiness in response to a patient's communication may be due to the messaging process, staffing, or inaccessible personnel, which seems less tolerated in a society of rapid electronic connectivity.

Currently, there is a paucity of literature regarding communication events and how they affect patients and providers. Our study aims to better understand documented communication methods used among arthroplasty patients within 30 days of their joint arthroplasty procedure. By reviewing postoperative patient phone calls and electronic portal messages, we compared the methods and frequency of communications between robotic and conventional joint arthroplasty cases. Additionally, we sought to relate messaging prevalence to unplanned emergency department visits during the early postoperative period. We hypothesize that patients undergoing robotic and manual joint arthroplasty will have different rates and methods of postoperative unplanned communication and that patients with an increased rate of unplanned postoperative contact will more likely have ER visits.

Material and methods

An institutional review board exemption was obtained for this study, which was a retrospective review of THA, TKA, and unicompartmental knee arthroplasty (UKA) procedures at our hospitals between 2017 and 2022.

We performed a retrospective review over 6 years (2017-2022) of all consecutive patients undergoing primary elective THA, TKA, or UKA by adult reconstruction surgeons throughout our healthcare system. THA approaches included direct anterior, anterolateral, and posterior approaches. We collected baseline patient demographics including age, sex, body mass index, race, tobacco use, marital status, and insurance status. We excluded patients younger than 18 years of age or patients undergoing joint arthroplasty procedures due to emergent indications. Phone calls between patients and any member of the orthopaedic department within 30 days of the postoperative period were included and reviewed. Patient portal messages and electronic texts were also reviewed in the immediate 30-day postoperative period. Incoming communications initiated by or sent from the patient were only considered as patient messages; replies or messages sent from the orthopaedic surgery department were excluded. Total number of messages sent per patient as well as the weekday they were sent was collected. As a secondary outcome, ER visits for included TJA patients within 30 days of their procedure were collected.

Statistical analysis

Descriptive statistics were utilized for patient demographics and postoperative communications. Frequency and percentages were reported for categorical variables, and the mean and standard deviation were reported for continuous variables. Statistical comparisons between groups were made using chi-square, Fisher's exact test, and student t-test, where appropriate. *P*-values of <.05 were considered statistically significant. Odds ratios between volume of unplanned patient contacts and emergency department visits were calculated using logistic regression analyses. All statistical analyses were performed using SPSS version 28.0.0.0 (IBM Corp., Armonk, NY).

Results

There were 12,300 robotic and manual consecutive primary THA, TKA, and UKA procedures performed on 10,908 patients by 32 unique surgeons over the study period. Average age of the identified patients was 65.2 ± 4. A detailed breakdown of the included patient demographics can be found in Table 1. Out of all the identified procedures, 9834 (80%) were performed manually. TKA was the most commonly performed procedure in both robotic and manual arthroplasty cohorts, comprising 48% and 59% of procedures, respectively. This was followed by THA (36.4% vs 37%) and UKA (15.9% vs 4.3%) in both cohorts. Although some demographic variables were found to have statistically significant differences between the manual and robotic arthroplasty cohorts, these differences did not appear to be clinically significant (Table 1).

A total of 905 (40.4%) patients and 2012 (23.2%) patients sent an electronic text message (ETM) in the robotic and manual arthroplasty cohorts ($P < .0001$), respectively. On average, patients who underwent robotic arthroplasty sent 4.31 ETMs, compared to 3.96 in the manual arthroplasty cohort ($P = .0415$) within 30 days of

Table 1
Baseline demographics for all included cases stratified by procedure type (robotic vs manual).

Baseline demographics	Robotic arthroplasty	Manual arthroplasty	*P*-value[a]
Cases, n	2466	9834	**<.01**
TKA	1184 (48%)	5778 (58.8%)	
Unicompartmental	393 (15.9%)	418 (4.3%)	
THA	889 (36.4%)	3638 (37%)	
Mean age, years (SD)	64.5 (10.3)	65.4 (10.6)	**.02**
BMI, mean (SD)	31.9 (5.7)	33.3 (61.8)	**<.01**
Male, n (%)	1114 (45.1%)	4190 (42.6%)	**.01**
Laterality, n (%)			
Right	1252 (50.8%)	5076 (51.6%)	.74
Bilateral	55 (2.2%)	198 (2%)	
Race, n (%)			
White	2377 (96.4%)	9505 (96.7%)	
Unable to obtain	16 (0.6%)	40 (0.4%)	
American Indian or Alaska Native	3 (0.1%)	16 (0.2%)	.20
Black	55 (2.2%)	185 (1.9%)	
Other	2 (0.1%)	15 (0.2%)	
Asian	7 (0.3%)	57 (0.6%)	
Hawaiian or Pacific Islander	6 (0.2%)	16 (0.2%)	
Tobacco use, n (%)			
Current	331 (13.4%)	1051 (10.7%)	**<.01**
No	2135 (86.6%)	8783 (89.3%)	
Marital status, n (%)			
Married	1555 (63.1%)	5838 (59.4%)	**<.01**
Single	911 (36.9%)	3996 (40.6%)	
Insurance status, n (%)			
Private, including Geisinger Health Plan (GHP)	1525 (61.8%)	5859 (59.6%)	
Medicare/Medicaid	890 (36.1%)	3659 (37.2%)	**<.01**
Military/Government	36 (1.5%)	216 (2.2%)	
No Fault/Work Comp	12 (0.5%)	78 (0.8%)	
Uninsured	3 (0.1%)	22 (0.3%)	

SD, standard deviation; BMI, body mass index.
Bold values indicate statistical significance ($P < .05$).
[a] Variables which display statistically significant results were unlikely to carry any clinically significant differences.

Table 2
Description of patient electronic text messages (ETMs) for all included patients stratified by TJA procedure types (robotic vs manual).

Electronic text message (ETM) variables	Total	Robotic arthroplasty	Manual arthroplasty	*P*-value
Patients who had procedures	10,908	2241	8667	
Patients sending ETMs within 30 days of their TJA, n (%)	2917 (26.7%)	905 (40.4%)	2012 (23.2%)	**<.01**
Number of ETMs between patients and orthopaedic department, n (messages per patient)	11872 (4.07)	3902 (4.31)	7970 (3.96)	**<.05**
Number of ETMs between patients who had an ER visit and orthopaedic department, n (messages per patient)	970 (1.25)	347 (2.41)	623 (0.99)	<.01
Days messages were sent, n (%)				
Monday	2204 (18.6%)	752 (19.3%)	1452 (18.2%)	
Tuesday	2279 (19.2%)	779 (20%)	1500 (18.8%)	
Wednesday	2106 (17.7%)	709 (18.2%)	1397 (17.5%)	.50[a]
Thursday	2014 (17%)	619 (15.9%)	1395 (17.5%)	
Friday	1769 (14.9%)	596 (15.3%)	1173 (14.7%)	
Saturday	685 (5.8%)	212 (5.4%)	473 (5.9%)	
Sunday	815 (6.9%)	235 (6%)	580 (7.3%)	

Bold values indicate statistical significance ($P < .05$).
[a] Chi-square test was performed for messages sent during the weekend vs weekday for each arthroplasty group.

their procedure. In both cohorts, ETMs were predominantly sent during the weekday compared to the weekend (Table 2).

Overall, 1942 (86.6%) patients in the robotic arthroplasty group and 6417 (74%) patients in the manual arthroplasty group had at least one phone call within the first month after their joint arthroplasty ($P < .0001$). Yet both the robotic and manual cohorts had an average of 2.49 phone calls within 30 days postoperation. ($P = .72$) (Table 3).

A subgroup analysis of specific surgical methods (UKA vs TKA vs THA) revealed a similar percentage for patients who sent ETMs after TKA in both cohorts (51.4% vs 54.6%, $P = .1098$). However, a statistically significant difference in the percentage of patients sending an ETM was detected for UKA (19.2% vs 3.7%, $P < .0001$) and THA (29.4% vs 41.7%, $P < .0001$) procedures in robotic and manual groups, respectively. The difference in average ETMs sent for these procedures in both the robotic and manual arthroplasty cohorts was not found to be statistically significant.

A similar subgroup analysis of these surgical methods for phone calls from patients within 30 days of their joint arthroplasty showed a higher percentage of patients who underwent either a manual TKA (46.5% vs 58.2%, $P < .0001$) or a robotic UKA (16.6% vs 3.7%, $P = .0001$) to have a phone call after their procedure. No statistically significant difference was detected for phone calls after THA in both cohorts (36.9% vs 38.1%, $P = .2355$). Table 4 displays the percentage of patients who contacted the orthopaedic surgery department after joint arthroplasty with respect to procedure type and surgical method utilized (Table 4).

From a procedural perspective, out of a combined 4527 THA cases, 3339 patients had a total of 11,349 postoperative communications (3.39 communications per patient). For the TKA cohort (total of 6962 cases), 4869 patients had a combined 19,169 postoperative points of communication (3.93 per patient). Lastly, of the 811 UKA cases, 584 patients had a total of 2219 postoperative communication encounters (3.79 per patient). The difference in these average total postoperative communications was statistically significant ($P < .01$), with TKA procedures having the most communication per patient and THA having the least.

There were 745 (7.5%) and 167 (6.8%) ER visits in the manual and robotic arthroplasty cohorts, respectively ($P = .17$). In total, there were 912 ER (7.4%) visits, resulting in a 0.07 visit rate per procedure. The average number of ER visits for the manual and robotic arthroplasty cohorts were 0.07 and 0.06, respectively ($P = .17$). Logistic regression analysis showed an odds ratio (OR) of 1.144 (95% confidence interval (CI) 1.097-1.193, $P < .001$) for the number of phone calls vs ER visits within 30 days after joint arthroplasty in the manual arthroplasty cohort. Similarly, an increased OR [OR = 1.185 (95% CI 1.087-1.291, $P < .001$)] was observed for the number of phone calls vs ER visits in the robotic arthroplasty group. Unplanned phone calls in robotic arthroplasty patients demonstrated 19% increased odds of presenting to the emergency department (ED). The number of ETMs did not appear to have an increased OR for ER visits in both surgical categories (Table 5).

Discussion

How patients decide to contact their surgeon following hip and knee arthroplasty can depend on several different factors. Our

Table 3
Description of patient phone calls for all included patients stratified by TJA procedure types (robotic vs manual).

Phone call variables	Total	Robotic arthroplasty	Manual arthroplasty	*P*-value
Patients who had procedure	10,908	2241	8667	
Patients with a phone call within 30 days of their TJA, n (%)	8359 (76.6%)	1942 (86.6%)	6417 (74%)	**.002**
Number of phone calls between patients and orthopaedic department, n (calls per patient)	20865 (2.49)	4826 (2.49)	16039 (2.49)	.72
Number of phone calls between patients with an ER visit and orthopaedic department, n (calls per patient)	1824 (2.35)	391 (2.71)	1433 (2.27)	**.01**
Days of the phone call, n (%)				
Monday	5060 (24.3%)	1115 (23.1%)	3945 (24.6%)	
Tuesday	3719 (17.8%)	880 (18.2%)	2839 (17.7%)	
Wednesday	3693 (17.7%)	860 (17.8%)	2833 (17.7%)	.49[a]
Thursday	3868 (18.5%)	928 (19.2%)	2940 (18.3%)	
Friday	4243 (20.3%)	973 (20.2%)	3270 (20.4%)	
Saturday	175 (0.8%)	46 (1%)	129 (0.8%)	
Sunday	107 (0.5%)	24 (0.5%)	83 (0.5%)	

Bold values indicate statistical significance ($P < .05$).
[a] Chi-square test was performed for messages sent during the weekend vs weekday for each arthroplasty group.

Table 4
Description of postoperative patient communications for all included patients stratified by anatomic procedure types.

Phone call and ETM variables	Total	Robotic arthroplasty	Manual arthroplasty	*P*-value
Patients sending ETMs within 30 days of their TJA, n (%)				
TKA	1563 (53.6%)	465 (51.4%)	1098 (54.6%)	.103
UKA	248 (8.5%)	174 (19.2%)	74 (3.7%)	**.009**
THA	1106 (37.9%)	266 (29.4%)	840 (41.7%)	**.006**
Number of ETMs between patients and orthopaedic department, n (messages per patient)				
TKA	6740 (4.31)	2121 (4.6)	4619 (4.2)	.15
UKA	912 (3.65)	665 (3.8)	247 (3.3)	.33
THA	4220 (3.49)	1116 (4.2)	3104 (3.3)	.09
Patients with a phone call within 30 days of their TJA, n (%)				
TKA	4638 (55.5%)	903 (46.5%)	3735 (58.2%)	**.008**
UKA	560 (6.7%)	322 (16.6%)	238 (3.7%)	**.006**
THA	3151 (37.7%)	707 (36.9%)	2444 (38.1%)	.23
Number of phone calls between patients and orthopaedic department, n (calls per patient)				
TKA	12429 (2.68)	2311 (2.6)	10118 (2.7)	**.041**
UKA	1307 (2.32)	806 (2.5)	501 (2.1)	**.002**
THA	7129 (2.24)	1709 (2.4)	5420 (2.2)	**.003**

Bold values indicate statistical significance ($P < .05$).

results show that, compared to joint arthroplasty performed manually, robotic joint arthroplasty had a higher percentage of patients who had a phone call (87% vs 74%), but the same average of 2.5 calls per patient within 30 days. *Kee et al.* reported an average of 0.73 after-hours phone calls per night in their study investigating a 3-month period where patients had access to a dedicated Google phone number [13]. Another report showed an average of 2.5 calls per patient in a rapid discharge and outpatient TJA setting and suggested that these situations could increase the postoperative communication burden for the surgical staff [14]. However, these findings are contradicted by *Husted et al.*, who reported no difference in phone calls between patients who were discharged on the day of surgery compared to those with an overnight hospital stay [15]. The variation within the reported literature, along with the findings of our investigation, highlight an interesting point: concerns for increasing communication without appropriately matched resources may challenge healthcare teams as the projected number of joint arthroplasty cases increases [1,16,17]. An underutilized resource may be an urgent care, which aids in triaging lower acuity patients between the clinic and the hospital [18]. Our investigation showed that robotic arthroplasty is associated with an increased rate of patients with a postoperative phone call compared to manually performed arthroplasty [7,14,17,19,20].

In addition to phone calls, our investigation analyzed ETMs sent by patients within the first month after joint arthroplasty. While robotic arthroplasty once again had a higher percentage of patients who initiated contact (40% vs 23%), the average number of ETMs sent by robotic arthroplasty patients were found to be significantly higher as well (4.3 vs 3.9). Historically, patients undergoing robotic UKA tend to be younger compared to their TKA counterparts. This younger population may be more technologically inclined and therefore quicker to either call or send an ETM to their provider. The reasons for manual THA and TKA having a higher rate of ETMs or phone calls, respectively, are not understood, and further investigation may be necessary. A previous study found that 48% of patients sent an electronic portal message within 90 days after TJA, which is higher than our investigation's finding of ~27% at 30 days postoperation [21]. This can be accounted for by their longer data collection period. In terms of absolute numbers, our results indicate that the majority of our patient population prefers phone calls over ETMs for postoperative communication. This is especially interesting when one considers the proposed advantages of ETMs, such as direct access to providers and staff and secure messaging. This may be explained by our institution's rural location and population, which have been shown to have lower levels of internet use and can account for this observed difference [22]. Furthermore, previous reports have shown that limited internet access and computer use are important factors in not using electronic portal messaging [23]. While surgical practices should offer a variety of patient communication options, one should be sensitive to their population's preferences.

The results of this investigation showed that a high number of phone calls between the patient and the orthopaedic surgery department carried a higher risk of visiting the ER within 30 days after joint arthroplasty. However, a higher number of ETMs were not found to carry an increased risk of an ER visit. This was observed in both the robotic and manual arthroplasty cohorts. Similarly, *Plate et al.* reported that electronic portal messaging after TJA did not decrease readmissions [21]. Previous studies have shown pain-related diagnoses to be the most common cause of ER visits after TJA [24]. Overall, our findings support *Plate et al.* in that ETMs did not increase ER visits; however, our study did reveal that phone calls may be a predictor of increased ER utilization.

In this context, patients' preference to use the phone as an "alert" mechanism to notify the orthopaedic surgery department seems plausible. A high number of telephone calls can be a warning sign to the surgeon or clinical team and a precursor to an impending ER visit, which is a known cause of increased healthcare costs in the postoperative setting [25-27]. Understanding a high call volume pattern in the early postoperative period can help the

Table 5
Total number of ER visits stratified by procedure and the results of the logistic regression model for ER visit within 30 d s/p TJA.

Manual arthroplasty		*P*-value
Total number of ER visit, n (%)	745 (7.5%)	.17[a]
Variables	OR for emergency room visit(s) (95% confidence interval [CI])	
Electronic text messages	1.004 (0.975-1.033)	.808
Phone calls	1.144 (1.097-1.193)	**.007**
Total contacts	1.042 (1.021-1.064)	**.009**
Robotic arthroplasty		
Total number of ER visit, n (%)	167 (6.8%)	.17[a]
Variables (for robotic arthroplasty)	OR for emergency room visit(s) (95% CI)	
Electronic text messages	1.039 (1-1.079)	.49
Phone calls	1.185 (1.087-1.291)	**.004**
Total contacts	1.062 (1.029-1.096)	**.006**

Bold values indicate statistical significance ($P < .05$).
[a] Chi-square test for the cases with and without an ER visit between the robotic and manual arthroplasty cohorts.

orthopaedic surgeon manage resources for patients at higher risk for an ED visit. Furthermore, interventions to direct patients to the orthopaedic care team rather than an unplanned ED visit would mostly likely provide more suitable postoperative care and reduce overall costs. A promptly coordinated office visit could be more efficient to evaluate, diagnose, and treat the early postoperative joint arthroplasty patient, in addition to potential cost savings [27].

The limitations of this study should also be acknowledged. Firstly, while we were able to identify ETMs that were sent from patients, the same "directionality" for postoperative phone calls could not be differentiated. Additionally, the content of postoperative communication points, of both ETMs and phone calls, were not evaluated in this study, and thus "factors" for phone calls were not directly defined. Patients were also not randomized to their surgical cohorts (robotic vs manual). This surgical technique decision was based on the surgeon's or patient's preference. Our investigation was carried out in a single healthcare system, and although patients from a variety of different surgeons were included, this can limit the investigation's generalizability. We did not define patients with or without technology available to communicate or patients who created an account to access portal messaging, which would potentially change the ratio of phone calls to ETMs. Our secondary outcome was to assess the number of ER visits. In this investigation, we did not review the causes of ER visits, which limits our ability to determine their appropriateness and distinguish between necessary vs potentially preventable occurrences. Future studies analyzing the causes of acute ER visits could help clarify preventable and nonpreventable visits and help target patients at risk. Lastly, this was a retrospective study, and thus, subject to the usual limitations retrospective studies have such as inferior level of evidence, sampling bias, and potential confounders. Despite these apparent limitations, the authors believe this to be the first study to compare the 30-day postoperative communication patterns of patients undergoing robotic and manual total hip and knee arthroplasty procedures.

As medicine further incorporates technology into patient communication avenues, artificial intelligence may allow messaging content categorization, leading to shortened response time. Some offices are currently testing artificial intelligence to respond to "inbox" messages from clinicians. A recent study by *Ayers et al.* found that the chatbot did a better job in some respects than clinicians [28]. Alternative communication methods, such as artificial intelligence or ChatGPT, may prove valuable in improving patient communication efficiency and reducing clinician burden but have yet to be aptly investigated [29].

Conclusions

This study sought to provide a comparison between the unplanned communication preferences of patients undergoing robotic and manual joint arthroplasty by determining the frequency of these communications from the patient to the orthopaedic team. Our investigation found robotic arthroplasty patients to place an increased demand on the orthopaedic surgery department in terms of unplanned patient contacts. Robotic arthroplasty patients had a significantly increased rate of ETMs and phone calls when compared to manual arthroplasty patients. When comparing arthroplasty procedures, THA had the overall lowest rate of unplanned postoperative patient communication, while TKA had the highest. This study contributes meaningfully to the literature by examining the early unplanned communication frequency of THA, TKA, and UKA patients, suggesting an increased number of contacts may be a harbinger of an unplanned ED visit. This knowledge can provide opportunity to intervene and direct patients to the most appropriate care site and provider while avoiding unnecessary healthcare expenses.

Conflicts of interest

The authors declare there are no conflicts of interest.
For full disclosure statements refer to https://doi.org/10.1016/j.artd.2024.101352.

CRediT authorship contribution statement

Yagiz Ozdag: Writing – review & editing, Writing – original draft, Software, Project administration, Methodology, Formal analysis, Data curation, Conceptualization. **Gabriel S. Makar:** Writing – review & editing, Writing – original draft, Project administration, Methodology, Formal analysis. **David J. Kolessar:** Writing – review & editing, Supervision, Methodology, Conceptualization.

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