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BRIEF REPORTS

Tablet Computers for Hospitalized Patients: A Pilot Study to Improve Inpatient Engagement

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Inadequate patient engagement in hospital care inhibits high-quality care and successful transitions to home. Tablet computers may provide opportunities to engage patients, particularly during inactive times between provider visits, tests, and treatments, by providing interactive health education modules as well as access to their personal health record (PHR). We conducted a pilot project to explore inpatient satisfaction with bedside tablets and barriers to usability. Additionally, we evaluated use of these devices to deliver 2 specific Web-based programs: (1) an interactive video to improve inpatient education about hospital safety, and (2) PHR access to promote inpatient engagement in discharge planning. We enrolled 30 patients; 17 (60%) were aged 40 years or older, 17 (60%) were women, 17 (60%) owned smartphones, and 6 (22%) owned tablet computers. Twenty-seven (90%) reported high overall satisfaction with the device, and 26 (87%) required ≤30 minutes for basic orientation (70% required ≤15minutes). Twenty-five (83%) independently completed an interactive educational module on hospital patient safety. Twenty-one (70%) accessed their personal health record (PHR) to view their medication list, verify scheduled appointments, or send a message to their primary care physician. Next steps include education on high-risk medications, assessment of discharge barriers, and training clinical staff (such as respiratory therapists, registered nurses, or nurse practitioners) to deliver tablet interventions. *Journal of Hospital Medicine* 2014;9:396–399.

BACKGROUND

Many hospitals have initiated intense efforts to improve transitions of care[1] such as discharge coordinators or transition coaches,[2,3] but use of mobile devices as approaches to add or extend the value of human interventions have been understudied.[4] Additionally, many hospitalized patients experience substantial inactive time between provider visits, tests, and treatments. This time could be used to engage patients in their care through interactive health education modules and by learning to use their PHR to manage medications and postdischarge appointments.

Greater understanding of the advantages and limitations of mobile devices may be important for improving transitions of care and may help leverage existing hospital personnel resources. However, prior studies have focused on healthcare provider uses of tablet computers for medical education,[5] to collect clinical registration data,[6] or to do clinical work (eg, check labs, write notes)[7–9] primarily in outpatient settings; few studies have focused on patient uses for this technology in hospital settings.[10,11] To address these knowledge gaps, we conducted a pilot project to explore inpatient satisfaction with bedside tablets and barriers to usability. Additionally, we evaluated use of these devices to deliver 2 specific Web-based programs: (1) an interactive video to improve inpatient education about hospital safety, and (2) PHR access to promote inpatient engagement in discharge planning.

METHODS

Study Design, Patient Selection, and Devices/Programs

We conducted a prospective study of tablet computers to engage patients in their care and discharge planning through Web-based interactive health education modules and use of PHRs. We used 2 tablets, distributed daily by research assistants (RAs) to eligible patients after morning rounds. Inclusion criteria for patients were ability to speak English and admission to the medical (hospitalist) service at University of California San Francisco (UCSF) Medical Center. Exclusion criteria were intensive care unit admission, contact isolation, or inability to complete the consent process due to altered mental status or cognitive impairment.

RAs screened patients for inclusion/exclusion via the electronic medical record and then approached them after rounds for enrollment (11:00 AM–1:00 PM). RAs then performed a tiered orientation tailored to individual patient experience and needs. First, they delivered a brief tutorial focused on the tablet itself and its basic

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TABLE 1. Patient Characteristics (N = 30)

Characteristic	No. (%)
Age, y	
18–39	11 (38%)
40–49	5 (18%)
50–59	4 (14%)
60–69	5 (18%)
70–79	3 (10%)
Gender, female	17 (60%)
Device ownership	
Desktop computer	12 (44%)
Laptop computer	19 (70%)
Smart phone	17 (60%)
Tablet computer	6 (22%)
Any mobile device (laptop, smartphone, or tablet)	26 (87%)
Internet use	
Daily	21 (72%)
Several times a week	3 (10%)
Once a week or less	5 (18%)
Prestudy online health tasks	
Looked up health information	21 (72%)
Communicated with provider	15 (52%)
Refilled prescription	8 (27%)
Scheduled medical appointment	6 (21%)

functions (touchscreen, keypad, and Internet browser use). Second, RAs showed patients how to access the online educational health module and how to navigate content within the module. RAs next explained what the PHR is and demonstrated how to login, how to navigate tabs within the PHR, and how to perform basic tasks (view/refill medications, view/modify appointments, and view/send messages to providers). The RAs left devices with patients for 3 to 5 hours and returned to collect them and perform debriefing interviews. After each device was returned, RAs cleaned devices with disinfectant wipes available in patient rooms and checked for physical damage or software malfunctions (eg, unable to turn on or unlock). Finally, RAs used the reset function to erase any personal data or setting modifications made by patients and docked the devices overnight to resynchronize the original settings and recharge the batteries.

We used the 16 gigabyte Apple iPad2 (Apple Inc., Cupertino, CA) without any enclosures, cases, or security devices. Our educational health module was Patient Safety in the Hospital, which was professionally developed by Emmi Solutions (www.emmisolutions.com; Emmi Solutions, LLC, Chicago, IL) and licensed to our medical center for use in patient care. The module presents topics with a combination of animated graphics and text that are narrated and customizable to patient preferences (faster, slower, more/less information). The content areas covered in this module are medication history and safety, communicating with the healthcare team, advanced directives, hand washing, fall prevention, and discharge planning. This content is developed by Emmi Solutions with clinician and patient input (with a wide range of health experiences and literacy) and is available in English and Spanish. Our PHR platform is Epic MyChart (http://www.epic.com/software-phr.php; Epic Systems Corp., Verona, WI).

Survey Instruments and Data Collection

We developed pre- and postintervention surveys to characterize patients' demographics, device ownership, and health-related Internet activities in the last year based on questions used in the Centers for Disease Control and Prevention National Health Interview Study (http://www.cdc.gov/nchs/nhis.htm). Both surveys were administered on the tablets using online survey tools (www.surveymonkey.com; SurveyMonkey, Palo Alto, CA). We also developed an interview tool that collected information on time needed to orient patients, problems with devices, and open-ended questions about overall experience using the tablet. During the debriefing interview, RAs observed patient ability to access their PHR and perform key functions (view medication list, view future appointments, or message a provider). Data from the debriefing interviews were entered into a Health Insurance Portability and Accountability Act-compliant online survey tool (REDCap, http://project-redcap.org; Vanderbilt University, Nashville, TN) via the tablet by the RA at bedside.

Analyses

We used frequency analysis to describe patient demographics, ability to complete online health educational modules, and utilization of their PHR. We performed bivariate analyses (Fisher exact test) to assess correlations between demographics (age, device ownership, Internet use) and key pilot program performance measures (orientation time $\leq$15 minutes, online health module completion, and completion of $\geq$1 essential function in the PHR). All analyses were performed in SAS 9.2 (SAS Institute Inc., Cary, NC). The institutional review board of record for UCSF approved this study.

RESULTS

As shown in Table 1, we enrolled 30 patients. Most participants (60%) were aged 40 years or older, and most (87%) owned a mobile device; 70% owned a laptop and 60% owned a smartphone, but few (22%) owned a computer tablet. Most participants accessed the Internet daily, but fewer reported Internet use for health tasks; about half (52%) communicated with a provider, but few refilled a prescription (27%) or scheduled an appointment (21%) online over the last year.

Nearly all participants (90%) were satisfied or very satisfied with their experience using the tablet in the hospital (Figure 1). Most (87%) required 30 minutes

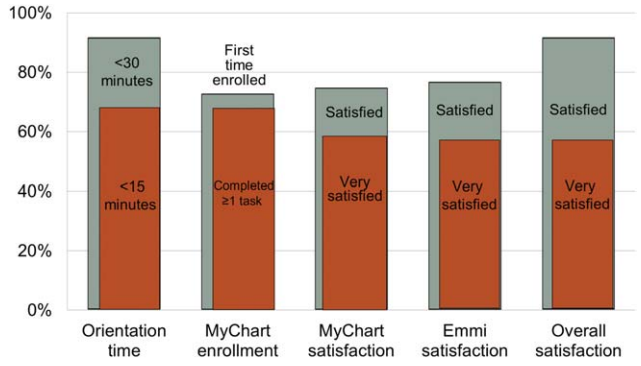

FIG. 1. Performance measures.

or less for basic orientation, and 70% required only 15 minutes or less. Most participants (83%) were able to independently complete an interactive health education module on hospital safety and were highly satisfied with the module. Despite the fact that 73% of participants were first-time users of our PHR, the majority were able to login and independently access their medication list, verify scheduled appointments, or send a secure message to their primary care provider.

Participants aged 50 years or older were less likely to complete orientation in 15 minutes or less compared to those under 50 years old (25% vs 79%, $P = 0.025$); however, age was not a significant factor in ability to complete the online health educational module or perform at least 1 essential PHR function. Other demographic features, such as device ownership and daily Internet use, did not correlate with shorter orientation time, educational module completion, or PHR use (data available on request).

Participants also made suggestions for improvement during the debrief interviews. Several suggested applications for entertainment (gaming, magazines, or music) and 2 suggested that all patients should be introduced to their PHR during hospitalization (data available on request). No device software malfunction (eg, device freezes, Internet connection failures), hardware issues (eg, damage from falls, wetness, or repeated disinfectant exposure), or theft or misappropriation were reported by patients or observed by the RAs to date.

DISCUSSION

Our pilot study suggests that tablet-based access to educational modules and PHRs can increase inpatient engagement in care with high satisfaction and minimal time for orientation. Surprisingly, even older patients and those who might be considered less "tech savvy" in terms of Internet use and device ownership were equally able to utilize our tablet interventions. Furthermore, we did not experience any hardware issues in the harsh physical environment of inpatient wards. These preliminary findings suggest the potential utility of tablets for clinically meaningful tasks by inpatients with a low rate of technical issues.

From a technical standpoint, our experience suggests several next steps. First, although orientation time was minimal, it might be even less if patients used their own mobile devices because most patients already owned one. This bring your own device (BYOD) approach could also promote postdischarge patient engagement. Second, the flexibility of a BYOD approach raises the question of whether to also allow patients a choice of application-based versus browser-based platforms for specific programs such as the PHR and educational video we used. Indeed, although we used a browser-based approach, several other teams have developed patient-facing engagement applications (or "apps") for mobile devices,[4,12] and hospitalists could "prescribe" apps at discharge as a more providers are now doing in outpatient settings.[13] Of course, maximizing flexibility for BYOD and Web-based versus app-based approaches would likely increase patient engagement but would come at the cost of more time and effort for hospital providers to vet apps/websites and educate patients about their use. Third, regardless of the devices and programs used, broader engagement of patients, nurses, hospitalists, and other providers will be needed in the future to identify key areas for development to avoid overburdening patients and providers.

From a quality-improvement perspective, recent literature has considered broad clinical uses for tablets by hospital providers,[14,15] but our experience suggests more specific opportunities to improve transitions of care though direct patient engagement. Tablets and other mobile devices may help improve discharge education for patients taking high-risk medications such as warfarin or insulin using interactive educational modules similar to the hospital safety modules we used. Additionally, clinical staff, such as nurses and pharmacists, can be trained to deliver mobile device interventions such as education on high-risk medications.[16] Ultimately, scale up for our intervention will require that mobile devices and content eventually improve and replace current practices by hospital staff (especially nurses) in a way that streamlines, rather than compounds, current workflow. This could increase efficiency in these discharge tasks and extend contributions of these providers to high-quality transitions.

Our study has several limitations. First, although this is a pilot study with only 30 patients, it adds needed scale to much smaller (N = 5–8) published feasibility studies of tablet computer use by inpatients.[11,12] Beyond more robust feasibility testing, our study adds new data about mobile device use for specific clinical tasks in the hospital such as patient education and PHR use. Second, we did not track postdischarge outcomes to test the effects of our intervention on transition care quality; this will be a focus of our future research. Third, we used existing platforms for interactive educational modules and PHR access at our site; participant satisfaction in our study

may not generalize to other platforms. Furthermore, most PHR platforms (including ours) are not optimally configured to engage patients during transitions of care, but we plan to integrate existing functions (such as ability to refill medications or change appointments) into discharge education and planning. Finally, we have not engaged caregivers as surrogates for cognitively impaired patients or adapted our platform for non-English speakers; these are areas for development in our ongoing work. Overall, our pilot results help set the stage to deploy mobile devices for better patient monitoring, engagement, and quality of care in the inpatient setting.[17]

In conclusion, our pilot project demonstrates that tablet computers can be used to improve inpatient education and patient engagement in discharge planning. Inpatients are highly satisfied with the use of tablets to complete health education modules and access their PHR, with minimal time required for patient training and device management by hospital staff. Tablets and other mobile devices have significant potential to improve patients' education and engagement in their hospital care.

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