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ORIGINAL ARTICLE

Telerounding Offers High Patient Satisfaction After Total Joint Arthroplasty

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Abstract *Background:* Research in surgical fields other than orthopedics has demonstrated high patient satisfaction with non-traditional telerounding modalities. *Questions/Purposes:* We sought to determine patient satisfaction and Hospital Consumer Assessment of Healthcare Providers and Systems (HCAHPS) scores of patients who experienced telerounding in the post-operative period after undergoing total joint arthroplasty (TJA). *Methods:* Fifty consecutive TJA patients were prospectively enrolled to receive telerounding. The patients were divided into two groups based on their satisfaction with telerounding. The HCAHPS scores of the patients who received telerounding were compared with 50 control patients. *Results:* Overall, the telerounding cohort had a positive reaction to telerounding. Comparing patients who were highly satisfied to those who were dissatisfied with telerounding, younger patients were found to be more frequently satisfied with telerounding. Compared with patients who did not receive telerounding, patients who experienced telerounding rated the hospital higher on a 10-point scale were more likely to recommend the hospital to others, more frequently believed their physicians treated them with courtesy and respect, and more often believed their physicians always listened to them carefully. *Conclusion:* An overwhelming majority of our patients found telerounding using FaceTime enhanced their care while recovering post-operatively from TJA. Those patients were typically younger and had significantly higher HCAHPS scores, which potentially can enhance the physician-patient relationship.

Keywords telerounding · patient satisfaction · hospital consumer assessment of healthcare providers and systems (HCAHPS) scores · total joint replacement

Level of Evidence: Level III: Therapeutic Study

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Introduction

Communication is a point of emphasis for all medical providers. Given the scheduling demands for orthopedic surgeons, both in the office and operating room, a time-efficient and effective method of communicating with patients is crucial. Rounding on patients is essential to tracking patient progress and enhancing the physician-patient relationship. In an academic setting, rounding involves both resident physicians and attending surgeons evaluating each patient. Unfortunately, time constraints inherent to a busy orthopedic practice too often lead to poor communication between the physician and patient.

The use of basic videoconferencing technology and mobile computing is a growing alternative to the classic "walking" rounds, which seeks to improve patient satisfaction by increasing both the efficiency of the rounds and time spent with each patient. The approach was initially piloted in a population of post-operative patients on a urology service using a remote-controlled robot with a microphone and video monitor [12]. The authors found a majority of patients in agreement that telerounding should be a regular part of patient care, communication was easy, and they would feel comfortable with daily telerounding. This platform is yet to be explored in the realm of joint replacement practice to our knowledge.

Telerounding with FaceTime (Apple Incorporated, Cupertino, CA, USA) software is a potential, widely available solution to providing patients with a personalized and thorough interaction with their surgeon that may also help to optimize surgeon time management. FaceTime has proven to be a Health Insurance Portability and Accountability Act of 1996 (HIPAA)-compliant and accessible tool that is frequently more available and less expensive than teleconferencing-specific devices [2, 8].

We sought to evaluate post-operative total joint arthroplasty patients' satisfaction with the tablet-style telerounding and whether it augments care. The purposes of our study were threefold. Our primary goal was to assess patient satisfaction through telerounding with FaceTime on a mobile device. Second, we aimed to determine which variables and patient characteristics might be correlated to satisfaction with using this type of telerounding. Third, we sought to compare the results of Hospital Consumer Assessment of Healthcare Providers and Systems (HCAHPS) scores of patients who experienced telerounding to those who did not receiving telerounding.

Materials and Methods

To quantify patient satisfaction with telerounding on FaceTime, 50 consecutive patients were prospectively enrolled between November 2016 and February 2017 from our institution. Informed consent was obtained according to pre-approved Institutional Review Board standards. The study population included willing patients indicated for either primary total knee or hip arthroplasty performed by the senior author and who spoke English as determined by the language they were consented in for surgery. To minimize the variability inherent an urban, multi-hospital system, all recruited patients had surgery on the same day of the week.

When FaceTime is used on a secure wireless network, it is considered HIPAA-compliant and has been approved for telecommunication use in all Veterans Affairs hospitals [10]. All internet access and communication conducted via FaceTime was carried out in a manner compliant with established hospital privacy protocols and federal legislation, as both the telerounding surgeon and patient were on the same secured, wireless hospital network.

Following pre-operative patient consent, subjects received our standard joint replacement center protocoled pre-operative and immediate post-operative care. On post-operative day 1, vital signs, pain scale scores, physical therapy progress, discharge plans, pertinent laboratory values, and any issues were reviewed remotely by the attending surgeon. A physician's assistant (PA) contacted the primary surgeon via FaceTime and supplied relevant patient information. Morning rounds were then conducted via FaceTime; a bedside PA mediated any interaction between the patient and primary surgeon. The PA would conduct any necessary physical exams or dressing changes under the primary surgeon's tele-observation. Given the variability of post-operative length of stay, all patients who stayed beyond post-operative day one received traditional inpatient rounding to avoid confounding. On the day of discharge, patients were asked to complete a verified satisfaction survey adapted from Daruwalla et al. [7] (Fig. 1). The HCAHPS standardized study instrument was administered via telephone by a member of the study team within 1 week of discharge.

Following discharge, patient-specific variables of all subjects were recorded. Data extracted from the patient record included operative details (procedure type, start time, total operative time, and intra-operative complications), relevant past medical or surgical history (previous pulmonary embolism, myocardial infarction, deep venous thrombosis, history of cancer, previous surgeries, and Charlson Comorbidity Index), demographic information (patient age, insurance type, and discharge plan), and daily progression with physical therapy (number of steps taken per session).

Statistical Analysis

For analysis of per-question survey results, patients who answered "not sure" or "not applicable" were excluded from analysis, leaving only patients who answered definitively with strongly agree, agree, disagree, or strongly disagree. To compare patient satisfaction after TJA among patients who participated in FaceTime rounding with the control group, the HCAHPS scores of the telerounding patients were compared with the previous fifty same-surgeon, consecutive TJA patients. These patients underwent traditional, daily in-person post-operative rounding prior to inception of the telerounding study in order to control for possible institutional confounders including ancillary staff changes, variations in offered hospital amenities, and hospital room upgrades. Subgroup analysis of the telerounding cohort was carried out by post hoc binary categorization as satisfied patients (who answered either "strongly agree" or "agree" to all survey questions) and unsatisfied patients (at least one answer of neutral, disagree, or strongly disagree). Patient variables were compared in attempt to define patient-driven factors associated with telerounding satisfaction.

All statistical analyses were performed with SPSS version 20.0 (SPSS, Chicago, IL, USA). Continuous variables were analyzed for normality with the Shapiro-Wilk test. Comparisons of continuous variables between the two groups were made using two-sample t tests when data was normally distributed or Wilcoxon rank-sum tests when data was not normally distributed. Categorical variables were

Survey results

1) My care was better because of the iPhone video (Facetime) with my surgeon.

Strongly Agree Agree Not Sure Disagree Strongly Disagree

2) I feel that iPhone video (Facetime) should be a regular part of patient care in the hospital.

Strongly Agree Agree Not Sure Disagree Strongly Disagree

3) The quality of the video was

Poor Fair Good Very Good Excellent

4) The quality of the sound was

Poor Fair Good Very Good Excellent

5) I could easily speak with my doctor using the iPhone video (Facetime)

Strongly Agree Agree Not Sure Disagree Strongly Disagree

6) If I were hospitalized again, I am comfortable with iPhone video (Facetime) everyday with my surgeon.

Strongly Agree Agree Not Sure Disagree Strongly Disagree

7) I would be very comfortable and happy with having only iPhone video (Facetime) on **weekends**.

Strongly Agree Agree Not Sure Disagree Strongly Disagree

8) If my surgeon were out of town and I was in the hospital, I would want to see my own doctor with iPhone video (Facetime) instead of seeing one of his partners.

Strongly Agree Agree Not Sure Disagree Strongly Disagree

Fig. 1. Questionnaire given to patients regarding their interaction with telerounding.

analyzed using χ-square analysis or Fisher's exact tests, if frequency cells were greater than 5 or less than 5, respectively. A standard $\alpha < 0.05$ was used for statistical significance.

Results

Mean patient age at time of surgery was 61.3 years (range 39 to 81 years) (Table 1). The majority of patients responded favorably to our questionnaire about their experience: when asked if their care was better, or if they felt telerounding should be a regular part of patient care in the hospital, 95.6% answered they strongly agree or agree with the statement to both questions. When asked if they would feel comfortable with daily telerounding on future inpatient stays, 92.5% strongly agreed or agreed. Lastly, 91.4% of patients responded that they strongly agree or agree that if their surgeon were locally unavailable, they would prefer telerounding over in-person coverage by a partner surgeon (Fig. 2).

Both the telerounding cohort and control group responded positively on HCAPHS scores concerning physician communication and their satisfaction with their hospital stay. When asked how often they felt doctors treated them with courtesy and respect, 88.6% of telerounding patients and 69.3% of control patients answered "always" ($p = 0.046$). The percentage of patients who answered "always" to how often their doctors listened carefully to them was also higher for the telerounding group (93.2% vs. 70.1%, $p = 0.02$). Lastly, both patient groups had a statistically similar rate of answering "always" when asked how frequently doctors explained medical circumstances in a sufficiently comprehensible fashion (88.6% vs. 75.6%, $p = 0.143$). Telerounded patients rated the hospital a 10/10 more often (59.1% vs. 31.7%, mean 9.1 vs. 8.5, $p = 0.044$). Finally, patients who experienced telerounding answered they would "definitely recommend" the hospital to their family and friends more often as well (86.4% vs. 73.1%, $p = 0.026$).

The satisfied group, which consisted of patients who answered either strongly agree or agree to all survey questions, had 24 patients. The unsatisfied group with 17 patients consisted of patients that had at least one survey answer of neutral, disagree, or strongly disagree. The average age of the satisfied group was significantly younger (58.96 years vs. 65.35 years, $p = 0.038$) than unsatisfied patients (Table 2). Among both groups, there were no adverse events up to 30 days post-operatively from the index procedure.

Table 1 Demographics

Mean age, years (SD)	61.6 ± 9.2
Median OR time, minutes (IQR)	86.5 (71, 116.5)
Mean case start, time of day (SD in hours)	12:54 PM ± 2:48
Median length of stay, days (range)	3 (2, 9)
Procedure, *n* (%)	
TKA	22 (53.7%)
THA	19 (46.3%)
Charlson comorbidity score, *n* (%)	
0	19 (46.3%)
1	6 (14.6%)
2	9 (22.0%)
3	4 (9.8%)
4	1 (2.4%)
5	2 (4.9%)
Previous joint replacement, *n* (%)	7 (17.0%)
Wound complications, *n* (%)	4 (16.7%)
PE, MI, or DVT during admission, *n* (%)	0
Transfusion, *n* (%)	0
Hospitalized previously, *n* (%)	17 (41.4%)
Home discharge, *n* (%)	38 (92.6%)
Mean sum of total steps with PT, *n* (SD)	264.2 ± 123.4

SD standard deviation, *IQR* interquartile range, *TKA* total knee arthroplasty, *THA* total hip arthroplasty, *PE* pulmonary embolism, *MI* myocardial infarction, *DVT* deep vein thrombosis, *PT* physical therapy

Adverse events were defined as Clavien-Dindo type 4 complications [11], surgical site/prosthetic joint infections, mechanical prosthetic complications, and hospital readmission for any reason. No other patient demographic variables were significantly different between the two subgroups.

Discussion

To our knowledge, this is the first study to prospectively analyze telerounding results data in patients having undergone joint replacement surgery, with encouraging results. Over 90% of patients responded favorably to each question in a previously published survey specific to analyzing telerounding satisfaction [7]. Further, when compared on standardized HCAHPS measures [27], telerounding patients felt more respected and cared for, were more likely to rank the hospital "10/10," and were more likely to recommend the hospital to others seeking hip or knee arthroplasty than those who experienced traditional rounding. This data-driven support of telerounding comes at an important time of increasing patient volumes and while interest in telerounding has continued to grow. There exists an expanding body of literature evaluating the role of

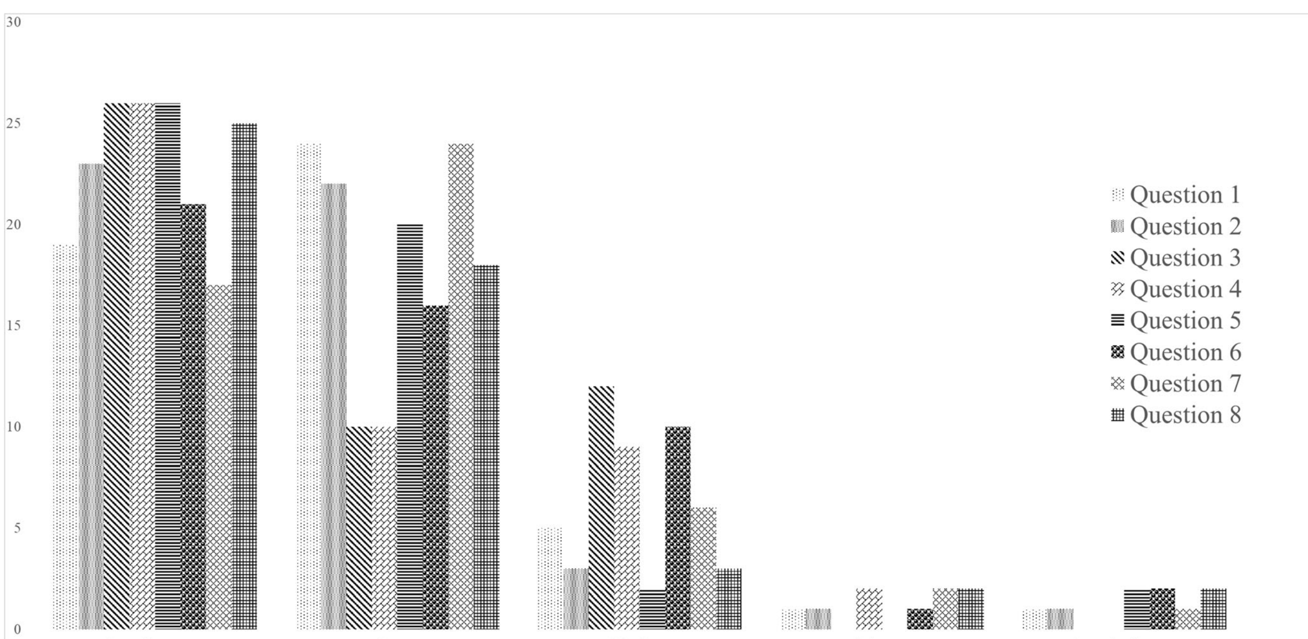

Fig. 2. Questionnaire results.

Table 2 Satisfied vs. unsatisfied patients

	Satisfied ($N = 24$)	Unsatisfied ($N = 17$)	p value
Mean age, years (SD)	59.0 ± 8.4	65.4 ± 10.7	0.038
Median OR time, minutes (IQR)	86.5 (71, 116.5)	84 (73, 89)	0.587
Mean case start, time of day (SD in hours)	13:31 ± 2:39	12:02 ± 3:08	0.162
Median length of stay, days (range)	3 (2, 9)	2 (2, 6)	0.307
Procedure, *n* (%)			0.938
TKA	13 (54.2%)	9 (52.9%)	
THA	11 (45.8%)	8 (47.1%)	
Charlson comorbidity score, *n* (%)			0.717
0	11 (45.8%)	8 (47.1%)	
1	5 (20.8%)	1 (5.9%)	
2	4 (16.7%)	5 (29.4%)	
3	2 (8.3%)	2 (11.8%)	
4	1 (4.2%)	0	
5	1 (4.2%)	1 (5.9%)	
Previous joint replacement, *n* (%)	5 (20.8%)	2 (11.8%)	0.679
Wound complications, *n* (%)	4 (16.7%)	0	0.128
PE, MI, or DVT during admission, *n* (%)	0	0	–
Surgical complication, *n* (%)	0	0	–
Transfusion, *n* (%)	0	0	–
Hospitalized previously, *n* (%)	12 (50.0%)	5 (29.4%)	0.217
Home discharge, *n* (%)	22 (91.7%)	16 (94.1%)	1.0
Mean sum of total steps with PT, *n* (SD)	279.0 ± 105.9	243.4 ± 147.3	0.372

SD standard deviation, *IQR* interquartile range, *TKA* total knee arthroplasty, *THA* total hip arthroplasty, *PE* pulmonary embolism, *MI* myocardial infarction, *DVT* deep vein thrombosis, *PT* physical therapy

telerounding in numerous healthcare settings. These include the post-operative inpatient setting [4, 7, 8, 12, 15, 18, 20, 26], the intensive care unit [6, 16, 22], and ambulatory outpatient medication compliance [17, 19, 25, 28].

Our study does have some limitations. Our sample size of 50 patients in each group may have diminished the study's power to detect smaller differences in groups between patients who did and did not favor telerounding. Additionally, participation in our study was voluntary via informed consent. This may have biased the cohort towards patients who were more open to our experimental rounding approach, though we do feel this to be unlikely as only one patient during the recruitment period declined to participate. In the same vein, the relative novelty of this technologic advancement in traditional rounding may have induced a Hawthorne observer effect on our overwhelmingly positive survey results; however, there is no way to create a placebo telerounding technique to control for this potential confounder. Similarly, because this type of rounding represented a paradigm shift for the surgeon, there is also the risk of experimenter's Hawthorne bias, for which the physician may adopt a more friendly tone of voice or line of communication to mediate the change in the patient's rounding experience. Furthermore, we elected to use a consecutive series of patients to generate our experimental and control groups. While a matched cohort may have better controlled for potential confounders, we felt that a study group that encompassed the smallest date range would mitigate the risk of external influences (hospital changes, ancillary staff turnover, variability in dietary offerings, weather shifts) that would potentially introduce bias into our satisfaction results. Lastly, given the categorical nature of our data responses, it is difficult to ascertain why certain patients did or did not prefer telerounding; a "free response" section could have helped elucidate this.

Our data aligns well with prior literature supporting telerounding in orthopedics in an Irish population: Daruwalla et al. [7] used a rounding robot to videoconference with an orthopedics joint replacement service and noted high patient satisfaction. Like our patients, the majority strongly agreed that their care was better with robotic telerounding, they would prefer to telecommunicate with an out of town physician rather than seeing the vacationing physician's partner, telerounding should be a regular part of patient care, communication was easy, and they would feel comfortable with daily telerounding. While we had similarly positive feedback with telerounding, we did so using readily available iPads with free FaceTime software, rather than a specialized, costly robot. Thus, our protocol implements a more externally valid, generalizable, and practical schema while retaining the optimal outcomes of previous studies. This is not without precedent, as FaceTime has effectively been used and positively reviewed by parents in neonatal intensive care units [13].

Our HCAHPS survey results also carry important implications in the modern healthcare delivery era. While the merits of this survey have been broadly debated, patient perception of respect for their care and communication have been shown as useful predictors of patient satisfaction [9, 21, 23]. Our data convincingly demonstrates a significant increase in HCAHPS scores for patients who received telerounding. As such, the specific findings of our HCAHPS investigation that show patient preference for telerounding through its association with communication, respect, and likelihood of hospital recommendation represent a meaningful opportunity to enhance patient satisfaction during elective surgery. With increased attention to quality improvement and patient-physician relations, it is impossible to ignore length of hospital stay and HCAHPS scores. Programs such as the Value Base Purchasing and Triple Aim Approach have satisfaction scores accounting for 25 to 30% of Medicare payments [1, 31], which also suggests reimbursement as a potential secondary benefit to the primary benefits of improving patient satisfaction and enhancing the patient-physician relationship.

While our data suggests that a permanent role for telerounding may be beneficial, not all patients were equally amenable to its use. The highest rates of satisfaction were associated with younger patients. This new application of newer technology is unsurprisingly less appealing to the older end of the spectrum of our hip and knee arthroplasty patients. However, this paradigm shift in inpatient care is perhaps less drastic than other such trends in arthroplasty, such as ambulatory joint replacement, multimodal analgesia, preferential home discharge disposition, and fast-track rehabilitation. While all interventions have proven beneficial in this population, patient adoption was often met with some hesitation. A consistently proven cornerstone of successful education on care changes has been pre-operative patient expectation setting [5, 14, 24, 29, 30]. This suggests a potential role for pre-operative patient education to further strengthen the effects of telerounding on patient's perception of their care.

A 2018 systematic review and meta-analysis of telemedicine in surgical patients also appears to support our findings. Asiri et al. reviewed 24 studies from 1998 to 2018, including 3 randomized controlled trials, 3 pilot studies, 4 retrospective cohort studies, and 14 prospective observational studies [3]. Their review included literature from the fields of pediatric surgery, urology, cardiothoracic surgery, transplant surgery, as well as orthopedics. They found that nearly all the described telemedicine protocols analyzed reported the technology to be diagnostically noninferior to in-person assessment by a physician. Furthermore, four studies included in the review concluded that telemedicine was a viable option to track post-operative surgical wound healing. Ten included studies assessed patient satisfaction specifically. In these, all reported high levels of patient satisfaction, with scores ranging from 4.5 to 5 out of 5 on post-operative patient surveys. The authors report that among the available literature, patient consensus appears to support the notion that telemedicine is a viable vehicle for delivering quality patient care [3].

While detractors of telerounding may inherently call its practice into question given its less personal, nontraditional nature, our data does not support this thinking. Traditionally, physicians have conducted their practice at a single location. Yet today there is a growing trend towards large-scale, multi-hospital healthcare systems where one physician may carry operative privileges and call responsibilities with an associated inpatient census at multiple institutions. When these hospitals are geographically distinct, physicians may often be focused with the impossible task of providing adequate time for inpatient rounding while also tending to a full surgical or ambulatory office schedule. Rather than penalize patients for the demands of modern healthcare, telerounding offers patients their deserved time on daily inpatient rounds while allowing the surgeon to physically be where his or her daily schedule demands. Our data demonstrates it to be a favorable method of delivering inpatient care. Though our study evaluates its use only in the inpatient setting, it may be even more useful in the ambulatory setting. As more patients seek care at reputable institutions that may be far from home, telemedicine may be a suitable and far more viable substitute for in-person incision evaluations and routine post-operative check-ins. During unusual periods such as the COVID-19 pandemic or a natural disaster, orthopedic tele-appointments allow effective, uninterrupted ambulatory care in circumstances where crucial in-person visitation is simply untenable. Future work should further expound upon the attitudes of surgeons using this method of rounding in the inpatient setting, as well as the adaptability of this approach to the outpatient setting. Further, with the growth of outpatient hip and knee replacement, this may prove to be an opportunity for enhancing acute post-operative interactions between surgeon and patient.

Our findings support the notion that telerounding with a relatively cost-friendly, widely available modality offers physicians an efficient and effective method to communicate with their post-operative inpatients, while enabling them to prepare for their current day's schedule remotely, and avoids the potential for a new surgeon, unknown to the patient rounding on them. It offers patients the care, respect, and open lines of communication they deserve to feel satisfied with their post-surgical care. Finally, it offers hospitals the opportunity to the patient experience and augment the relationship between patients and physicians with a net effect of potentially growing the demand for elective services via patient testimonial. Though it represents a potential paradigm shift in total hip and knee arthroplasty care, we recommend the use of simple videoconference telerounding and feel that the process can be further refined through pre-operative expectation setting and retrospective quality improvement analyses and may further be adapted to the orthopedic ambulatory care setting.

Compliance with Ethical Standards

Conflict of Interest: Andrew M. Schwartz, MD; Ferdinand J. Chan, MD; Benjamin J. Levy, MD; Sandip P. Tarpada, MD; and Evan M. Schwechter, MD, declare that they have no conflicts of interest.

Human/Animal Rights: All procedures followed were in accordance with the ethical standards of the responsible committee on human experimentation (institutional and national) and with the Helsinki Declaration of 1975, as revised in 2013.

Informed Consent: Informed consent was obtained from all patients for being included in this study.

Required Author Forms Disclosure forms provided by the authors are available with the online version of this article.

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