

Title

Impact of Patient Engagement on Tailored Education for Joint Replacement Using Technology

Abstract

Patient engagement and technology use for healthcare are important for optimal care. This study was designed to leverage technology in education among the adult joint population based on their engagement capacity and utilization of technology for care. A convenience sample of 80 patients undergoing joint replacement surgery and followed in the inpatient setting participated. Comparisons were made between an intervention group who completed the Person Engagement Index to measure their engagement capacity and received a technological educational plan based on their score versus those receiving the standard educational plan. The PEI psychometrics were sound and indicated high engagement capacity. Overall, the groups did not differ in utilization, satisfaction, and education comprehension; however, the intervention group reported a higher unit mean for the extent they felt ready for discharge and instructions for care at home. Results of this study informed patients' engagement capacity and technology use for pre/post-op education for procedure expectations and self-management throughout the joint replacement process and recovery. Future research includes use of technology for engagement capacity and outcomes with other populations, collecting socio-demographic data to determine differences among groups and examining the patient and provider experience and satisfaction with using technology to enhance care and outcomes.

Introduction (Background /Significance)

According to the American Academy of Orthopedic Surgeons, joint replacement surgery is one of the top elective surgical procedures in the United States.¹ In fact, a study found that in 2014, over 370,000 total hip replacements and over 680,000 total knee replacements were performed in the U.S.¹ Another study showed that total hip replacements are expected to grow at a rate of almost 175% and over 600% for total knee replacements by 2030.² With such a large portion of the population receiving total joint replacements, it is essential to understand factors that impact patient and clinical outcomes.

One of the key drivers of patient and clinical outcomes for joint replacement patients is patient education. In fact, joint replacement programs that provide preoperative patient education have shown positive postsurgical outcomes.³⁻⁵ Many organizations hold face-to-face classes before surgery for patients to receive education about their procedure, set expectations, discuss discharge planning, and decrease anxiety.³ However, not all patients can attend a face-to-face class prior to surgery. Some joint replacement education programs were developed to meet the needs of patients living in rural settings to receive their preoperative education through telehealth.³ This initiative launched the movement for providing joint replacement education through technology.³

One study examined the impact of using their traditional joint school education with a technology-enhanced program on length of stay, clinical, financial, and patient-focused outcomes.⁶ This study examined 2,080 adult patients undergoing joint replacement in the United Kingdom.⁶ The program intervention in this study included the use of videos, a patient website along with the Allied Health Professional website, and tools tailored to patients' individual needs.⁶ This study found that patients who completed the comprehensive intervention program demonstrated decreased length of stay, decreased 30-day and six-month readmission rates, fewer generic and specific complication rates, and decreased visits to the emergency room compared to patients who only attended the original joint school.⁶ These findings are significant

in that they demonstrate how providing education in multiple formats and accounting for patients' specific needs impacted outcomes.⁶

Patient satisfaction is another key driver in healthcare organizations. Since the majority of total joint replacements are elective surgeries, patient satisfaction plays an essential role in the future of these surgeries.⁷ Traditionally, joint replacement surgery success was measured with clinical outcomes, including pain, mobility, and infection.⁷

A study by Hamilton and colleagues⁷ differentiated clinical and surgical outcomes from overall patient satisfaction with the surgery and experience as an outcome. This large scale study included 4,709 patients that received hip (n=2,462) or knee (n=2,247) replacement surgery over the course of four years.⁷ Data related to satisfaction was collected both before and after surgery. Measurements included preoperative patient-reported outcome measures (PROMs), the Oxford Hip and Knee Score, and the Medical Outcomes Study Short Form 12 (SF-12), and post-operative PROMs.⁷ This study examined the results of satisfied versus dissatisfied patients and identified three main factors related to satisfaction including "meeting pre- operative expectations of surgery, achieving satisfactory pain relief following surgery and the overall hospital experience" .^{7(p.4)}

Another study that included 712 hip and knee joint replacement patients examined overall patient satisfaction as well as identifying patient characteristics that impacted satisfaction.⁸ All patients in this study adhered to a standardized joint replacement protocol that included "oral and written information, a detailed introduction for patients and relatives before the actual surgery, anesthesiological procedures, and rapid postoperative mobilization" .^{8(p.169)} This study found that patients had a higher level of satisfaction when they had a shorter length of stay.⁸ In addition, several factors were associated with increased satisfaction which included "increasing age (p = 0.01), being married (p = 0.02), and there being no need for opioid pain killers preoperatively (p = 0.02)" .^{8(p.171)} These factors related to increased patient satisfaction

can be used when developing interventions and programs for patients undergoing joint replacement surgery.

Education is a significant contributor to successful outcomes in elective hip and knee joint replacement surgery.⁹ Patients at this study site receive a comprehensive education plan both preoperatively and postoperatively.⁹ This education plan begins with a preoperative class attended by both the patient and their care circle member and is led by the joint replacement inpatient nursing staff.⁹ The postoperative education plan continues during the inpatient stay with reinforcement by the inpatient clinical team. This education is provided verbally by the nursing and physical therapy staff and supplemented with patient facing technology-platform on the patient's in room television. Patients are oriented to the technology platform upon admission and assigned individualized education to complete prior to discharge. Nursing staff typically provide a great deal of assistance to patients to navigate the technology platform and complete education.⁹ This process is reported to be based on generalizations that the joint replacement patient population in the local community has a decreased ability to engage in their health using technology. Prior to discharge, key discharge education concepts are reviewed with the patient and/or caregiver to ensure a safe discharge plan. Therefore, this study was formulated to look at opportunities to test the use of technology in education among the adult joint population based on their capacity to utilize the technology and engage in their healthcare.⁹

Methods

Design

This is an IRB approved quality improvement study that examined the impact of an assessment of a person's capacity to engage in their care (*Person Engagement Index* (PEI) score) and assigning individualized education on patients' utilization of technology for their healthcare, satisfaction and comprehension of education among the adult joint replacement population. The site for this project was an acute care inpatient setting serving 400 patients per year adult joint replacements. The project design consisted of comparing a control group that

received the standard of care and education (pre) and an intervention group that received individualized education based on their capacity to engage in their care through technology (post). No PHI or demographic information was collected on participants.

Sample

This was convenience sample of 80 patients (40 per group) that were seen at a Pre-Assessment Clinic (PAC) prior to joint replacement surgery and followed up in the inpatient setting. The PAC is a clinical area comprised of nurses, healthcare providers, and anesthesiologists who evaluate and screen patients before surgical procedures for anesthesia consent. An average of 400 patients /month are screened at the PAC and 35 joint replacement patients/month are evaluated in this setting. Patients seen at PAC for joint surgery over an initial 8-week time period (May-July 2019) were placed in the control group and followed the current standard of care and education. Patients seen at PAC after the initial 8-week period were placed in the intervention group and followed from August 2019-January 2020. The inclusion criteria included patients 18 years of age or older, ability to comprehend spoken and written English, that were assessed and educated prior to surgery in the PAC and anticipated to be admitted post-operatively to the total joint replacement inpatient unit. All patients that met the inclusion criteria were given a fact sheet and asked if they are interested to be involved in this study. Participation in taking the PEI survey was completely voluntary and anonymous.

Measurement

Person Engagement Index (PEI)

The PEI is a psychometrically sound, valid and reliable instrument to assess a person's capacity to be engaged in his or her care.¹⁰ The PEI is an assessment tool used to determine a person's capacity to engage in their care and apply appropriate interventions based on a PEI score. The PEI score is assessed utilizing an 18- item instrument which is comprised of 4 subscales: Engagement in Health Care, Technology Use in Health Care, Proactive Approach to Health Care, and Psychosocial Support. The total scale and four subscales have good internal

consistency, with each exceeding the Cronbach's alpha reliability measurement threshold of $>.70$. The total scale Cronbach's $\alpha = .896$ and each subscale results were: Engagement in Health Care = .885, Technology Use in Health Care = .854, Proactive Approach to Health Care = .728, and Psychosocial Support = .880. Each subscale and total scale has standardized scoring from 0%-100% for three levels of engagement capacity scores: low scores (0-33%), medium scores (34%-66%) and high scores (67%-100%).

Utilization metrics for use of technology platform/patient experience perception (PXP) for medication education

The healthcare organization has a patient-facing technology platform that provides pathways of care that are specific to various populations. The care pathways include specific educational information and videos, daily care reminders and milestones, goal attainment checklists, and general hospital information delivered through the television, tablet or by a patient's own device. For this project, utilization metrics that were evaluated included the inpatient unit's utilization of the inpatient technology solution for the joint replacement educational pathway and medication pathway. In addition, the platform included patient experience perception (PXP) questions on a scale from 0-10 with 0= "not good", 5= "okay" and 10= "great". For this study, the PXP medication teaching question, *"Have we done a good job teaching you about your medications?"*, unit's average was measured during the data collection period of the control and intervention groups.

Hospital Consumer Assessment of Healthcare Providers and Systems (HCAHPS) questions

Patients who are discharged from an inpatient stay may receive a HCAHPS survey, a 32-item survey used as a data collection methodology for measuring patients' perceptions of their hospital experience by the Center for Medicare and Medicaid Services (CMS).¹¹ For this project, two questions were examined on the feedback received from patients on the joint replacement unit during the study comparison time period. The two HCAHPS questions examined were: 1) *When I left the hospital, I had a good understanding of the things I was*

responsible for in managing my health and 2) When I left the hospital, I clearly understood the purpose for taking each of my medications.

Post-Education Comprehension Quiz

A post-education quiz was delivered verbally on the day of discharge to the control and intervention groups and documented by the provider delivering the education on the patient's comprehension and whether remediation was needed. Table 1 outlines the post-quiz questions.

Intervention

The differentiation between the control and intervention group is the administration of the PEI and individualized education assigned to the intervention group participants that was based on the PEI technology subscale score. Both the control and intervention group received post-op education with follow up comprehension questions with the control group receiving standard education. The inpatient staff used the PEI technology subscale score and applied the appropriate interventions that correlated to the patient's PEI technology subscale score.

The three items included in the PEI technology subscale were scored based on a low, medium, and high engagement capacity scale. Interventions were developed to correspond to each engagement capacity level to specifically educate patients according to their ability to utilize technology as a learning tool. The unit standard of care includes joint replacement surgery education provided on an interactive patient care platform hosted on the in room Smart TV. Nursing staff introduce this technology to patients upon admission and assist with use throughout the patient stay, launching the videos for the patient. Prior to the study, no measurable method existed to assess the level of assistance required for each patient to utilize technology to engage in post-operative education.

Low score interventions included high levels of assistance, reminders, and supplementation with additional paper education. This level of assistance was the standard for most patients prior to the study. Medium score interventions included lower levels of individual assistance using interactive patient care but access to self-guided instructions and

encouragement to utilize additional technological resources upon discharge. High score interventions included an introduction to the interactive patient care platform and validation that the patient was enrolled in the patient portal to continue to access technology resources after discharge. Refer to Table 2 for details of interventions based on PEI technology subscale score.

The PEI survey was administered to the patient during the pre-operative joint replacement class. The class was facilitated by one of the inpatient nursing staff from the Joint Replacement Unit, who explained the purpose of the study, providing the informational letter to the patient. The survey was administered electronically at the end of the class on a tablet device using the technology application. Scoring logic in the electronic PEI survey allowed staff to access the patient's technology subscale score and document it securely. Upon admission, the staff referenced the score, applying the corresponding interventions. The PEI implementation provided staff with a method to tailor technology related education to the level of the individual, as opposed to broad interventions for all patients.

Results

Person Engagement Index

Two surveys with greater than 50% missing data were removed from the intervention group PEI analysis with imputed means for those responses with less than 5% missing data (n=38). Of the 38 completed responses, ___ had a low score (0-33%), ___ had a medium score (34-66%), and ___ had a high score (67-100%). The psychometric properties of the PEI among this sample all demonstrated good reliability (Cronbach's alpha >.70.), for the total scale and all four subscales. Refer to Table 3 for reliability statistics. The overall item mean was 4.33, indicating a high level of capacity engagement among this population. The item with the highest mean, (4.66) was *I have the necessary support from family and friends in my life to achieve my health goals* and the item with the lowest mean (4.03) was *I am open to receiving some of my health care through technology (i.e., computers, cellphones, email, texting, video chat, internet etc.)*. Refer to Table 4 for detailed item descriptive statistics.

Utilization metrics for use of technology platform/patient experience perception (PXP) for medication education

Utilization of the technology platform system for unit completion of at least one video education via the technology platform was between 89-97% of patients during the control group period and 80-97% during the intervention group period. There was no difference in the joint replacement unit's PXP medication teaching question: "*Have we done a good job teaching you about your medications?*" responses. During the control group data collection time period ($n=44$), question had an average of 10 (great) compared to the intervention group data collection period, ($n=88$) with an average of 9.9 (great).

Patient satisfaction (HCAHPS)

During the control group data collection period, 100% ($n=30$), either agreed (23.3%) or strongly agreed (76.7%) compared to the intervention group data collection period, 95.8% ($n=48$) either agreed (20.8%) or strongly agreed (75%) on the question of having a good understanding of managing their health. For the understanding of the purpose of medications, the data collection during the control group time period indicated 100% ($n=30$) either agreed (20%) or strongly agreed (80%) whereas, the intervention group data collection period reflected 95.1% ($n=41$) either agreed (19.5%) or strongly agreed (75.6%). In addition, the intervention group data collection period reported a higher unit mean for the extent they felt ready for discharge and instructions for care at home. Refer to Figure 1 and Table 5 for detailed results on the unit HCAHPS questions examined.

Education Comprehension

There was no difference among the control ($n=40$) and intervention groups ($n=38$) on the educational comprehension post-op quiz. Both groups were able to answer the comprehension questions accurately with one person needing remediation of education in the intervention group.

Limitations

Some limitations should be noted about the generalizability of this study. Our measures may be susceptible to response and recall bias since the survey was all based on self-reported data. The sample size is relatively small, which limits the generalizability of the results to the population in other settings.. Furthermore, many confounding factors are not under control in our study (e.g., caregiver influence, technology usage background, patient-provider relationship, and no demographic data).

Discussion/Practice Implications

This study further validated the use of the PEI to measure a person's capacity to engage in their healthcare. Overall, the control and intervention groups did not differ in utilization, satisfaction and education comprehension; however, the ability to know a person's capacity to engage in their healthcare offered the opportunity to partner with patients on how they want to receive their care and education. Furthermore, the option for patients to have different teaching modalities based on their engagement capacity may enhance patient participation in their care and self-management, ultimately impacting patient outcomes.

Involving bedside clinicians in the research process has had positive implications for nursing practice. It was critical to design the study and educational interventions with the involvement of bedside clinicians familiar with the educational standards and approach on the joint replacement unit and to determine the study impact on nursing workflow. A professional practice culture provides clinical staff with the support and opportunity to positively impact patient outcomes.¹²

The results of this study provide evidence for clinical staff to develop more individualized technology based education plans for patients undergoing joint replacement surgery. Rather than generalized instructional interventions, this study provides a measurable tool to determine the patient's ability to engage using technology. The use of this measurement allows the clinical team early identification of patients needing an alternate educational approach, focusing interventions on the individual patient's health care engagement strengths. The ability to offer

patients individualized interventions with the use of the PEI tool supports continued application of this educational approach.

Technology Use in Healthcare

Through the use of technology, patients can become active participants in their healthcare journey, which can help meet the ultimate goal of managing their own care. Interactive use of technology continues to increase in the healthcare setting with many benefits identified.⁶ The direction and future application of technology in healthcare will continue to grow for patients and be a significant part of their healthcare experiences.¹³ Technology can serve as an extension of care for patients to access in their own time and at their own pace.

Utilization of the PEI survey can help guide patients to proactively interact with the health system delivering care. The PEI survey provides a real time measure to help guide clinicians to work with patients to individualize care with appropriate goals and interventions. Clinicians can use a patient's PEI overall and technology subscale score to assist with the identification of patients' preferences for care. The automatic scoring available through the technology can impact practice as clinicians will require less time to manually assess a person's capacity to be engaged and partner with patients to plan accordingly based on an individual's wants and needs.

For example, a patient with a PEI technology subscale score of "medium capacity" can be evaluated by the clinician on their technology proficiency and use teach-back methods to ensure they can use technology effectively to meet their care goals. Clinicians can devise interactive interventions through the use of technology to address education, patient satisfaction and outcomes achievement. In contrast, a patient with a PEI technology subscale score of "low capacity" would indicate a deeper assessment is needed and additional support materials should be provided. Among the group of low scoring patients, technology may not be the appropriate method for education delivery or goal setting.

The ability to streamline administering the PEI survey through technology reduces variation in practice as well. Leveraging technology to administer the PEI reduces clinician variation and standardizes the process, assuring a uniform experience for all patients. The same is true for re-surveying patients at regular intervals to monitor for improvements in their capacity to be engaged.

Patient Satisfaction

Healthcare consumers are looking for various options for how they interact with providers and receive and access services. To enhance the patient experience, healthcare systems are utilizing technology for access to electronic medical records as well as the increase demand for the ability to receive services through technology.¹⁴ Several studies utilizing technology for healthcare showed high patient satisfaction with this as a mode of care.¹⁵⁻¹⁷ Furthermore, technology use in healthcare has shown promise for self-care management and improving clinical outcomes.¹⁸⁻²⁰ Healthcare organizations continue efforts to bolster consumer loyalty, patient satisfaction through various options for receiving healthcare services which is an important driver for improving the patient experience.

Patient Education

Tailoring patient education and the patient experience are not new concepts. Several other studies identified both patient and learning attributes of patients as a means of tailoring education.^{7,8,20} This study showed that tailoring education using technology to a patient's technology subscale score allowed providers to adjust their workflow and allow patients to receive part of their joint replacement education through technology. Healthcare organizations need to continue to evaluate different methods to educate patients that meet the individual patients' needs and learning styles. Utilizing the PEI and the technology subscale score can help organizations and providers determine the best method for patient education.

Conclusion

The results of the study supported the initial staff assessment of the patient population's engagement ability. Many of the patients fell in the low to medium range PEI score range for technology use in health care. Limitations of the study included difficulties implementing behavior change among the clinical staff and support staff. Staff have a natural tendency to apply the same interventions to all patients rather than an individualized educational plan based on technology use in health care. This could be a result of bias among the staff members related to patient age and/or rural geographic region of the hospital service area. The educational standard is also a long standing practice on this unit and difficult to modify. The educational plan and interventions for the joint replacement program are very prescriptive given the consistent patient population. A future study could be considered using a more variable patient population with multiple educational needs that may provide opportunity for different results.

This study informed on assessing a person's capacity to use technology to engage in their healthcare for the pre/post-op education for procedure expectations and self-management throughout the joint replacement process and recovery. Opportunities for future research include studying other populations' use of technology for engagement capacity and related outcomes, collecting socio-demographic data to determine differences among groups and their technology use for healthcare and examining the patient and provider experience and satisfaction with using technology to enhance care and outcomes.

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Table Legend

Table 1. Joint Replacement Post Quiz Questions

Table 2. Intervention based on Technology PEI Score

Table 3. PEI Sample Reliability

Table 4. Person Engagement Index Item Descriptive Statistics

Table 5. HCAHPS Results