




Using Qualitative Research to Reduce Readmissions and Optimize Perioperative Cystectomy Care

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BACKGROUND: Preventable complications and readmissions after cystectomy may be detectable via postoperative monitoring of patient-reported outcomes (PROs). However, no study has defined meaningful PROs or the use of mobile communication devices (mobile health [mHealth]) to capture them. The objectives of this study were to determine which high-priority PROs influence patients' perioperative experience, what processes influence these outcomes, how patients and caregivers differ in their experiences, and how mHealth might be used to improve outcomes. **METHODS:** Forty-five semistructured, in-depth interviews were conducted with readmitted cystectomy patients, caregivers, and providers with an interview guide that addressed perioperative education, symptoms, function, and the potential for mHealth interventions. Among 15 patients, 10 had an interviewed partner. A thematic analysis of interviews conducted with readmitted patients, caregivers, and providers was performed to examine processes that affected perioperative care and readmission and to determine how mHealth interventions might be implemented. **RESULTS:** Readmitted patients and caregivers ranged in age from 33 to 78 years and were diverse in race and stage. The providers included a diverse representation of physicians, nurses, and other specialists. Cystectomy preoperative education was overwhelming and lacked personalization, and this contributed to a fundamental lack of knowledge regarding normal and abnormal symptoms after surgery. Three connecting themes were identified: 1) cystectomy education overload, 2) a need to define normal symptoms, and 3) education with incremental learning through mHealth. **CONCLUSIONS:** A personalized mHealth intervention addressing themes of education overload, the definition of normality, and incremental learning could be realized through mHealth technology and provide the right information for the right patient at the right time. **Cancer 2019;125:3545-3553.** © 2019 American Cancer Society.

KEYWORDS: cystectomy, education, mobile health (mHealth) quality improvement, patient-reported outcomes, readmissions.

INTRODUCTION

Readmissions after oncologic surgery are prevalent and costly, with as many as 1 in 3 patients readmitted within 30 days.^{1,2} Readmissions may also be measurable indicators of preventable complications such as dehydration and infection, which could be mitigated by timely outpatient surveillance and management.²⁻⁵ Complications of major cancer surgery are expected to rise because of an increasing number of older cancer patients with comorbidities.^{6,7} Among these surgeries, cystectomy for bladder cancer has the highest rate of readmissions, with 43% readmitted within 90 days.⁵ An intervention that focuses on preventable complications is likely to both reduce morbidity and avert hospital readmissions and could serve as a model for patient-centered cancer programs in other postsurgical contexts.

Preventable complications and readmissions are detectable via postoperative monitoring of patient-reported outcomes (PROs).⁸ These PROs can drive interventions to avert complications, particularly when mobile and wireless devices are used to improve health outcomes (mobile health [mHealth]). However, defining the most salient PROs is challenging. Furthermore, little is known regarding patients' perception of the postoperative experience, and no studies to our knowledge have captured the most meaningful PROs to improve the postoperative experience and reduce readmissions. Therefore, our research objectives were to define which high-priority PROs influence a patient's perioperative experience, what processes influence these outcomes, how patients and caregivers differ in their experiences, and how mHealth might be used to improve postoperative outcomes. By identifying opportunities in care delivery, we hope to offer solutions for undesirable patient-centered outcomes that could inform future interventions.

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MATERIALS AND METHODS

Design

This article presents a thematic analysis of semistructured, in-depth interviews conducted with readmitted patients, caregivers, and providers to examine processes that affect perioperative care and readmission.

Sampling

Purposive sampling was used to identify patients of different sexes, races, and ages as well as providers with different types of expertise (eg, home health nurses, physicians, ostomy nurses, and social workers).

Data Collection

In-depth interviews were conducted with a semistructured interview guide that covered 3 general topics: 1) education, symptoms, and function before and after surgery; 2) medication adherence after surgery; and 3) intervention design with a focus on mHealth. mHealth was specifically addressed because of its potential for personalized intervention and prior supportive research in the field of PROs.⁹ An a priori goal of this study was to investigate the role that mHealth technology could play in creating such an interactive learning intervention. Therefore, patients, caregivers, and providers were asked about their views of this type of intervention and how it might be incorporated into perioperative care. Interviews were conducted between January 2016 and May 2017. Patients and caregivers were recruited from the urology clinic and hospital, whereas providers were recruited from the urology clinic and inpatient urology ward. Interviews were audio-recorded and transcribed by a transcription service. Although some interviews were performed in person, others were conducted over the phone according to participant preference. A total of 45 participants were interviewed (15 patients, 15 caregivers, and 15 providers). Only 3 patients declined participation (1 was unable to hear, and 2 felt “too ill” to participate), whereas 2 caregivers declined. No providers refused participation.

Interviews lasted between 30 and 60 minutes with an average duration of 40 minutes. Interviews elicited detailed narratives of individual experiences and perceptions regarding the perioperative period and readmission.

Research Team and Reflexivity

The first author (A.B.S.) is a urologic oncologist who performs cystectomy as part of her clinical practice. Because of the potential influence of her own opinions and experiences, interviews were conducted by an objective research assistant (the second author [D.M.]). A constructivist

epistemology was maintained during the analysis that was congruent with the belief that patients, caregivers, and providers experience different (but equally valid) realities of the perioperative process and its relationship with readmission.¹⁰

Ethics

The institutional review board at the University of North Carolina at Chapel Hill provided approval for this study. Before enrollment, all participants signed informed consent. If interviews were conducted in person, participants were provided a written consent form to sign. If interviews were conducted over the phone, the participant was sent a consent form in the mail before study initiation and also read the contents of the oral consent form before providing both verbal and written (mailed) consent for participation.

Analysis

Data for analysis included transcripts of audio recordings from in-depth interviews. The first and second authors (A.B.S. and D.M.) coded transcripts in the software program NVivo (version 11; QSR International, Victoria, Australia) initially with a grounded theory approach.¹¹ Grounded theory methods are used to discover a theory within textual data—in this case, a theory about why patients are readmitted and how the processes leading to readmission could be improved. As interviews were conducted, a codebook was created jointly by the first and second authors (A.B.S. and D.M.). Codes were grouped into categories and compared with each other iteratively while they focused on differences and how categories were related. However, during this inductive process, the need for a connecting approach became evident because of the interconnected relationship between the preoperative and postoperative experiences of participants. Because of the chronologic connectedness of the data, a thematic analysis with a narrative approach using memos was performed, with particular attention paid to differences in the patient/caregiver dyad.¹² Each transcript was read once; a second reading of the transcript was conducted, and the transcript was coded according to emerging themes. Then, meaningful segments were identified according to thematic function. As new interviews were conducted, each was compared and contrasted with prior ones. Interpretations were re-analyzed by checking transcripts as new information emerged. Subsequently, the larger meaning of the combined narratives was interpreted and represented by a focus on themes, content, and structure. After 12 interviews in each category (patient, caregiver, and provider), no

TABLE 1. Study Participant Characteristics

	Sex	Age, y	Race
Patient stage			
pT2c pN0	Male	74	White
pT3a pN0	Male	78	White
pT3a N0 Mx	Male	73	White
pTis pN0	Female	72	White
pT3b pN1	Male	69	White
pT2 pN0	Male	70	White
pT4a pN0	Male	56	White
pTis pN0	Female	59	White
pT3a N3	Male	63	White
pT2b pN0	Female	68	White
pT3a pN1	Female	63	White
pTis pN0	Male	64	Black
pT3a pN0	Male	67	White
pTis pN0	Male	66	Black
pT4a pN0	Female	63	White
Caregiver relationship			
Wife	Female	74	White
Daughter	Female	50	White
Wife	Female	42	Black
Wife	Female	69	White
Wife	Female	70	White
Daughter	Female	55	White
Wife	Female	59	White
Daughter	Female	40	White
Daughter	Female	36	White
Daughter	Female	33	White
Spouse	Female	59	White
Daughter	Female	45	White
Partner	Female	65	Black
Husband	Male	65	White
Partner	Female	56	Black
Provider role			
Surgeon	Male		
Physician's assistant	Female		
Resident	Male		
Floor nurse	Female		
Nurse practitioner	Female		
Floor nurse	Female		
Case manager	Female		
Ostomy nurse	Female		
Ostomy nurse	Female		
Surgeon	Male		
Nurse navigator	Female		
Ostomy nurse	Female		
Nutritionist	Female		
Clinic nurse	Female		
Resident	Male		

Color coding denotes patient/caregiver dyads.

new information was emerging from the interviews. The primary author (A.B.S.) consulted with a coauthor, who agreed with this assessment, and 3 additional interviews were conducted to ensure that no new information would be gained. Recruitment ceased after 15 interviews in each category (45 total interviews).

RESULTS

The 15 readmitted patients and the 15 caregivers ranged in age from 33 to 78 years, with a mean age of 67 years for patients and a mean age of 55 years for caregivers.

The majority of the patients and caregivers were white (87%), with 13% black; this reflected epidemiologic trends of bladder cancer in the United States.¹³ Half of the patients had localized disease (\leq pT2), 6 (40%) had pT3-T4N0 disease, and 3 (20%) had pN+ disease (Table 1). Among 15 interviewed patients, 10 had an interviewed partner (representing a patient/caregiver dyad). The 15 providers represented a diverse representation of urology providers, including physicians, nurses, social workers, nutritionists, and wound care specialists. Although each patient, caregiver, and provider experience was unique, there were many commonalities, particularly with respect to the amount of cystectomy education and its content. Differences were noted on the basis of the perceived need for additional information and when/how it was delivered. From an exploration of the narratives of each participant, 3 connecting themes emerged: 1) cystectomy education overload, 2) definition of normal symptoms, and 3) personalization of education for incremental learning. Each theme will be described separately but integrated incrementally to highlight their connectedness.

Cystectomy Education: “Drinking Water out of a Fire Hydrant”

General perceptions regarding cystectomy education emphasized the large amount of information required to be fully prepared for surgery or its postoperative symptoms. One patient described a feeling of being overwhelmed by the large volume of perioperative information in a short time period:

Patient: I remember being totally overwhelmed at just the thought of what they were talking about... that just kinda blew me away. If one has never walked down that road and all the sudden, you're facing that surgery, post-op and all that business, learning how to use the bag and so forth, it's like drinking water out of a fire hydrant. There's so much there. There's so much to be learned. Even now, there's still things I need to learn, I'm quite sure...learning incrementally was a benefit and not a negative.

This quote illustrates the large amount of information required to be “fully prepared” and also highlights the impossibility of acquiring that knowledge. Providers commented that knowledge is provided formally at 2 distinct time points: once during the preoperative visit and another time during the discharge process. Both time points highlight the same issue of information overload, which is recognized by providers as well. Both nurses and physicians commented on the amount and quality of provided education:

Provider: Written stuff maybe is way over their head.... Sometimes you'll load them with information and then they are gonna forget it when they walk out the door.

Provider: A lot of times they don't realize the questions they have until they get home and get to trying to do different things.

Although the current perioperative process emphasizes formal, written education before surgery and directly afterward, both patients and providers highlighted the need to learn incrementally to acquire knowledge at the point of care. However, the best source of this knowledge may differ. Patients and caregivers agreed that information can come from numerous sources, but they diverged about the best perceived source. The following patient describes value from entirely different sources of information:

Interviewer: From whom did you receive this education before your surgery?

Patient: I'd list these in an order of significance to me as far as time and information. One, I spoke to a friend of mine who's a pastor of his church who had this surgery about 15, 20 years ago. I've spoken to him three or four times. That's been very beneficial because it's real life. It's "this has happened to me" kind of a thing. That would be number one. Number two would be the surgeon. Number three would be from nurses and other medical personnel who, at those junctures, were filling in some of the gaps of information. Those'd be the three from whom I think I gained the most information.

Interviewer: Which information source did you find most helpful?

Patient: Well, that's a hard question in that in one sense, the gentleman who'd had the real life experience. That was extremely helpful because I could look at it through his eyes. His comments were more of a testimonial thing. When the doctor or the surgeon spoke, it was more of the academic and more of the scientific, medical, physical, those things. In that regard, his was the best description, in that sense. I'd say it was a tie there. They'd come at the issue from two different perspectives.

A provider also recognized that learning needs differ, and different educational sources are useful:

Provider: I think each patient learns in their own way. Some of these folks don't have access to computers.

Some are very computer savvy and like that. Some are just so overwhelmed they don't know where to go and need a link to a person that they trust that has been involved in their care throughout the process. I think a combination of those things are good, just based on patients' learning needs.

Multiple sources of information provide context and information from different perspectives (the nonmedicalized patient experience vs the medicalized provider experience). According to patients' and caregivers' testimonials, both are recognized as valuable and necessary, filling different learning needs of the patient. Providers seemed to appreciate this nuance as well. In comparison, other patients/caregivers preferred information from the provider and his or her team only:

Interviewer: Which information source did you find most helpful?

Patient: The doctor, cuz, honestly, I didn't trust too many of the people. I trusted the doctors and nurses at UNC, so that's pretty much why I didn't bother looking. I also didn't want to get scared....

Although patients and caregivers differed on their preferred source of information, they similarly chose that source on the basis of trust.

When we explored differences based on patient/caregiver dyads, perspectives were not always aligned and appeared to be related to the level of preparedness for surgery. Caregivers were more likely to perceive a lack of assistance and a need for additional information. Patients, on the other hand, often expressed adequate information, regardless of the source. In one particular dyad, the patient expressed distrust with respect to additional sources (eg, online) and chose to receive all information through her provider. Although she admitted that education "could have been way more in depth," particularly with respect to her stoma, she also described being prepared for surgery and declining home health services (which assist with stoma care). Her caregiver explained that her mother was "very shy" and "doesn't do well with strangers" while also lamenting that they were only a "little bit prepared," with provided information described as "not patient-oriented" and a "generic one for all." Both the patient and her caregiver came to the conclusion that reporting symptoms to her provider team would have eased their concerns, particularly by providing an understanding of what was normal and abnormal.

In summary, preoperative cystectomy education in its current form is overwhelming. Attempts to provide

this information at a single time point are futile from patient, caregiver, and even provider perspectives. Information can be delivered via multiple sources, but ultimately the most preferred source would be those whom the patient and caregiver trust.

Postsurgery Symptoms: Defining Normal

The issues surrounding information overload in the preoperative setting connect directly to a poor understanding of postsurgery symptoms. Symptoms described by the provider team both before and after surgery clearly focused on complications (ie, abnormal) and action-based items (ie, what to do or not do) rather than expected (ie, normal) symptoms. Patients, caregivers, and providers identified similar lists of symptoms and complications that were either described or experienced. These included dehydration, infection, swelling, and constipation among others (Table 2). Additional information provided by the care team focused on actions rather than symptoms (eg, what to eat and what to do or not do). For example, a nutritionist provided nutritional recommendations for before and after surgery. Surgeons described activity limitations to expect after surgery.

Patients and caregivers also described postsurgical symptoms that were “normal” (in that they did not require treatment) yet bothersome. However, they lacked the understanding needed to distinguish those symptoms that required emergent evaluation (abnormal symptoms) and those that could be observed (normal symptoms). Preoperative education often lacked this comprehensive information, and even if it contained all of the information, the content was difficult to remember. The need for a distinction between normal and abnormal symptom education was recognized by both patients and providers in several interviews:

Patient: The surgeon may have mentioned that as a possibility and—but there’d been so many things that had [been] mentioned to me that, “This might be a rare occurrence or in a few cases, this particular thing takes place.”

Provider: One set of education needs, that’s related to anticipated changes that are normal. The new normal for them, living with a stoma or whatever.

All patients and caregivers expressed a lack of understanding of what constituted normal postsurgical symptoms and how this might hinder them from contacting the provider team when necessary. An analysis of dyads revealed a diverging narrative in which caregivers particularly described overwhelming stress, which was often

TABLE 2. Postcystectomy Abnormal Symptoms, Normal (Expected) Symptoms, and Recommended Actions Described by Patients, Caregivers, and Providers

Abnormal Symptoms	Actions	Normal (Expected) Symptoms
Decreased urine output Fever	Avoid heavy lifting Walk daily	Taste change Decrease in appetite (mild)
Redness of incision	Avoid bathing for 2 weeks	Leaking ostomy bag
Drainage from incision	Dietary recommendations	Hematuria
Opening from incision Constipation Diarrhea		Mild fatigue Mild pain Mild bleeding from stoma
Abdominal pain Loss of appetite Other pain Poor sleep Weakness Mental status change Flank pain Severe fatigue		

unrecognized by the patients. According to caregiver interviewees, the stress often resulted from misunderstanding normal and abnormal symptoms, and this influenced when and whom they would call. This stress often resulted in a waiting period that led to readmission. Although stress was not as prominent among patients, they also described confusion stemming from the inability to distinguish between normal and abnormal symptoms.

Bridging Preoperative-Postoperative Education: The Right Information for the Right Patient at the Right Time

In addition to a need for education and incremental learning, patients, caregivers, and providers also described barriers to receiving education. Here, a patient, a caregiver, and a provider describe issues with calling the clinic for postoperative information:

Patient: Well, depending on the operator that answers, if you say that, they will say to you, “Oh, you need to call the clinic.” [Laughter] You feel like a rat in a maze running in a circle.... It could be all day long before they get back to you, which is, when you’re really down in a lot of pain, too long.

Caregiver: Then, even after she was readmitted, I wish that they called way more. I had to call them constantly when they shoulda been calling me.

Provider: We’ll direct them where they need to call, but there’s certainly a delay there.

The overwhelming majority recognized that the current (traditional) system of calling (a clinic or on-call provider) did not provide prompt responses. Although the feasibility of a prompt response was recognized as impossible within the constraints of the current system (ie, a physician in surgery may not call you back immediately), patients and caregivers both desired this type of feedback. Interviewed participants offered the solution of symptom tracking but made it very clear that these symptoms would need to be relayed to the provider team to provide value:

Patient: I don't know that there was a better way [to manage symptoms], except, unless the symptoms were tracked regularly.

Caregiver: I think [a list of normal and abnormal symptoms] would be good—great to maybe put it up there. You can expect maybe some bleeding. The bowel movement, her memory wasn't that good for quite a few days.

Patients and caregivers recognized the value of tracking symptoms to better understand whether they were getting better or worse, particularly because memory can be affected postoperatively. Patient/caregiver dyads did not diverge here, with both agreeing on the benefits, although sometimes for different reasons. Caregivers appeared to embrace symptom tracking to alleviate the stress of missing abnormal signs/symptoms, whereas patients appeared to embrace symptom tracking to avoid issues of distrust (eg, the need to seek outside information). Patients and caregivers also agreed on a very important caveat to the success of such an intervention—somebody must be “listening” on the other end:

Caregiver: If the patient and caregiver understand that what they put in there is going directly to the nurse navigator or doctor—then, that's a huge value. If it's some community where you're talking about all the hell you're going through, then, that's, I think, a waste of time, and I wouldn't take advantage of that. Forums and stuff, I don't personally like that. Because, normally, you have a bunch of people on there complaining, talking about how terrible they feel. If it's a direct hookup to the doctor or nurse, sure!

Provider: I think there has to be—it has to be designed in a way where the patients can be assured that someone is gonna look at it.

Patients, caregivers, and providers agreed that the intervention should provide a means to rapidly alert the provider team to worrisome signs while reassuring the patient/caregiver regarding normal symptoms. All

agreed that the intervention should be prompted regularly (daily, weekly, or graduated over time [first daily and then weekly]) with the option of on-demand completion. With this structure, benefits were clear, but barriers remained as described in the following quotations:

Interviewer: What might prevent you from effectively using a tool like this?

Patient: Just being so sick that I couldn't focus on it.

Provider: Then the other side of that coin is that clinicians are already overwhelmed. It has to be designed sensitive to that reality. If it's just gonna be a ton of information that comes in, in e-mails, and a lot of it's normal or not actionable, that's just more crap.

Barriers from the patient/caregiver perspective included being “too sick” to use the tool, whereas 2 patients and caregivers cited a lack of interest. Internet use itself was not an explicit barrier. For those patients who did not use the internet, their interviewed caregivers were interested in completing the mHealth questions on their behalf. Providers, on the other hand, worried about alert fatigue and emphasized success only if specific thresholds for alerts were carefully selected to avoid unnecessary calls.

Despite these barriers, there was a clear connection between inadequate preoperative education, an inadequate understanding of postoperative recovery, and the potential benefit of symptom tracking with feedback to alleviate these concerns. The following quotations from a patient and her caregiver highlight each theme in succession:

Inadequate patient education:

Patient: I think you supplied a lot of information, but I don't know if I grasped it all or not.... You know, well, 'cause it was just so overwhelmin' that, you know, you're not never gonna get it all.

Inadequate understanding of postoperative recovery:

Patient: I wasn't prepared for, I guess, for my stomach to hurt the way it was, and I don't know if that is just normal for the bladder surgery.

Potential benefit of mHealth symptom tracking:

Caregiver: A way to track it would have been great, because then somebody would be able to—who knew more than we did would be able to say, “Hey, wait a minute. She's getting up less here and less here.” I think that would be amazing to be able to track, and maybe the doctors check in on your tracking in some kind of way.

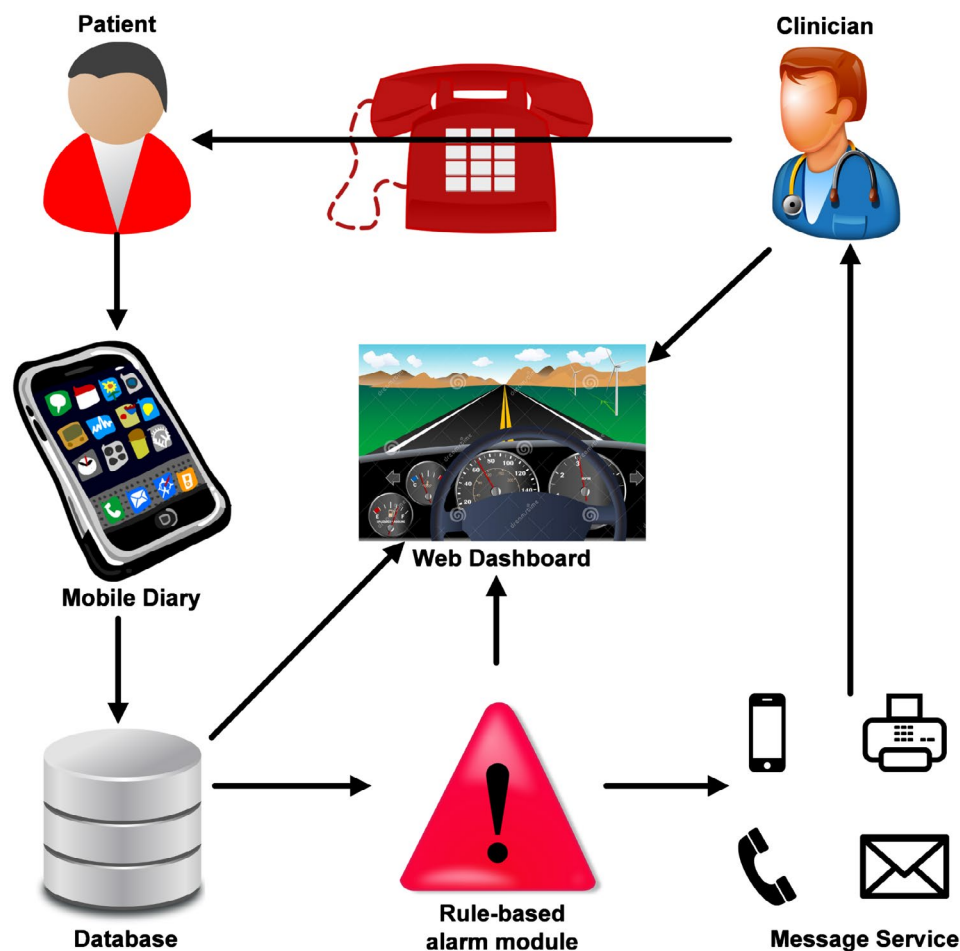


Figure 1. Conceptual model of a mobile health intervention.

DISCUSSION

In this study, we used semistructured interviews with patients, caregivers, and providers to define high-priority PROs, processes that influence a patient's perioperative experience, and a potential method for improving perioperative care. All groups described an unsurmountable learning curve necessary to understand postoperative cystectomy care, and this was exacerbated further by the inability to distinguish the need for timely intervention. The value of learning incrementally could alleviate many concerns expressed by patients and caregivers, and although information can come from multiple sources, all preferred (at least some) information directly from their provider team. Ultimately, a better understanding of expectations is required for a comprehensive and satisfactory postoperative experience. Expectations must include normal and abnormal symptoms but be provided

at the appropriate time. The appropriate time is defined by patients and caregivers as the time at which postoperative symptoms are experienced. Providing the right information at the right time carries the most meaning for the patient and the caregiver.

The connection between inadequate preoperative education and the need for understanding postoperative symptoms supports a personalized solution that emphasizes the right information for the right patient at the right time. Symptom tracking with direct feedback from the provider team was described as a potential solution to improve the current state of preoperative education and its negative impact on postoperative symptom understanding. Although some barriers exist, these can be overcome with the caregiver's assistance. For example, if a patient is too sick to complete a questionnaire or is unable to use the

internet, the caregiver can provide assistance. Using an mHealth tool that provides timely information and feedback can facilitate the incremental learning that patients and caregivers crave and providers wish to deliver. A properly designed mHealth tool (Fig. 1) could offer relevant information along the patient's trajectory and address the need for incremental learning with respect to normal and abnormal symptoms.

An innovative mHealth intervention that facilitates timely management of PROs after discharge could address the overarching problems identified by readmitted patients: an inability to provide adequate preoperative education and a subsequent lack of preparedness for postoperative symptoms. Current strategies for preoperative education are aimed at increasing resources, pamphlets, and data regarding processes, symptoms, and instructions. However, the majority of these instructions are not applicable to the patient. Provided every what-if scenario, the patient and the caregiver become overwhelmed. In other words, the noise overpowers the signal, and the opportunity for timely recognition and intervention is missed.

On the basis of our semistructured interview data, we hypothesized that an mHealth intervention that tracks PROs and allows real-time feedback via internet-enabled devices has the potential to improve the quality of care delivery and overall patient experience. mHealth applications use internet-based devices such as laptops, mobile phones, tablets, and other computer-based systems to collect clinical health data and deliver health care information to patients and providers.¹⁴ Effective mHealth applications that provide 2-way communication between the provider and the patient have often been applied to support behavioral outcomes, such as medication adherence, smoking cessation, and weight management.¹⁵⁻¹⁷ However, mHealth is beginning to focus on tracking PROs, the outcomes most important to patients, including their symptoms, functional status, and medication adherence. mHealth has been recently applied to PRO tracking in the medical and surgical oncology setting,^{18,19} but these studies have been limited by 1-way communication in which patients report symptoms to providers. Extending the capability of mHealth to provide real-time feedback to the patient while alerting the care team when necessary may enhance PRO monitoring by enabling 2-way communication. Two-way communication is critical for patients, caregivers, and providers to recognize value in the connection that it creates with the care team.

Linking PRO monitoring counteracts the 2 overarching issues identified in this article: overwhelming (and largely unnecessary) preoperative information and

a need to understand symptoms as they arise. Creating an interactive, internet-based mHealth intervention that encourages patient feedback and closes the feedback loop by incorporating provider feedback could improve clinical outcomes by promoting patient-centered care to postoperative elderly populations.

Patients undergoing surgical oncology procedures such as cystectomy often travel long distances for care, with increasing distance strongly associated with complications and readmissions.⁵ By using the concepts learned from mHealth in largely nononcologic and nonsurgical contexts, the careful and systematic design of an electronic, internet-based mHealth tool that collects PRO data while providing timely feedback to patients and clinicians has the potential to reduce geographical barriers associated with complications and readmissions. Furthermore, timely feedback of PRO data will facilitate incremental learning and improve patient and caregiver satisfaction: these are important opportunities for improvement highlighted in participant interviews. Ultimately, monitoring postsurgical patients with an mHealth intervention may have a significant impact on postoperative outcomes after discharge by reducing readmissions and emergency room visits, increasing patient satisfaction, and decreasing mortality. If effective, a properly designed mHealth intervention could be adapted to other surgical procedures, be incorporated into the electronic health record, and have the flexibility to be modified for different health care systems and patient populations. The mHealth intervention could also be used with different internet-based platforms such as smartphones, tablets, and laptops; thus, it could flexibly meet the needs of specific patient populations, and this would also increase its scalability. Embedding the intervention within the electronic health record would increase care coordination because information would be available to the entire care team, including other providers and home health nurses.

Because this study is one of the first studies investigating patient, caregiver, and provider narratives after cystectomy surgery, many possibilities exist for expanding on our findings. The current study was restricted to patients who were readmitted within 90 days of cystectomy. Future studies could compare and contrast the experiences of patients who did not experience complications and readmissions. Second, this study was conducted at a single institution. Although purposive sampling was used to increase generalizability, a qualitative study at multiple different institutions (eg, academic/private, rural/urban, and north/south/east/west region) with a larger sample

could offer further insight. Finally, other non-mHealth interventions could be developed that capitalize on the opportunities set forth in this article.

In summary, our study details 2 major opportunities for improvement in perioperative cystectomy care: avoiding a deluge of unnecessary preoperative information and personalizing educational content as the patient recovers from surgery. Using mHealth represents one solution for alleviating patient and caregiver stress by providing reassurance when needed and prompt contact with the provider team for emergent issues.

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CONFLICT OF INTEREST DISCLOSURES

Angela B. Smith reports funding from the Patient-Centered Outcomes Research Institute and acting as a consultant for Photocure, Merck and Urogen outside the submitted work. Eric Wallen reports stock in MDxHealth. Michael Woods reports acting as a consultant for Photocure outside the submitted work. Matthew Nielsen reports other from the American College of Physicians High Value Care Task Force and Grand Rounds and grants from the Patient-Centered Outcomes Research Institute and the National Institutes of Health outside the submitted work. The other authors made no disclosures.

AUTHOR CONTRIBUTIONS

Angela B. Smith: Conceptualization, formal analysis, funding acquisition, investigation, methodology, project administration, supervision, writing—original draft, and writing—review and editing. **Dana Mueller:** Conceptualization, formal analysis, project administration, writing—original draft, and writing—review and editing. **Brandon Garren:** Conceptualization, formal analysis, investigation, methodology, writing—original draft, and writing—review and editing. **Hung-Jui Tan:** Conceptualization, supervision, and writing—review and editing. **Eric Wallen:** Conceptualization, supervision, and writing—review and editing. **Michael Woods:** Conceptualization, supervision, and writing—review and editing. **Raj Pruthi:** Conceptualization, supervision, and writing—review and editing. **Matthew Nielsen:** Conceptualization, supervision, and writing—review and editing.

REFERENCES

- Weiss AJ, Elixhauser A, Steiner C. Statistical brief #154: readmissions to U.S. hospitals by procedure, 2010. <https://www.hcup-us.ahrq.gov/repor-t/statbriefs/sb154.pdf>. Published April 2013. Accessed June 25, 2019.
- Smith AB, Raynor M, Amling CL, et al. Multi-institutional analysis of robotic radical cystectomy for bladder cancer: perioperative outcomes and complications in 227 patients. *J Laparoendosc Adv Surg Tech A*. 2012;22:17-21.
- Halverson AL, Sellers MM, Bilimoria KY, et al. Identification of process measures to reduce postoperative readmission. *J Gastrointest Surg*. 2014;18:1407-1415.
- Smith AB, Woods ME, Raynor MC, Nielsen ME, Wallen EM, Pruthi RS. Prevention and management of complications following robot-assisted radical cystectomy: lessons learned after >250 consecutive cases. *World J Urol*. 2013;31:441-446.
- Stitzenberg KB, Chang YK, Smith A, Nielsen ME. Place of readmission and outcomes after major cancer surgery [abstract 6531]. *J Clin Oncol*. 2014;32(15 suppl):6531.
- Glance LG, Kellermann AL, Osler TM, et al. Hospital readmission after noncardiac surgery: the role of major complications. *JAMA Surg*. 2014;149:439-445.
- Badgwell B, Stanley J, Chang GJ, et al. Comprehensive geriatric assessment of risk factors associated with adverse outcomes and resource utilization in cancer patients undergoing abdominal surgery. *J Surg Oncol*. 2013;108:182-186.
- Cleeland CS, Wang XS, Shi Q, et al. Automated symptom alerts reduce postoperative symptom severity after cancer surgery: a randomized controlled clinical trial. *J Clin Oncol*. 2011;29:994-1000.
- Jensen RE, Snyder CF, Abernethy AP, et al. Review of electronic patient-reported outcomes systems used in cancer clinical care. *J Oncol Pract*. 2013;10:e215-e222.
- Grbich C. Epistemological changes and their impact on the field. In: Grbich C, ed. *Qualitative Data Analysis: An Introduction*. 1st ed. London, United Kingdom: Sage Publications; 2007:3-15.
- Charmaz K. Grounded theory. In: Emerson RM, ed. *Contemporary Field Research: Perspectives and Formulations*. 2nd ed. Prospect Heights, IL: Waveland Press; 2001.
- Riessman CK. Thematic analysis. In: Riessman CK, ed. *Narrative Methods for the Human Sciences*. Los Angeles, CA: Sage Publications; 2008.
- Siegel RL, Miller KD, Jemal A. Cancer statistics, 2018. *CA Cancer J Clin*. 2018;68:7-30.
- Weinstein RS, Lopez AM, Joseph BA, et al. Telemedicine, telehealth, and mobile health applications that work: opportunities and barriers. *Am J Med*. 2014;127:183-187.
- Ybarra ML, Holtrop JS, Prescott TL, Strong D. Process evaluation of a mHealth program: lessons learned from Stop My Smoking USA, a text messaging-based smoking cessation program for young adults. *Patient Educ Couns*. 2014;97:239-243.
- Waterlander W, Whittaker R, McRobbie H, et al. Development of an evidence-based mHealth weight management program using a formative research process. *JMIR Mhealth Uhealth*. 2014;2:e18.
- Rodrigues R, Bogg L, Shet A, Kumar DS, De Costa A. Mobile phones to support adherence to antiretroviral therapy: what would it cost the Indian National AIDS Control Programme? *J Int AIDS Soc*. 2014;17:19036.
- Andikyan V, Rezk Y, Einstein MH, et al. A prospective study of the feasibility and acceptability of a Web-based, electronic patient-reported outcome system in assessing patient recovery after major gynecologic cancer surgery. *Gynecol Oncol*. 2012;127:273-277.
- Basch E, Artz D, Dulko D, et al. Patient online self-reporting of toxicity symptoms during chemotherapy. *J Clin Oncol*. 2005;23:3552-3561.