
Research and Applications

Use and impact of an online community for hospital patients

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ABSTRACT

Objective: Although patient-peer support technologies have demonstrated effectiveness in a variety of health contexts—including diabetes, weight loss, and cancer—less is known about how hospitalized patients can benefit from this support. We investigated the nature of peer support in the hospital and the impact this support had on patients' hospital stays.

Materials and Methods: We created a technology, resembling an online health community, in which patients could exchange advice about their hospitalization. We deployed it at 1 pediatric hospital and 1 adult hospital. With 30 participants, we conducted bedside interviews, observed how they used the technology during their hospitalization, and completed follow-up phone interviews.

Results: Participants shared advice about several topics, including adjusting to the hospital and building relationships with providers. Contrary to concerns that such a system would primarily serve as a place for patients to "complain," sentiment analysis showed that 23 of 36 (64%) of the shared advice reflected positive sentiment. Patients also reported positive impacts to their quality, safety, and hospital experience due to the inpatient peer support community.

Discussion: Participants benefited from peer support that transcended diagnoses and individual health conditions. The shared experience of being in the hospital was sufficient to yield valuable and practical peer support. Participants who did not contribute their own advice still experienced benefits from reading their peers' advice.

Conclusions: Our study demonstrated the positive nature of peer advice exchanged, and the benefits of this advice on patients' hospital stays. Inpatient peer support technologies could be an additional resource for patients to engage in their care.

Key words: peer support, patient-facing technology, human-computer interaction, quality and safety, patient engagement, online health communities

INTRODUCTION

The hospital is a challenging place for patients, owing to its high-risk, high-stress, and information-poor environment. Patient-facing technologies—such as paper and electronic information displays,^{1,2}

patient portals,^{3,4} safety toolkits,⁵ and education modules⁶—have emerged to address patients' clinical information needs and promote their engagement in hospital care. However, patients often have experiential, emotional, and informational needs that extend

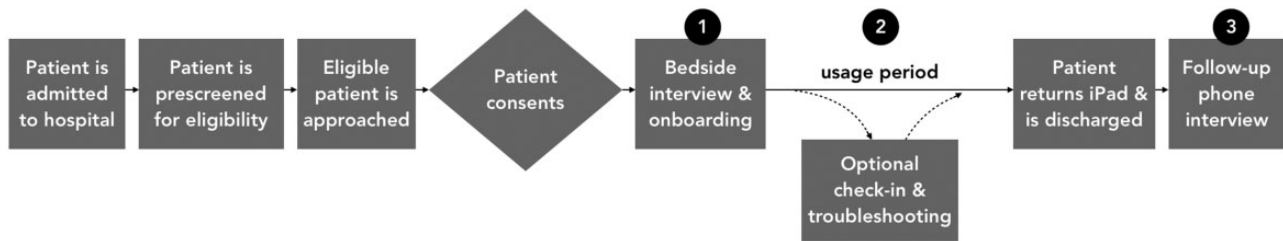


Figure 1. Technology probe study design. Numeric labels indicate the 3 phases of data collection (bedside interview, usage period, and follow-up phone interview).

beyond their clinical information needs, outside their providers' expertise.

Peer support could help patients overcome the challenges they face in the hospital and complement the clinical expertise that they receive from their care team.⁷ Research has consistently shown the positive effects of patient-peer support, including self-efficacy, knowledge, and empowerment in health care.^{8–10} Technologies to facilitate peer support exist in many forms—such as mobile applications,^{11,12} online health communities,^{13–16} and social media^{17–19}—to help patient-peers exchange beneficial support.

Despite evidence that inpatients have a need for peer support,^{20,21} most peer support technologies are designed for patients managing health conditions outside the hospital and do not account for design constraints—such as limited mobility and a dynamic health status—that are unique to the hospital setting.²² Currently, peer support occurs face to face among inpatients with shared diagnoses or recovery trajectories.^{23–26} Yet, many barriers exist in scaling face-to-face inpatient peer support, including infection risk, physical location within the hospital, and uncertainties in care schedules to communicate with peers. Moreover, peer support programs are often designed to evaluate clinical outcomes rather than patient-centered experiential outcomes.^{27–29} Thus, the nature and impact of peer support technologies are unknown in the hospital context.

OBJECTIVE

To understand the nature and impact of peer support in the hospital, we created an inpatient peer support technology resembling an online community for patients to exchange advice and support during their hospital stay. We deployed this technology at a pediatric hospital and an adult hospital, then investigated how patients used and perceived the technology. We report what advice patient-peers exchanged, the sentiment of this advice, and how inpatients were impacted by peer support. Our findings demonstrate the value of inpatient peer support to improve patients' hospital experiences, quality, and safety.

MATERIALS AND METHODS

We used the technology probe method, drawn from the human-computer interaction (HCI) field in which researchers deploy a technology (ie, probe) in a real-world context, reflect on how it is used, and explore its impact on the user's perspectives and behaviors.³⁰ We conducted bedside interviews with participants, instructed them how to use our technology probe, observed their usage during their hospital stay, and completed follow-up phone interviews (Figure 1). Study procedures were approved by the authors' and hospitals' institutional review boards.

Settings and eligibility

This study took place at 2 sites: 1 pediatric hospital and 1 adult hospital in the Pacific Northwest region of the United States. Both hospitals collectively maintain over 800 beds and serve more than 25 000 patients per year from broad demographic and geographic backgrounds.

Participants were considered eligible for this study if they were at least 7 years of age, comfortable speaking and reading English, and well enough to provide informed consent. During the informed consent process, we told eligible patients about the study format, explained that only fellow participants at their respective hospital sites were given access to the technology probe, confirmed that their study contributions would not be shared with their care team, and reviewed the privacy risks of sharing their information. Parental consent was also obtained for all pediatric patients.

Technology probe

To create an inpatient peer support technology, we followed design recommendations from our prior low-fidelity prototype study with pediatric and adult inpatients.^{20,21} The research team conducted an iterative brainstorming, ideating, and prototyping process to identify a technology that met the design recommendations we identified.

The technology probe we created was a customized website theme with functional similarities to Reddit, a tool commonly used by online communities, that allowed patients to read, post, comment on, and upvote stories (Figure 2). The probe met several design recommendations (eg, creating aliases for anonymity, facilitating asynchronous communication, finding relevant information via predetermined “story categories” of known peer support needs)^{20,21} and used WordPress as its technical infrastructure. We provided participants with internet-enabled and sanitation-compliant iPads to access the web-based probe. Because participants chose whether to share their own health information, the probe was HIPAA compliant.³¹ We tested an early version of the probe with HCI experts to fix usability issues and adjusted settings on the backend (eg, restricted search engine indexing) to protect participants' privacy. We then created 2 independent versions of the probe to deploy at each study site.

Bedside interview and tutorial

We first conducted semistructured interviews to build rapport with the participant and learn about their health situation, experience in the hospital, and their thoughts on exchanging support with peers in the hospital. Afterward, we introduced the participant to the technology probe and asked them to complete a short tutorial to learn how to use the probe. Participants were instructed to create an alias for the probe and to not share personally identifying information

Figure 2. Screenshots of technology probe deployment at the pediatric site. The home page (top) shows patient stories and topic categories to browse stories. The expanded story view (bottom) shows a story posted by P04's caregiver and the comment thread associated with that story.

(eg, phone or hospital room numbers). The combined interview and tutorial lasted 30-60 minutes and was audio recorded.

Technology probe usage period

After the bedside interview and tutorial, we asked participants to use the probe at their discretion for the rest of their hospital stay. During this time, we collected usage log data and the stories and comments participants shared with peers through the tool.

Follow-up phone interview

We conducted follow-up phone interviews at least 24 hours after participants were discharged from the hospital. We asked participants to reflect on their use of the probe and what impact, if any, it had on the remainder of their hospital experience. These interviews lasted 15-40 minutes and were audio recorded.

Data analysis

To understand what conversation topics were exchanged within the probe, we used a priori themes that were derived from our prior work characterizing inpatient peer support needs.^{20,21} Following the template analysis approach, 1 coder applied these themes to each story or comment that was present on the technology probe.³² Throughout the process, the coder regularly discussed progress and code interpretations with the research team until complete.

To determine the emotional tone of participants' content, we did a sentiment analysis using IBM Watson's Natural Language Understanding API, a text analysis tool.³³ A score was produced for each story and comment representing the type and magnitude of the expressed sentiment. Scores approaching +1 indicated more positive sentiments while those approaching -1 indicated more negative sentiments.

To examine the impact of the probe on participants, 3 coders followed an inductive thematic analysis with the transcribed audio recordings.³⁴ These coders met between 2 rounds of independent coding on randomly selected transcripts to discuss emerging themes and formulate a codebook. Two of the 3 coders then tested this codebook on a new set of transcripts, achieved consensus, and applied the codebook to all transcripts.

Participants

A total of 30 participants were enrolled in this study: 15 pediatric patients (P1-P15) and 15 adult patients (A1-A15). This sample size was sufficient to reach thematic saturation and is similar to other patient-centered technology probe studies.^{35,36} Caregivers of P04 and P14 became primary users due to patient illness. Table 1 provides our participant demographics.

RESULTS

Our study produced qualitative and quantitative data about participants' usage and perceptions of the probe. Here, we describe what type and sentiment of support they exchanged, and how this support impacted their stay.

Type and sentiment of peer advice

Eighteen (60%) participants contributed a total of 19 stories and 17 comments to the technology probe (Table 2). Ten (55.6%) of these 18 participants posted more than 1 story or comment during their hospital stay. Seven (23.3%) of the 30 participants were "lurkers" and nonusers who did not contribute stories, comments, or otherwise engage with peers.

Table 3 summarizes per advice topics covered, their frequency, and representative posts. Across the 2 study sites, information about adjusting to the hospital and emotional support were most commonly exchanged. Participants also frequently shared advice for communicating with providers involved in their care.

Sentiment analysis revealed that 13 of 19 (68%) stories and 10 of 17 (59%) comments reflected positive sentiment. For example, P09's statement about thanking providers (Table 3) received a score of 0.94. The remaining stories and comments reflected negative sentiments and dealt with patient dislikes about their hospital experience (eg, fear of needles and pain). For instance, A12's comment, "the worst [part of being in the hospital] is boredom and no real exercise" scored -0.97. Viewing this sentiment data by individual participants shows that—despite some variation among participants—the majority posted stories and comments that had mean sentiment scores >0 (Figure 3).

Impact of inpatient peer support

Although a subset of the 30 participants actually shared advice, interviews revealed that peer support impacted most of their hospital experiences, whether or not they posted stories or comments. Here, we describe this impact.

Increased awareness and value of peer networks

The stories that patients shared via the technology probe helped participants view their peers as a new source of support and helped them feel more connected to other patients. For example, A15's procedure restricted her ability to leave her bed, walk around, and interact with other patients in person. The probe increased her cognizance of the patients around her, as well as their experiences. She explained:

Table 1. Summary of participant demographics

	Pediatric Site	Adult Site
Participants	15 ^a	15
Sex		
Female	8	7
Male	7	8
Age, y	13 ± 2.56	55.8 ± 15.84
7–12	6	0
13–17	9	0
18–24	0	0
25–44	0	3
45–64	0	6
65+	0	6
Education		
Less than high school	15	2
High school graduate	0	2
Some college	0	5
College graduate	0	4
Postgraduate	0	2
Race/ethnicity ^b		
White/Caucasian	13	11
Black/African American	2	0
Hispanic/Latin American	2	1
Asian	0	1
American Indian/Alaska Native	0	1
Other	0	1
Hospital service		
Medical	10	7
Surgical	5	8
Length of stay in days	5.13 ± 3.74, 4 (2-16)	14.4 ± 22.79, 8 (2-95)
Length of technology probe usage period in days	3.7 ± 2.69, 3 (1-11)	8.9 ± 15.98, 4 (1-65)
Prior experience as a patient in the hospital		
Yes	9	14
No	5	1
Unsure	1	0

^aIncludes demographic data of P04 and P14, instead of their caregivers (ie, mothers), who used the probe in place of their patient.

^bParticipants could select more than 1 category.

Values are n, mean ± SD, or median (interquartile range).

Table 2. Number of stories and comments posted by hospital site

Site	Stories (n = 19)	Comments (n = 14)
Pediatric	13	3
Adult	6	14

"I liked a lot of things about [the probe]. I thought it was pretty useful. Before the [study participation] came up, I had been talking to myself about I wonder what other people are in here for and how they're doing. Some people are up walking around, I'm just stuck in this bed. So it was interesting to see what other people were doing." (A15)

In contrast, A02 initially viewed peer support as a helpful resource and was inspired by an earlier interaction she had with her hospital roommate. Later in her stay, however, she experienced multiple errors during her discharge process. Although she stopped engaging with the probe as a result, it increased her awareness of her peers'

Table 3. Peer advice topics that were shared on the technology probe (across both study sites), their frequency (ie, number of times each topic was coded in participants’ stories and comments), and a quote from representative posts from these stories and comments

Peer Advice Topic	Definition	Frequency	Quote From Representative Post
Adjusting to the hospital and managing downtime	Providing tips for navigating the hospital, available amenities, and easing the transition from home	19	“Words of advice! If you will be staying the night I would suggest packing your own comfortable blanket.” (P04’s Caregiver)
Exchanging emotional support	Empathizing with others’ hospital experiences and encouraging self-advocacy in their care	17	“Just being able to talk with [other patients] that are in the same or similar situation is somewhat therapeutic...” (A05)
Learning about and communicating with providers	Mentioning ideas for communicating, working, and building relationships with care team members	12	“We should give thanks to nurses because of all they do. They help take care of us some give us food and I really appreciate that.” (P09)
Understanding and normalizing care	Discussing the experience of receiving care in the hospital	3	“If you are in a lot of pain like I am the doctors will have to jump through a lot of hoops to get you good painkillers.” (P01)
Preventing and reporting medical errors	Sharing strategies for how to identify and intervene in errors that occur during their hospitalization	2	“If you don’t think you’re getting the care you need then there’s recourse and you can ask for the charge nurse.” (A01)

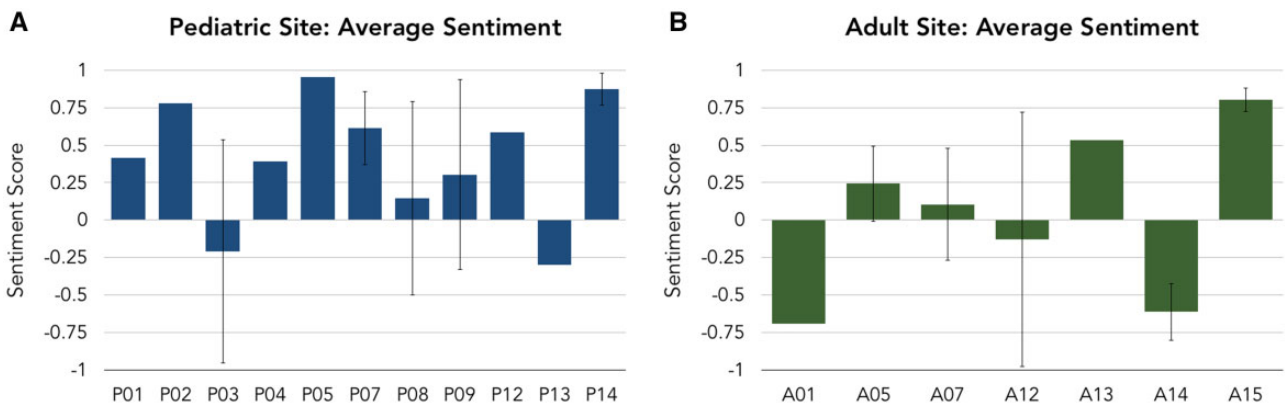


Figure 3. Average sentiment scores of participants’ stories and comments at the (A) pediatric and (B) adult hospital sites. Positive and negative error bars represent the SEM for participants that posted more than 1 story or comment. A#: adult patient; P#: pediatric patient.

experiences: “I’m just feeling like if [the error] happened to me, it probably happened to other people too...”

Aside from an increased awareness, participants described how the probe allowed them to learn their peers’ expertise. Although patients like A06 and A11 preferred information specific to their health condition, others saw value in having convenient access to insights from a broader peer community. P15, who read but did not post any stories or comments, thought patients less familiar with the hospital environment could benefit from having access to peer information: “I think it would just be helpful for like other people who are new to being in the hospital and they don’t really understand yet or they don’t know what to do, that kind of thing.” A07 at first expressed some reluctance about receiving peer advice, stating that he didn’t know if he “would really take too much heed.” His use of the probe, however, changed his opinion on this advice and how he thought about his care: “It’s informative. It lets you know how other people feel and then I would say oh, [another patient] thinks this? I don’t know if I think that way, you know?”

Those who had expertise as hospitalized patients also saw value in easily sharing their expertise with other patients. A12, a frequent hospital visitor and self-described “advocate,” thought it was important to “make people aware” of lesser known amenities that the hospital offered. A05 expressed a similar opinion about the importance

of sharing his knowledge with others: “I think there’s a lot that patients have in common, common feelings from what tastes good in the cafeteria to important medical things. I think by sharing that, other people can...learn from somebody else’s experience.”

Some patients expressed their perceived value of peer support in terms of how it compared with the support from their healthcare providers. They maintained the opinion that their providers were the best resource for care- and condition-specific health information, whereas patient-peers were the preferred resource for personal, experiential information on “how to be a patient.” When asked about the comparison between advice from providers vs peers, P09 likened the technology probe to “school, but at the hospital” where her peers were analogous to her classmates and nurses had the role of giving “the advice a teacher would give.” P11 sometimes preferred reading the information from his peers because it was more helpful and easier to understand than the information from his care team. He explained: “sometimes you understand [other patients] more, because the big words that the doctors are using...if we’re talking about [my] medicine, sometimes I don’t always know what they’re talking about.”

Increased appreciation for providers in the hospital

Participants discussed how the information and interactions they shared with each other through the technology probe affected their

perceptions of their care team. P10 described how reading stories from other patients changed her attitude toward her care team members as people. A frequent hospital visitor with a “tricky” health case, and an expert in managing her condition, P10 was “fed up” with her providers’ uncertainty and miscommunications surrounding her treatment. Her initial belief that advice from peers and providers were similar shifted after reading advice from peers. She said, “I just liked seeing [the] wide variety of opinions. . .because not everyone’s body is the same and. . .I think some doctors struggle with the fact that not everyone’s going to be by the book and that kind of thing.” In recognizing her care team’s struggle, P10 thought the technology probe helped her understand their approach to decision making: “my surgeons are doing as much as they can with what they have. It was a gentle reminder that yeah, it sucks, but it’s life.”

In addition to their perceptions of providers, participants discussed how the technology probe impacted their thoughts about the hospital where they were receiving care. P14 and his caregiver were given the probe during his admission to receive his first round of chemotherapy. With such a new diagnosis and treatment plan, P14’s caregiver explained how the probe helped process the overwhelming information they received and indicated the hospital cared about their family:

“I mean, there are [support] groups online, but. . .I kind of felt like this particular website, knowing that the hospital is investing resources in the families’ experience, the patients’ experience, and helping to connect people. . .made me feel just a little more cared for. . .just that one extra step that okay, this hospital—really is invested in my family, not just my son and his clinical care and his emotional care. It’s like our whole family is being wrapped and supported. . .through this horrible awful time.” (P14’s caregiver)

Being exposed to a broad range of opinions and ideas within the technology probe allowed participants to gain a deeper appreciation of their providers on an individual level, and appreciation for the support their hospital could provide at an institutional level.

Improved perception of quality and safety

Aside from the value of learning from peers’ general hospital experiences, a number of participants articulated how the technology probe served as a resource for patients to be aware of and avoid potential problems in their care. A09 was a patient who was in the hospital to correct a mistake that was made in his previous surgery. He wanted more information from peers about both positive and negative hospital experiences: “if it’s just positive [experiences] all the time and nobody knows if there’s anything wrong happening – I’m not sure everybody has a positive experience in [the hospital].”

A01 experienced multiple errors over the course of her hospital stay, including a missed dose of pain medication. Her original impression of peer advice was: “[it’s] like gossip pretty much to me. That’s like let’s bitch to each other about what’s going on.” Later in her stay, she discovered the role and power of her charge nurse in resolving these errors. She shared this knowledge via the probe and explained why she did so: “If people knew that was available, it would resolve a lot of issues by the end of the day. You wouldn’t have to go through what I went through. . .you shouldn’t have to ask for a charge nurse. Ideally, you’re in a hospital, they should be taking care of you.”

A subset of participants translated their peers’ knowledge into action. Reading advice from P04’s caregiver—recommending patients to have a comfortable blanket in the hospital—caused P09

and P11 to ask their families to bring these personal effects from their homes, which increased the “comfort and warmth” of their stay (P09). A08 had never been to the hospital before and was on a rigid intravenous (IV) fluid schedule during his visit. His preliminary thoughts about peer support was that it might only be useful from peers with his similar condition. However, after noticing a care coordination issue in which his IV was not refilled in a timely manner, A08 used advice from the technology probe to speak up to his care team:

“There was another [thread]. . .related to engaging more with the nursing staff and being proactive with reminding them about steps. [. . .] I didn’t directly confront them or anything, but I did tell them that the machine is beeping a lot and maybe they could keep one or two [IV] bags ready so they don’t have to go off looking for them when they start beeping. . .the last 36 hours [of my stay] they did have one or two bags always on the table. So whenever the thing started beeping, one of them ran in and switched it out.” (A08)

In using the technology probe, participants recognized—and in some cases, fulfilled—the potential for peer support to benefit others and improve the perceived quality and safety of their hospital stay.

Improved emotional well-being

Finally, participants described how using the technology probe impacted their emotional wellbeing over the course of their hospital stay. Participants such as P03, P15, and A07 thought the technology probe passed the time and made their hospitalization more enjoyable and entertaining. P08 felt “happy” after reading a “funny” post on the technology probe. P09 said that the technology probe was fun to use because “it really made me smile to think that other patients were also smiling. . .”

Others cited the interactions with peers as satisfying their need to feel supported by patients with shared experiences and similar struggles. Moreover, this peer support was viewed as a source of reassurance that helped individual patients manage the negative emotions surrounding their hospital stay. P05 described how “scared” he felt upon his admission owing to the risk of having to undergo surgery. Although the surgery was ultimately avoided, P05 “wasn’t as nervous” because of the emotional support from peers. Another pediatric patient, P07, also explained how the technology probe helped to address feelings of isolation during her hospital stay: “It made me feel a little better about being in that situation. . .because I felt like I wasn’t alone and I could relate to people.” When asked what her thoughts were on sharing her own advice with other patients, P07 responded: “I thought it might help other kids with what they’re going through. . .sharing that the first time isn’t as scary as you would think.”

Participants used the technology probe to alleviate negative emotions—such as fear, worry, and anxiety—during their hospital stay. Sharing their experiences and support helped manage these emotions.

DISCUSSION

Our participants exchanged advice about multiple aspects of their hospitalization—including amenities in the hospital and strategies for preventing errors—that had positive impacts, such as increasing their appreciation for peers and providers, and improving their care quality, safety, and emotional wellbeing.

Participants were from diverse hospital services and clinical backgrounds. They ranged from having no prior experience as a patient to living in different stages of managing a chronic condition, to being self-described experts and advocates in managing their care. In contrast, most peer support technologies are designed for patients with shared diagnoses or health conditions. For example, mobile applications and online health communities (OHCs) have been created for diabetes, weight loss, and cancer management.^{37–39} Yet, our participants benefited from peers with different health conditions. P04 was in the hospital for epilepsy treatment, but his caregiver's advice about bringing a comfortable blanket resonated with P11, a cancer patient. Those with varying familiarity of the hospital also saw the probe's value. A12 thought it was important to share her advice as an experienced hospital patient, while peer advice helped A08, a first-time hospital patient. Thus, the shared experience of being in the hospital was sufficient to yield benefits of peer support. Moreover, these benefits were felt by participants who did not post any stories or comments (eg, P10, P15), confirming previous research that despite their lack of active engagement with peers, "lurkers" still benefit from access to OHCs.^{40,41}

A subset of participants shared advice about actions they could take to improve their hospital experience, care quality, and safety. A08 was an example of someone who used this advice to successfully resolve a coordination problem in his care. Findings from our study indicate that—in addition to error reporting apps,⁴² patient portals,^{43,44} and medication reconciliation tools⁴⁵—peer support could also help inpatients proactively and successfully engage in the quality and safety of their care.

Throughout our study, participants requested the probe remain accessible to them after completing study procedures, suggesting the desire for a permanent system within hospitals. However, how to implement this system remains an open question. Nonpatient stakeholders (eg, healthcare providers, executives) have historically voiced concerns about inpatient-facing technologies and the quality of medical information on OHCs.^{46–48} Yet, our participants did not exchange medical treatment recommendations. Conversations instead focused on normalizing experiences and improving their hospital stay, supporting prior findings that provider concerns about OHCs are largely unfounded.^{49,50} Although the inpatient setting might introduce other concerns (eg, patients "complaining" about providers when errors occur), the nature of advice shared on the probe conveyed an overall positive sentiment. Posts with negative sentiment scores dealt with patient dislikes about general hospital experiences (eg, fear of needles, lack of exercise) rather than "complaints." Participants who experienced errors shared actionable peer advice on avoiding these problems (eg, requesting charge nurses).

Although we gave all participants iPads to ensure equitable access to the probe, hospital-wide informatics opportunities also exist to implement peer support. For example, researchers have discussed incorporating peer support within patient portals to help contextualize their health information.⁵¹ The growing prevalence of tablet- and monitor-based inpatient portals lends itself well to facilitating peer support through technologies that hospitals already provide to inpatients.^{52,53} Increasing access to peer support could help inpatients "triage" the questions and concerns they relay to providers. This support could be a new information source for hospitals, and future work is necessary to examine potential risks of identifiability to providers or fellow peers, and how this information could be managed alongside the current influx of quality improvement and patient feedback data sources.

LIMITATIONS

Although our findings provide important insights for how peer support can enhance inpatients' hospital experiences, we acknowledge study limitations. The demographics of our limited sample from 2 institutions in 1 geographic area of the United States might not translate to other populations. Our design of the probe (eg, predefined story categories), presence of the research team,⁵⁴ the novelty effect, and participants' access to the probe while dependent on hospital care could also have influenced their use and feedback of the probe.

CONCLUSION

We used the technology probe method to examine the support exchanged through an inpatient peer support technology probe and its impact on patients during their hospital stay. Participants used the probe to exchange a variety of peer advice with overall positive sentiments. The peer support offered through the probe increased participants' awareness and value of peer networks, increased their appreciation of their providers, improved their perceived quality and safety, and improved their emotional wellbeing. Our study demonstrated that these positive impacts can be experienced by patients across health conditions and levels of engagement with the technology. Offering inpatient peer support technologies could help patients take proactive steps to improve the quality, safety, and overall experience of their hospital stay.

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AUTHOR CONTRIBUTIONS

SH, AH, AHP, and WP were involved in study conception and design; SH, SRM, YK, and AHP in technology probe design and implementation; SH and SRM in data collection; SH and YK in template and sentiment analysis of peer advice; SH and SRM in inductive analysis of interviews; and SH, SRM, YK, AH, AHP, and WP in manuscript authorship, edits, and feedback.

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CONFLICT OF INTEREST STATEMENT

None declared.

REFERENCES

1. Duckworth M, Leung E, Fuller T, *et al.* Nurse, patient, and care partner perceptions of a personalized safety plan screensaver. *J Gerontol Nurs* 2017; 43 (4): 15–22.
2. Wilcox L, Morris D, Tan D, *et al.* Designing patient-centric information displays for hospitals. *Proc SIGCHI Conf Hum Factor Comput Syst* 2010; 2010: 2123–32.

3. Kelly MM, Hoonakker PLT, Dean SM. Using an inpatient portal to engage families in pediatric hospital care. *J Am Med Informatics Assoc* 2016; 24: 153–61.
4. Grossman LV, Choi SW, Collins S, et al. Implementation of acute care patient portals: recommendations on utility and use from six early adopters. *J Am Med Informatics Assoc* 2017; 25: 370–9.
5. Dalal AK, Dykes PC, Collins S, et al. A web-based, patient-centered toolkit to engage patients and caregivers in the acute care setting: a preliminary evaluation. *J Am Med Inform Assoc* 2016; 23 (1): 80–7.
6. Greysen SR, Harrison JD, Rareshide C, et al. A randomized controlled trial to improve engagement of hospitalized patients with their patient portals. *J Am Med Informatics Assoc* 2018; 25: 1626–33.
7. Hartzler AL, Pratt W. Managing the personal side of health: how patient expertise differs from the expertise of clinicians. *J Med Internet Res* 2011; 13 (3): e62.
8. Embuldeniya G, Veinot P, Bell E, et al. The experience and impact of chronic disease peer support interventions: a qualitative synthesis. *Patient Educ Couns* 2013; 92 (1): 3–12.
9. van Uden-Kraan CF, Drossaert CHC, Taal E, et al. Participation in online patient support groups endorses patients' empowerment. *Patient Educ Couns* 2009; 74 (1): 61–9.
10. Høybye MT, Johansen C, Tjørnhøj-Thomsen T. Online interaction. Effects of storytelling in an internet breast cancer support group. *Psychooncology* 2005; 14 (3): 211–20.
11. Chen Y, Chen Y, Randriambelonoro M, et al. Design considerations for social fitness applications: comparing chronically ill patients and healthy adults. In: 20th ACM Conference on Computer Cooperative Work Social Computing (CSCW 2017); 2017: 1753–62.
12. Rotheram-Borus MJ, Tomlinson M, Gwegwe M, et al. Diabetes buddies: peer support through a mobile phone buddy system. *Diabetes Educ* 2012; 38 (3): 357–65.
13. Mamykina L, Nakikij D, Elhadad N. Collective sensemaking in online health forums. In: proceedings of the ACM CHI'15 Conference on Human Factors in Computing Systems 2015: 3217–26.
14. Frost JH, Massagli MP. Social uses of personal health information within PatientsLikeMe, an online patient community: what can happen when patients have access to one another's data. *J Med Internet Res* 2008; 10 (3): e15.
15. Zhang S, O'Carroll Bantum C, Owen J, et al. Online cancer communities as informatics intervention for social support: conceptualization, characterization, and impact. *J Am Med Inform Assoc* 2017; 24: 451–9.
16. Friedman EM, Trail TE, Vaughan CA, et al. Online peer support groups for family caregivers: are they reaching the caregivers with the greatest needs? *J Am Med Inform Assoc* 2018; 25 (9): 1130–6.
17. Huh J, Liu LS, Neogi T, et al. Health Vlogs as social support for chronic illness management. *ACM Trans Comput Hum Interact* 2014; 21: 23.
18. Naslund JA, Aschbrenner KA, Marsch LA, et al. The future of mental health care: peer-to-peer support and social media. *Epidemiol Psychiatr Sci* 2016; 25 (2): 113–22.
19. Moorhead SA, Hazlett DE, Harrison L, et al. A new dimension of health care: systematic review of the uses, benefits, and limitations of social media for health communication. *J Med Internet Res* 2013; 15 (4): e85.
20. Haldar S, Mishra SR, Khelifi M, et al. Exploring the design of an inpatient peer support tool: views of adult patients. *AMIA Annu Symp Proc* 2018; 2018: 1282–91.
21. Haldar S, Mishra SR, Khelifi M, et al. Opportunities and design considerations for peer support in a hospital setting. *Proc SIGCHI Conf Hum Factor Comput Syst* 2017; 2017: 867–79.
22. Skeels M, Tan DS. Identifying opportunities for inpatient-centric technology. In: ACM International Health Informatics-IHI '10; 2010: 580.
23. Wodinski LM, Mattson McCrady HM, Oswald CM, et al. Family bedside orientations: An innovative peer support model to enhance a culture of family-centred care at the Stollery Children's Hospital. *Paediatr Child Health* 2017; 22: 387–90.
24. Liang WH, Madan-Swain A, Cronin RM, et al. Development of a technology-supported, lay peer-to-peer family engagement consultation service in a pediatric hospital. *AMIA Annu Symp Proc* 2018; 2018: 730–9.
25. Patterson F, Fleming J, Doig E. Patient perceptions of participation in group-based rehabilitation in an inpatient brain injury rehabilitation setting. *Patient Educ Couns* 2019; 102 (1): 148–54.
26. Tolley JS, Ferooshani PS. How do burn patients feel about peer support? Preliminary data from the SHARE program. *J Burn Care Res* 2014; 35: e283–4.
27. Parent N, Fortin F. A randomized, controlled trial of vicarious experience through peer support for male first-time cardiac surgery patients: Impact on anxiety, self-efficacy expectation, and self-reported activity. *Hear Lung J Acute Crit Care* 2000; 29 (6): 389–400.
28. Sledge WH, Lawless M, Sells D, et al. Effectiveness of peer support in reducing readmissions of persons with multiple psychiatric hospitalizations. *Psychiatr Serv* 2011; 62 (5): 541–4.
29. Riegel B, Carlson B. Is individual peer support a promising intervention for persons with heart failure. *J Cardiovasc Nurs* 2004; 19: 174–83.
30. Hutchinson H, Bederson BB, Druin A, et al. Technology probes: inspiring design for and with families. *Proc SIGCHI Conf Hum Factor Comput Syst* 2003; 2003: 17–24.
31. U.S. Department of Health and Human Services. Summary of the HIPAA Privacy Rule. <https://www.hhs.gov/hipaa/for-professionals/privacy/laws-regulations/index.html>. Accessed June 6, 2019.
32. Brooks J, McCluskey S, Turley E, et al. The utility of template analysis in qualitative psychology research. *Qual Res Psychol* 2015; 12 (2): 202–22.
33. IBM. Watson Natural Language Understanding. <https://www.ibm.com/watson/services/natural-language-understanding/>. Accessed June 6, 2019.
34. Braun V, Clarke V. Using thematic analysis in psychology. *Qual Res Psychol* 2006; 3 (2): 77–101.
35. Kjærup M, Kouzeli S, Skov MB, et al. Diagnostic agents: collaborative interpretation for cardiac patients at home. In: NordiCHI '18: proceedings of the 10th Nordic Conference on Human-Computer Interaction; 2018: 1–10.
36. Mamykina L, Mynatt ED, Kaufman DR. Investigating health management practices of individuals with diabetes. *Proc SIGCHI Conf Hum Factor Comput Syst* 2006; 2006: 927–36.
37. Huh J, Ackerman MS. Collaborative help in chronic disease management. *CSCW* 2012; 2012: 853–62.
38. Li V, McDonald DW, Eikev EV, et al. Losing it online: characterizing participation in an online weight loss community. In: proceedings of the 18th International Conference on Supporting Group Work-GROUP '14. New York, NY: ACM Press; 2014: 35–45.
39. Demjén Z. Laughing at cancer: humour, empowerment, solidarity and coping online. *J Pragmat* 2016; 101: 18–30.
40. Han JY, Hou J, Kim E, et al. Lurking as an active participation process: a longitudinal investigation of engagement with an Online Cancer Support Group. *Health Commun* 2014; 29 (9): 911–23.
41. Mo PKH, Coulson NS. Empowering processes in online support groups among people living with HIV/AIDS: a comparative analysis of 'lurkers' and posters. *Comput Human Behav* 2010; 26 (5): 1183–93.
42. Collins S, Couture B, Smith AD, et al. Mixed-methods evaluation of real-time safety reporting by hospitalized patients and their care partners: the MySafeCare application. *J Patient Saf* 2018 Apr 27.
43. Woollen J, Prey J, Wilcox L, et al. Patient experiences using an inpatient personal health record. *Appl Clin Inform* 2016; 7: 446–60.
44. Grossman L, Masterson Creber R, Restaino S, et al. Sharing clinical notes with hospitalized patients via an acute care portal. *AMIA Annu Symp Proc* 2017; 2017: 800–9.
45. Prey JE, Polubriaginof F, Grossman LV, et al. Engaging hospital patients in the medication reconciliation process using tablet computers. *J Am Med Inform Assoc* 2018; 25: 1460–9.
46. Collins S, Rozenblum R, Leung WY, et al. Acute care patient portals: a qualitative study of stakeholder perspectives on current practices. *J Am Med Inform Assoc* 2016; 24: e9–17.

47. Wilcox LG, Gatewood J, Morris D, *et al.* Physician attitudes about patient-facing information displays at an urban emergency department. *AMIA Annu Symp Proc* 2010; 2010: 887–91.
48. Tan SSL, Goonawardene N. Internet health information seeking and the patient-physician relationship: a systematic review. *J Med Internet Res* 2017; 19 (1): e9.
49. Esquivel A, Meric-Bernstam F, Bernstam EV. Accuracy and self correction of information received from an internet breast cancer list: content analysis. *BMJ* 2006; 332 (7547): 939–42.
50. Huh J. Clinical questions in online health communities: the case of ‘See your doctor’ threads. *CSCW Conf Comput Supp Coop Work* 2015; 2015: 1488–99.
51. Reynolds TL, Ali N, McGregor E, *et al.* Understanding patient questions about their medical records in an online health forum: opportunity for patient portal design. *AMIA Annu Symp Proc* 2017; 2017: 1451–60.
52. McAlearney AS, Fareed N, Gaughan A, *et al.* Empowering patients during hospitalization: perspectives on inpatient portal use. *Appl Clin Inform* 2019; 10: 103–12.
53. Asan O, Scanlon MC, Crotty B, *et al.* Parental perceptions of displayed patient data in a PICU: an example of unintentional empowerment. *Pediatr Crit Care Med* 2019; 20 (5): 435–41.
54. Dell N, Vaidyanathan V, Medhi I, *et al.* ‘Yours is better!’ Participant response bias in HCI. *Proc SIGCHI Conf Hum Factor Comput Syst* 2012; 2012: 1321–30.