
Research and Applications

Implementation of acute care patient portals: recommendations on utility and use from six early adopters

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Received 15 March 2017; Revised 9 June 2017; Accepted 16 June 2017

ABSTRACT

Objective: To provide recommendations on how to most effectively implement advanced features of acute care patient portals, including: (1) patient-provider communication, (2) care plan information, (3) clinical data viewing, (4) patient education, (5) patient safety, (6) caregiver access, and (7) hospital amenities.

Recommendations: We summarize the experiences of 6 organizations that have implemented acute care portals, representing a variety of settings and technologies. We discuss the considerations for and challenges of incorporating various features into an acute care patient portal, and extract the lessons learned from each institution’s experience. We recommend that stakeholders in acute care patient portals should: (1) consider the benefits and challenges of generic and structured electronic care team messaging; (2) examine strategies to provide rich care plan information, such as daily schedule, problem list, care goals, discharge criteria, and post-hospitalization care plan; (3) offer increasingly comprehensive access to clinical data and medical record information; (4) develop alternative strategies for patient education that go beyond infobuttons; (5) focus on improving patient safety through explicit safety-oriented features; (6) consider strategies to engage patient caregivers through portals while remaining cognizant of potential Health Insurance Portability and Accountability Act (HIPAA) violations; (7) consider offering amenities to patients through acute care portals, such as information about navigating the hospital or electronic food ordering.

Key words: personal health records, patient portals, medical informatics applications, patient participation, patient access to records

INTRODUCTION

Health care organizations offering patient portal technologies increased from 43% in 2013 to 92% in 2015.¹ As patient portals become widely available, patients will expect on-demand access to

their health information. A recent survey reported that 41% of respondents would be “likely” to switch doctors if switching meant gaining access to their medical records.² Studies of hospital inpatients found the vast majority (>90%) wanted in-hospital access to their medical records.^{3–6}

Most health care organizations limit use of patient portals to the ambulatory or home setting. Because the federal financial incentive program Meaningful Use does not require that health information be released until 36 hours after discharge,⁷ hospitals generally do not promote inpatient access to portals. However, patients' desire to access their health information while hospitalized has prompted some organizations to adopt acute care patient portals. The acute care setting offers unique opportunities to engage patients through portals. Patients may give more thought to their health while hospitalized, and may be more easily reached with interventions. Early research suggests that bedside access to information may increase patient safety and satisfaction.^{4,6,8–11}

As patient portal use expands to acute care settings, system implementers must address challenges to ensure that these portals deliver value to patients. One challenge is the adaptation of portal utility to the inpatient setting. Utility refers to the features and content of an application, as opposed to usability, which is a quality attribute that assesses how easy user interfaces are to use.¹² A substantial amount of literature discusses the utility and use of outpatient portals, including the effects of various features on health care quality^{13–17} and differential adoption among disadvantaged populations.^{18–20} While many conclusions from the outpatient setting will inform inpatient work, not all the conclusions will translate to the inpatient setting. Outpatient portals may prioritize features and goals, such as symptom management or medication adherence, that require less emphasis in acute care settings. Conversely, features and goals such as developing the day-to-day care plan gain greater significance in acute care settings.

Collins et al.²¹ recently described stakeholder perspectives on acute care patient portals, and offered suggestions for design and implementation. Building on this work, we provide recommendations for improving utility. These recommendations are based on the experiences of 6 early adopters of acute care portals, and focus on the following features: (1) patient-provider communication, (2) care plan information, (3) clinical data, (4) patient education, (5) patient safety, (6) caregiver access, and (7) amenities.

SIX EARLY ADOPTERS OF ACUTE CARE PATIENT PORTALS

Brigham and Women's Hospital

In 2015, the Brigham and Women's Hospital implemented its Patient-Centered Toolkit (PCTK) (Tables 1–3).^{8,22–30} The PCTK is a suite of patient-facing and provider-facing tools designed to facilitate patient-provider communication and engage hospitalized patients in developing their care plan. The patient-facing tools include a plan-of-care tool, safety tools including MySafeCare and FallTIPS, a discharge preparedness checklist, and information about medications, diet, laboratory test results, safety reminders, and the care team. The plan-of-care tool displays the care plan (diagnoses, care team goals, and schedule) and enables patients to establish recovery goals, input preferences, and rate priorities.³¹ MySafeCare enables patients to report safety concerns while hospitalized.³² FallTIPS displays the fall prevention care plan based on evidence-based nursing fall risk assessment and interventions from the electronic health record (EHR). Features include infobuttons that link to educational materials about the patient's diagnoses, test results, and medications. A clinical trial is ongoing to assess whether the PCTK, along with a suite of provider tools, improves patient activation and reduces adverse events.

NewYork–Presbyterian Hospital/Columbia University

In collaboration with investigators at Columbia University, NewYork–Presbyterian Hospital (NYP) created an inpatient portal

in 2012 based on its outpatient myNYP.org application.^{4–6,33,34} The portal provides hospitalized patients with information about their medications, allergies, vital signs, diet, laboratory test orders and results, and care team. Patients can enter questions and comments that are visible to providers within the EHR. Other features include English and Spanish content translation, links to medication education videos and materials, and the ability to recognize favorite members of the care team (“Shining Star” award). A randomized controlled trial is in progress to assess whether the myNYP.org inpatient portal increases patient engagement and reduces patient information needs compared to usual care.³⁵

C.S. Mott Children's Hospital, Michigan Medicine

After ethnographic research on the in-hospital needs of blood and marrow transplant (BMT) patients,^{36–39} the C.S. Mott Children's Hospital launched an inpatient portal, BMT Roadmap, in 2015.^{40–43} BMT Roadmap engages patients and caregivers throughout the 2- to 6-week hospitalization period post-BMT, facilitating the transition to outpatient management. The portal outlines progress expectations, milestones each patient will accomplish prior to discharge, and recovery techniques, presented as a roadmap visual and a checklist. The portal also provides information about medications, laboratory results, enrolled clinical trials, and the care team. Features include educational videos, tailored medication education content for the drugs most commonly prescribed to BMT patients, a glossary of terms, and audio on mindfulness. A clinical trial is ongoing to assess feasibility.⁴⁰

The Ohio State University Wexner Medical Center

In 2014, The Ohio State University Wexner Medical Center (OSUWMC) became the second hospital system to pilot the MyChart Bedside application from Epic Systems (Madison, WI, USA). In 2016, OSUWMC made MyChart Bedside available hospital-wide at 6 of its 7 hospitals, including University Hospital, Ross Heart Hospital, and James Cancer Hospital. MyChart Bedside provides hospitalized patients with information about medications, diagnoses, vitals, laboratory test results, prescribed diet, weights, allergies, the treatment team, and scheduled procedures, medications, diagnostic tests, and meal times. Patient-provider messaging is active on all units. Features include infobuttons, a “bookshelf” where patients can access assigned educational materials about their diagnoses, and the ability to order from dining services or the gift shop. Patients can add events to their schedules and save audio, video, or written notes for themselves. A study is ongoing to determine the effectiveness of MyChart Bedside in increasing engagement among chronically ill patients.⁴⁴

El Camino Hospital

El Camino Hospital launched an inpatient portal, Family Medical Officer (FMO), in 2015. A controlled trial is ongoing to assess whether the portal increases engagement on an adult medical-surgical unit.³⁵ The portal provides hospitalized patients with information about their medications, allergies, care team, laboratory test results, safety reminders, and discharge instructions. Features include the ability for patients to record their own and family members' medical information. Lessons learned from the controlled trial and focus groups⁴⁵ will inform the configuration and implementation of MyChart Bedside at both El Camino Hospital and the nearby Santa Clara Valley Medical Center.

Table 1. Characteristics of acute care patient portals

Portal	Affiliate institution	Patient users		Timing of information release	Development and access	EHR system
		No.	Population			
Patient-Centered Toolkit (PCTK)	Brigham and Women's Hospital	241	Adult medical intensive care unit, medicine, neurology, and oncology inpatients	Some test results and diagnoses require provider approval before appearing (eg, HIV, cancer); otherwise no delay	Locally developed, web-based application, accessed in-hospital only, via the patient's own device or hospital-issued device; remote access in development	Epic Systems
myNYP	NewYork-Presbyterian Hospital/Columbia University	308	Adult cardiology and general medicine inpatients	No delay	Locally developed, web-based application, accessed in-hospital only via hospital-provided iPads	Allscripts
BMT Roadmap	C.S. Mott Children's Hospital, Michigan Medicine	70	Adult and pediatric blood and marrow transplant (BMT) inpatients	No delay	Locally developed, web-based, application, accessed in-hospital only via hospital-provided iPads	Epic Systems
OSUWMC MyChart Bedside	The Ohio State University Wexner Medical Center	268	Adult inpatients at 6 of the 7 affiliated hospitals, including University Hospital	No delay	Commercially available, web-based application, accessed in-hospital only via hospital-provided Android tablets	Epic Systems
Family Medical Officer (FMO)	El Camino Hospital	60	Adult medical-surgical specialty unit inpatients	Delayed; all information updated once every 24 h	Externally developed via contractor, native application, accessed in-hospital only via hospital-provided iPads	Allscripts
NMH Patient Portal	Northwestern Memorial Hospital/ Northwestern University	118	Adult general medicine inpatients	No delay	Locally developed, web-based application, accessed in-hospital only via hospital-provided iPads	Cerner PowerChart
Portal use						
Portal	Duration of access	Use per day	Period in use	Primary goals		
Patient Centered Toolkit (PCTK)	Mean length of stay: 7 days	On average, users accessed the portal on 63% of days with access	Pilot research: 2012–2015, Implementation: 2015-ongoing	Facilitate patient-provider communication, engage hospitalized patients in developing their care plan, improve patient safety, reduce medical errors		
myNYP	Mean: 3.2 days (range: 1–18)	Mean: 1.3 logins per day (range: 0–13)	Pilot research: 2012–2014, Implementation: 2014-ongoing	Increase patient engagement in care, establish transparency of patient information, address inpatient information needs, facilitate patients' access to their own data		
BMT Roadmap	Mean: 14.5 days (range: 1–28)	Mean: 55.04 minutes per hospital stay (max: 138.75)	Pilot research: 2014–2015, Implementation: 2015-ongoing	Facilitate transition to outpatient management after blood and marrow transplant, reduce uncertainty regarding post-transplant hospitalization course, meet information needs of transplant patients and caregivers		
OSUWMC MyChart Bedside	Not measured	Not measured	Pilot phase: 2014–2016 Implementation: 2016-ongoing	Involve patients in their own care, help them be more knowledgeable about their own health, strengthen patient-clinician relationship, allow for more enjoyable and productive stay during hospital visit		
Family Medical Officer (FMO)	Mean: 1.5 days (range: 1 to 3)	Not measured	Implementation: 2016-ongoing	Provide patients and families with treatment care information, allow patients and families to keep records of hospitalizations, facilitate transition to outpatient management		
NMH Patient Portal	Mean: 2.5 days (range: 1–10)	Mean: 6.2 home page visits per day (range: 0–32)	Pilot research: 2014–2015 Implementation: 2015–2016	Test feasibility of providing tablet and portal to hospitalized patients, improve patients' knowledge of their care plan, enhance patients' engagement in their care		

Table 2. Features of acute care patient portals

Feature	PCTK	NYP	BMT	OSU	FMO	NMH
Medications	X	X	X	X	X	X
Care team	X	X	X	X	X	X
Laboratory test results	X	X	X	X	X	
Prescribed diet	X	X		X		
Vital signs		X		X		
Safety reminders	X				X	
Weights		X		X		
Allergies		X		X	X	X
Enrolled trials			X			
Diagnoses/problem lists	X			X		X
Daily schedules	X	X		X		X
Upcoming procedures	X			X		X
Upcoming medication doses				X		
Upcoming diagnostic tests	X	X		X		X
Rounding times						X
Family meetings	X					
Meal times				X		X
Patient-added events				X		
Overview (entire hospital course)			X			
Discharge criteria/care goals	X		X			
Discharge instructions					X	
Educational materials	X	X	X	X		
Written	X	X	X	X		
Audio			X	X		
Video		X	X	X		
Request in-person educator				X ^a		
Amenities				X		
Navigation tutorials		X		X		X
Spanish translation		X				
Patient-generated content	X ^a	X ^a		X ^a		X
Notes (written, audio, or video)		X ^a		X		
Patient-provider messaging	X ^a			X ^a		
Safety concerns	X ^a					
Care goals, preferences, priorities	X ^a					
Perceived discharge preparedness	X ^a					
Pain levels		X ^a		X		
Provider feedback	X ^a	X				
Platform feedback	X	X				X

^aDenotes information electronically sent to providers via the EHR or another application.

Abbreviations: PCTK: Patient-Centered Toolkit at Brigham and Women's Hospital; NYP: myNYP at NewYork-Presbyterian Hospital/Columbia University; BMT: BMT Roadmap at C.S. Mott Children's Hospital, Michigan Medicine; OSU: MyChart Bedside at The Ohio State University Wexner Medical Center; FMO: Family Medical Officer at El Camino Hospital; NMH: NMH Patient Portal at Northwestern Memorial Hospital/Northwestern University.

Northwestern Memorial Hospital/Northwestern University

In 2015, Northwestern Memorial Hospital (NMH) in Chicago, Illinois conducted a cluster randomized controlled trial of a locally developed inpatient portal on 2 general medicine units.^{46,47} The hospital based the portal content on a prior study of patients'

preferences and input from the hospital's family advisory council.⁴⁸ The portal outlines the patient's daily agenda, including meal times, rounding times, and scheduled tests and procedures. The portal also provides information about medications, allergies, diagnoses, and the care team. Features include role descriptions for each care team member, iPad instructions, a link to the ambulatory patient portal, and access to news, games, and a weather report. NMH will use the lessons learned from the portal's trial during design adaptations for an anticipated implementation of Epic MyChart Bedside in 2018.

LESSONS LEARNED AND RECOMMENDATIONS FOR FUTURE ADOPTERS

Patient-provider communication

Patient-provider communication is a key feature of most acute care patient portals and distinguishes portals from health care applications that offer information or capture patient-generated data. Patients communicate with providers for multiple reasons, including: (1) to convey and clarify health concerns, needs, and preferences, (2) to request clinical updates or information, (3) to coordinate care, and (4) to offer feedback.³⁰

One feature that facilitates patient-provider communication is electronic messaging. Implementing messaging is potentially beneficial, but also potentially disruptive. Providers fear constant interruptions and overwhelming amounts of patient contact, as well as unreasonable patient expectations and potential legal liability.²⁸ Patients want informative and fast responses, but also fear overburdening providers. More research is needed to determine the validity of providers' and patients' fears, and how to mitigate potential barriers.

Electronic messaging is generic, because it does not prompt patients with topics to communicate about. As an alternative to generic patient-provider messaging, some organizations impose structure on patient communications by asking specific questions. For example, the PCTK's plan-of-care tool specifically asks patients to communicate their recovery goals, care priorities, and care preferences, but allows them to respond in an unstructured format. Early-adopted acute care portals include additional structured communication features such as reporting safety concerns, assessing discharge preparedness, reporting pain levels, recording feedback, and requesting an in-person educator. Unlike with generic messaging, having defined categories of communication encourages patients to convey relevant information while not overburdening clinicians. On the other hand, structured communication lacks the flexibility of generic messaging. At the least, structured communication can enhance generic messaging by providing complementary conduits for communication.

Future considerations

Implementing messaging requires explicit attention to clinical workflow integration. Requiring providers to log in to a third-party application to access messages limits utility, and messaging may be easier for clinicians when communication tools sit within the EHR. Regarding structured communication, potential new opportunities include collecting end-of-life preferences, preparing questions for rounds, and verifying demographic information electronically.

Care plan information

Historically, patients have participated only minimally in developing their hospital care plans, and providers have acted as gatekeepers of

Table 3. Characteristics of studies on acute care patient portals

Source	Population and setting	Topic	Methods	Outcome
Caligtan et al. (2012) ⁸	30 inpatients and 30 providers from trauma, neurology, oncology, medical/surgical units	Identify patients' information needs	Interviews, surveys	Information requirements identified <5 themes, including care plan, education, and safety
Dykes et al. (2013) ²²	8 inpatients and 3 caregivers	Design and pilot the portal	Interviews, usability tests	Participants appreciated portal access and requested revisions to care plan and communication features
Dykes et al. (2014) ²⁴	19 discharged patients and family members, 18 nurses, and 10 physicians	Design and pilot the portal	Interviews, iterative design	Participants rated features on potential for use and offered feedback for improvement
Collins et al. (2014) ²⁵	Providers on a medical intensive care unit and an oncology unit	Integrate features with clinical workflow	Observations, interviews	Discovered possible methods for creating a shared care plan document between patients and providers
Morrison et al. (2014) ²⁶	4 patient and family advisors with intensive care or oncology experience	Design and pilot the portal	Interviews, focus groups	Advisors gave feedback on portal features and emphasized promoting dignity and respect
Ohashi et al. (2014) ²⁷	Providers on a medical intensive care unit and an oncology unit	Integrate features with clinical workflow	Observations, interviews	Developed a prototype of a patient safety checklist tool shared between providers and patients
Dalal et al. (2014) ²⁸	8 inpatients, 2 patient advocates, 15 providers, and 8 institutional stakeholders	Identify patients' and clinicians' perceptions	Interviews, focus groups	Elucidated the benefits and concerns surrounding use of a patient-centered microblog
Dalal et al. (2015) ³⁰	119 inpatients and 120 caregivers on a medical intensive care unit and an oncology unit	Implement and evaluate the portal	Surveys, usage data	Observed modest use of the portal; identified barriers to adoption and strategies to promote use
Couture et al. (2015) ³²	8 inpatients and family members on an oncology unit	Design the patient safety application	Usability tests	Obtained feedback; found patients may experience difficulty categorizing potential safety concerns
Vawdrey et al. (2011) ⁶	5 inpatients on a cardiology step-down unit	Design and pilot the portal	Interviews, surveys	Patients were enthusiastic about the portal but exhibited varying levels of comfort with the tablet
Wilcox et al. (2012) ³³	11 inpatients and 6 nurses on a cardiology step-down unit	Identify patients' information needs	Interviews	Discovered cohesive trends in medication information needs across cardiology inpatients
Prey et al. (2014) ⁴	7 inpatients (interviews) and 53 providers (surveys) on a cardiology step-down unit	Identify patients' and clinicians' perceptions	Interviews, surveys	Clinicians felt comfortable sharing medical records, patients appreciated receiving their records
Wilcox et al. (2016) ³⁴	32 inpatients and 5 clinical pharmacists on a cardiology step-down unit	Design and pilot the portal	Interviews, usage data	Patients used a medication-tracking feature and offered feedback for improvement
Masterson Creber et al. (2016) ³⁵	426 inpatients on 2 medicine/cardiology step-down units	Implement and evaluate the portal	Surveys, usage data	Protocol paper for randomized controlled trial; outcomes to be determined
Woollen et al. (2016) ⁵	14 postoperative cardiac surgical inpatients and family members	Design and pilot the portal	Observations, interviews	Patients reported high satisfaction and described useful existing and potential features
Keusch et al. (2014) ³⁶	17 adult BMT patients, 6 caregivers of pediatric BMT patients	Identify patients' information needs	Focus groups	Participants want access to better informed consent and follow-up information for clinical trials
Kaziunas et al. (2015) ³⁷	10 adult caregivers of pediatric BMT patients	Identify patients' information needs	Observations, interviews	Better understanding of the types of information and assistance needed to support caregivers in their role
Buyuktur et al. (2015) ³⁸	Providers in a BMT clinic, 6 BMT patients, and 3 caregivers of BMT patients	Identify patients' and clinicians' perceptions	Observations, interviews	Described patient and physician viewpoints about transition to long-term outpatient management
Maher et al. (2015) ⁴⁰	10 adult caregivers of pediatric BMT inpatients, 12 providers on a BMT inpatient unit	Implement and evaluate the portal	Interviews, surveys	Protocol paper for clinical trial; outcome described in Runaas et al. (2017) ⁴³

(continued)

Table 3. Characteristics of studies on acute care patient portals (continued)

Source	Population and setting	Topic	Methods	Outcome
Kaziunas et al. (2016) ³⁹	17 BMT inpatients or recently discharged BMT patients and their caregivers	Identify patients' information needs	Interviews, observations	Identified 3 stages of recovery amenable to support with health information technology
Maher et al. (2016) ⁴¹	8 BMT patients and 11 adult caregivers of pediatric BMT patients	Design and pilot the portal	Focus groups	Identified improvements to features and discussed usefulness of existing and potential features
Runaas et al. (2017) ⁴³	10 adult caregivers of pediatric BMT inpatients, 12 providers on a BMT inpatient unit	Implement and evaluate the portal	Interviews, surveys	Patients expressed enthusiasm about portal access; providers stated the portal did not disrupt care
McAlearney et al. (2016) ⁴⁴	6000 patients and/or caregivers, 100 providers on 6 select hospital units	Implement and evaluate the portal	Surveys, interviews	Protocol paper for randomized controlled trial; outcomes to be determined
Yen et al. (2017) (manuscript in preparation)	19 adults recruited through the patient and family experience program	Evaluate usability of the portal	Think Aloud protocol	Design of inpatient portals can impact how patients navigate and comprehend information
O'Leary et al. (2015) ⁴⁸	150 inpatients admitted to general medical service units	Identify patients' information needs	Structured interviews	42% reported wanting electronic health info while hospitalized, especially about drugs, diagnoses, tests
O'Leary et al. (2016) ⁴⁶	202 inpatients on 2 general medical service units	Implement and evaluate the portal	Structured interviews	Portal access increased patients' ability to state physicians' names and roles, but not other measures
O'Leary et al. (2016) ⁴⁷	18 inpatients (interviews) and 21 providers (focus groups)	Implement and evaluate the portal	Interviews, focus groups	Patients desired more features; providers concerned about impact on workflow and patient anxiety

information.⁸ Consequently, the patient's goals and preferences regarding his or her care plan and care transitions may be overlooked. In one analysis, a patient, nurse, and physician all selected the same overall hospital goal in only 20% of cases.³⁰

An effective portal not only conveys care plan information, but encourages patient-provider communication regarding the patient's care plan. Early-adopted acute care portals include provider-generated content such as: (1) a daily schedule of events such as imaging or lab tests, (2) a list of diagnoses or problems, (3) daily goals or daily action items for the patient, (4) discharge criteria or in-hospital goals, (5) an expected hospital course overview, and (6) post-hospitalization care plan and goals. Ideally, portals enable patients to not only review this provider-generated content, but also add to it and provide feedback. Early-adopted portals include patient-generated content such as additional events, goals, preferences, priorities, and action items.

Daily schedule

Daily schedules may reduce patients' uncertainty about how the hospital functions. Daily schedules in early-adopted portals include: (1) upcoming procedures, laboratory tests, or imaging studies, (2) timing of medication doses, (3) anticipated consultations or therapy sessions, (4) typical rounding times, (5) family meetings, and (6) meal times. In the experience of 3 institutions, patients seemed most eager to know about upcoming procedures, laboratory tests, and consultations.

A major challenge to providing daily schedules is anticipating the timing of events. Especially for procedures and imaging studies, the exact timing is often unknown or not readily available. Patients seldom complained about nonspecific times such as "today" for events, possibly because some information is better than none.⁴⁵

However, patients did complain when given specific but ultimately inaccurate times for events.

List of diagnoses or problems

Patients appreciate the care team's written comments about their list of diagnoses or problems. Ideally, the portal either displays medical diagnoses in plain language or interprets unfamiliar terms directly in the application.

Daily care goals

An understanding of the daily care goals is critical for patients to actively participate in their hospital care. Examples of daily care goals include: (1) walk around the unit at least once, (2) wear assistive devices like compression stockings, (3) participate in physical therapy, and (4) learn about medications. In the experience of 1 institution, patients especially value trends showing day-to-day progress for specific goals such as physical activity.

Discharge criteria

Discharge criteria, or in-hospital goals, refers to the goals the clinician believes the patient should reach before discharge. Presenting discharge criteria electronically helps set expectations for treatment course and discharge timing. To avoid frustration, it may be prudent to avoid displaying the anticipated discharge date until it is relatively certain.

Post-hospitalization care plan

An electronic post-hospitalization care plan feature may supplement paper-based discharge instructions and verbal discharge information. Content includes: (1) an electronic copy of the paper

discharge instructions, (2) discharge medications, including purpose, side effects, and dosing schedule, (3) an assessment of the patient's discharge preparedness, (4) names of care management and social work staff participating in the discharge planning process, and (5) the name of the physician who will write the discharge order.

Examples of care plan information in portals

The PCTK at Brigham and Women's Hospital includes a plan-of-care tool, where patients review their problem list, in-hospital goals, and daily goals, as well as input their own goals, priorities, and preferences.³⁰ A care team member, usually the nurse, reviews patient-entered information during interdisciplinary rounds with the care team.³¹ Similar to patient-provider messaging, one major challenge is integrating the tools with providers' workflows. Successful integration is unlikely without linking to existing workflows and getting strong support from nursing and operations leadership.³¹

Michigan Medicine's BMT Roadmap demonstrates how care plan information can be tailored to specific diseases or procedures. BMT Roadmap covers the patient's entire transplant experience and provides granular communication of the expected hospital course.⁴⁰ Cartoon images of buildings along a roadway represent recovery periods and major clinical events.⁴¹ For each building, potential symptoms and side effects, recovery techniques, and emotional health are discussed. A concurrently displayed list of overarching recovery goals doubles as the discharge criteria. Care providers use a 4-point scale to communicate progress toward achieving each goal.

Clinical data

In the experience of 2 institutions, patients and caregivers assigned the most value to patient-provider communication and care plan features.^{30,45} However, patients and caregivers emphasized that acute care portals must also provide useful summaries of clinical information. With acute care portals, patients can review information at their convenience, rather than solely relying on providers to convey and explain it. Patients may identify errors, such as missing medications, which can be lifesaving. Early-adopted acute care portals display clinical data such as laboratory test results, care team information, medications, prescribed diet, vital signs, weights, allergies, and patient characteristics.

Hospitals that want to offer patients immediate electronic access to their medical records should consider some key issues. First, it may be prudent to omit or explain potentially alarming information that carries a low degree of certainty, such as cancer on a differential diagnosis list. Second, timing of information release is critical to consider. Less risk may be associated with releasing results such as glucose levels, compared with more sensitive results such as HIV status. Notably, many hospitals maintain guidelines regarding information release to outpatient portals, which may be adapted to the inpatient setting. Finally, information displays should accommodate patients with varying reading levels, numeracy, health literacy, and preferences.

Laboratory test results

Challenges with presenting laboratory test results include: (1) integrating results measured in different laboratory systems, (2) displaying results across various time frames, and (3) conveying each result's clinical importance.⁴⁹ Research on presentation formats for laboratory test results indicates that visual displays, rather than tables, facilitate better understanding of results.^{50,51} We recommend

that visual displays include actual numbers, rather than just an indication of normal or abnormal, especially for highly engaged populations such as transplant patients. Notably, visualizing the degree of abnormality, such as highly abnormal versus slightly abnormal, is subjective and may vary according to the disease, provider, or institution.

Care team

The Joint Commission recommends that patients "remind staff to identify themselves."⁵² Displaying the names, photographs, and roles of care team members, as well as describing roles such as "attending" or "resident," facilitates identification and communication. Many hospitals already have photographs of care team members from their websites or ID badge databases. Ideally, the care team feature displays both active and historical members, and regularly updates this information from the EHR. Portal adopters may consider displaying a brief biography of each care team member, as patients may value knowing about the training and certification of their providers.

Medications

The medication feature may display generic name, trade name, dose, frequency, method of administration, and common side effects. Consider converting abbreviations and medical terms into plain language, such as "as needed" instead of "PRN." Ideally, the medication feature explains the rationale for prescribing a medication, either in the physician's own words or from an outside source, to facilitate patient education and medication reconciliation. Patients may want to track which providers prescribed which medications, as well as the administration times of PRN medications.^{30,45} However, providers have expressed concern that patients will rely on time rather than pain level to request PRN medications, and that competing priorities may hinder nurses from administering them at the exact time.

Clinical notes

The OpenNotes consortium reports that >10 million individuals now have electronic access to their primary care providers' office notes.⁵³ Access to notes helps patients take medications as prescribed, be better prepared for future clinic visits, and better understand their conditions.^{17,54,55} Columbia University Medical Center piloted note-sharing within its inpatient portal. Based on system usage data, participants navigated to the "clinical notes" feature more frequently and for longer durations than any other feature.

Patient characteristics

Patient characteristics include sociodemographic information as well as medical traits such as blood type and transplant date. Patient characteristics do not add to the patient's knowledge, and patients may not want this information displayed for privacy reasons. On the other hand, patients may wish to view their characteristics to verify them or keep a record of them.

Future considerations

Electronic access to laboratory, radiology, and pathology results may enable patients to retain them for future reference and electronically share them with outside specialists, perhaps preventing repeat diagnostic testing. Stakeholders should explore opportunities to educate patients regarding nutrition and the relationship between diet and disease, beyond displaying the prescribed diet. Possible content

could include verifying food allergies, displaying the rationale for dietary restrictions, linking to hospital menus or food ordering, and offering dietary reminders such as “do not eat until your blood sugar is checked.”

Patient education

While acute care portals may contain explicit educational features, in truth, all clinical data within the portal contribute to patient education. The most common explicit educational feature is infobuttons placed near medications, diagnoses, or test results. The infobuttons link to various educational sources, including Lexicomp, UpToDate, MedlinePlus, FamilyDoctor.org, and YouTube videos. In the experience of 2 institutions, patients use the infobuttons, but not as much as expected. This is partly because patients perceive that infobuttons provide similar or less information than simply googling the term does.

To deliver value to patients, educational features must go beyond what Google can offer. One solution is to indicate that the content is physician-endorsed. OSUWMC’s MyChart Bedside offers a “bookshelf” feature, where patients can read educational material about their diagnoses. The nurse or other clinician assigns the materials the patient can access, and an in-person educator is available on request.

Ideal educational content is disease-specific, tailored to age and health literacy level, and is not so dense as to be overwhelming. Unfortunately, such content is not always easily available or developed. Michigan Medicine created easy-to-read educational materials for common transplant medications. While developing the content locally ensured readability and appropriateness, developing such content for all possible medications is not feasible. One solution is to offer a broader variety of endorsed content so that patients can choose based on their preferences.

Future considerations

Patient education through acute care portals aims to help patients assume responsibility for their care after discharge, supplement provider-based education, and lessen patients’ uncertainty about their condition. Targeted strategies to achieve these goals require further consideration and evaluation. One potential strategy is to better integrate education with medical record viewing, such as pop-ups that define medical terms. Another potential strategy is to provide access to trusted online communities or electronic meetups, where patients can learn from other patients with more experience.

Patient safety

Emerging data suggests that widespread use of portals will improve patient safety.^{4,6,8-11} Given the urgent need to reduce medical errors and the promising potential role of patients in preventing them,⁵⁶ an explicit portal feature devoted to safety is justifiable. Ideally, the portal’s safety feature would encourage patients to participate in their safety plan and highlight specific, actionable steps that patients can take to improve their own safety.

Early-adopted portals include safety-oriented content such as: (1) the ability to report safety concerns, including potential medical errors, (2) personalized tips and reminders to prevent falls, (3) explanations of any isolation precautions and instructions for visitors, (4) activity orders, such as physical therapy orders, (5) activity limitations, such as use of a walker or weight-bearing status, (6) display of generalized actionable safety measures, such as reminders to wash hands or turn every 2 hours to avoid bedsores, (7) display of specific orders related to safety, including “NPO”

(nothing by mouth) or “keep head of bed elevated to 30 degrees”, and (8) reminders to avoid specific locations or limbs for blood pressure readings or blood draws.

The PCTK from Brigham and Women’s Hospital includes MySaFeCare, an application for patients to report safety concerns in real time. Patients can categorize safety concerns as related to (1) medications, such as potential medication errors, (2) hygiene, such as providers not washing their hands, (3) patient-provider communication, (4) care plan, (5) accommodations, (6) privacy, (7) pain, (8) waiting time, and (9) other. Patients can submit anonymously, and providers view submissions on a secure clinical dashboard. Personalized safety information such as the fall prevention plan, patient preferences such as the need for a translator, and care plan information such as NPO populate a screensaver in the patient’s room to drive increased situational awareness among the patient, caregivers, clinicians, and staff.

Future considerations

Future studies should determine whether patient reporting of safety concerns through portals mitigates potential safety incidents and describe how patients perceive safety threats. Potential additional safety-oriented content could include: (1) reporting of adverse events, such as worsening symptoms or medication side effects, (2) verification of contact names and numbers in case of emergency, (3) wishes and information related to resuscitation and emergency care, and (4) medication review.

Caregiver access

The emerging consensus is that acute care portals must engage patients’ caregivers as well as patients themselves. This is especially true regarding surrogate decision-makers for incapacitated or pediatric patients. Caregivers not only will benefit from better access to information, but can contribute detailed information to improve quality of care.

Currently, both Brigham and Women’s Hospital and OSUWMC provide portal access to caregivers with patient consent and to legally recognized health care proxies of incapacitated patients. Michigan Medicine provides access to the parents and guardians of pediatric patients. In the absence of formal structures for caregiver access, patients typically decide whether to share their login information with their caregivers or loved ones, which is not recommended as a best practice.⁵⁷

Future considerations

Violation of HIPAA privacy rules is a concern. One potential solution is an “invite” feature, where patients can invite caregivers to access the portal. Patients can then be alerted to the potential benefits and risks of sharing their access, and caregivers can be educated regarding confidentiality. Another possible solution is to give patients the option to share partial information. For example, links to e-mail or Google Calendar could allow easy sharing of specific information, such as family meeting time, discharge information, or prescription pickup location. Finally, enrolling patients and their caregivers in the outpatient setting, prior to hospitalization, could ensure full consent for caregiver access before the patient’s incapacitation.

Unlike patients, most caregivers are not in the hospital for the entire hospitalization. Home access would keep caregivers informed and reduce the anxiety of not being present.²¹ Home access will become more feasible when institutions offer portal access on personal devices (eg, Bring Your Own Device, or BYOD) in addition to

hospital-provided devices. A videoconferencing feature might help patients connect with their caregivers and loved ones outside the hospital.

Amenities

Amenities may not directly impact quality of care, but can greatly enhance the patient experience. Early-adopted portals include amenities such as: (1) food ordering, menus, and hospital dining options, (2) hospital orientation information such as maps, visiting hours, parking, sleeping accommodations, and nearby hotels, (3) gift shop ordering, (4) entertainment such as television, Netflix, or games, (5) navigation tutorials for the portal or the hospital stay itself, and (6) details for maintaining orientation, such as date, time, floor, and room number. Amenities may encourage patients to log in more often and view other features as well. Certain amenities, such as games and movies, may distract patients from boredom and discomfort. Notably, implementing food or gift shop ordering may require connecting with non-EHR information systems.

DISCUSSION

Stakeholders adapting outpatient portals to acute care settings must modify existing features and create novel features to meet inpatient needs. Our synthesis of 6 institutions' experience with acute care patient portals may help stakeholders innovate and spread best practices regarding acute care portal features. The design and implementation of acute care portal features depends on patient information needs, clinical judgment about appropriateness of information release, potential impact on clinicians, medicolegal concerns, and technical feasibility. Each feature presents unique considerations and challenges for implementation, but also unique opportunities to deliver value to patients.

To date, studies describing acute care portal implementation have focused on patients' needs. Future studies should also emphasize providers' needs, since providers play a critical role in encouraging use and actualizing utilities such as patient-provider messaging. System implementers should consider how each feature advances their organization's goals, such as improved transparency, patient engagement, or patient-provider communication. Additional research should explore which outcomes the various portal features influence. Standardized metrics for tracking portal use and impact may enable better comparisons across systems.

LIMITATIONS

This work summarizes the experiences of only 6 early adopters, including 5 large academic medical centers with relatively advanced informatics infrastructures. We based our lessons learned and recommendations on existing literature from the early adopters, as well as insights from the authors, who each represent 1 of the 6 institutions. Lack of widespread adoption limits the level of available evidence, and thus the generalizability of our early recommendations to institutions with sufficient resources to implement them. Future studies should explore acute care portal implementation and use in non-academic settings.

FUNDING

This work was supported by the Agency for Healthcare Research and Quality (R01HS21816, R21HS023613, P30HS023535, R21HS024349), Brigham

and Women's Hospital, and the Gordon and Betty Moore Foundation Patient Care Program (4609).

CONTRIBUTORS

All authors contributed extensively to the work presented in this manuscript, including the generation of content for the manuscript and the revision and refinement of the manuscript. The first author (LVG) wrote the manuscript.

COMPETING INTERESTS

The authors have no competing interests associated with this work.

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