Case Reports

From development to implementation—A smartphone and email-based discharge follow-up program for pediatric patients after hospital discharge

Israel Green Hopkins [a,*], Kelly Dunn [b], Fabienne Bourgeois [b], Jayne Rogers [b], Vincent W Chiang [b]

[a] Division of Pediatric Emergency Medicine, UCSF Benioff Children's Hospital, San Francisco, United States
[b] Department of Medicine, Boston Children's Hospital, United States

ABSTRACT

The purpose of this case study was to investigate opportunities to electronically enhance the transitions of care for both patients and providers and to describe the process of development and implementation of such tools.

We describe the current challenges and fragmentation of care for pediatric patients and families being discharged from inpatient stays, and review barriers to change in practice. Care transitions vary in the complexity of the clinical and social scenarios and no one-size-fits-all approach works for every patient, provider or hospital system. A substantial challenge that providers who are designing and implementing digital tools for patients surrounds the complexity in building such tools to apply to such broad populations.

Our case study provides a framework using a multidisciplinary approach, brainstorming and rapid digital prototyping to build an in-house electronic discharge follow-up platform. In describing this process, we review design and implementation measures that may further support digital tool development in other areas.

© 2015 Elsevier Inc. All rights reserved.

1. Background

Care transitions from the inpatient to outpatient setting are frequent yet may represent challenging periods for caregivers and patients with failures in communication and coordination.[1,2] Healthcare providers continue to search for optimal ways to provide continuity and improve communication to patients amid care transitions.

Electronic communication tools, including mobile messaging, smartphone applications and email are increasingly being studied in patient self-management and follow-up care as potential solutions.[3–5] In pediatrics, recent studies on patients and caregivers provide early evidence that their utilization of electronic tools including email and text-enabled phones is frequent.[6,7] Research has also shown that the use of text-message communication is independent of age, sex or socioeconomic status.[8] Furthermore, a wide variety of patients across socioeconomic status, ethnicity and educational background demonstrate interest in using internet and mobile technology to receive healthcare information from providers.[7,9,10]

While short-message service (SMS), or text messaging, has been studied in adult care transitions,[5] questions remain about how to best design and develop these programs; there remain no absolute guidelines on the process and examples in the literature vary widely.[4,11] Properly designed and implemented, electronic communication strategies may provide a better alternative to perform outreach and follow-up to patients recently transitioning from inpatient to outpatient care.

In this report, we describe the development of an automated, SMS-text and email-based follow-up system for pediatric patients discharged from an inpatient hospital stay. From concept to design and implementation, we explore our lessons learned by this electronic follow-up tool for discharged patients and explore the utility in similar clinical settings

2. Organizational context

This case study took place within a general medicine inpatient unit at Boston Children's Hospital. Boston Children's Hospital is a tertiary care, academic pediatric hospital with 395 inpatient beds and 18,000 admissions annually, serving a socioeconomically

* Corresponding author.
 E-mail address: Israel.green-hopkins@ucsf.edu (I.G. Hopkins).

diverse population in the Boston area, as well as a significant number of out-of-state and international patients.

The medical center has a primary responsibility to provide patients with appropriate follow-up options and strives to meet the demands of a heterogeneous population. Furthermore, it is a leader in pediatric care and embraces opportunities to design and investigate new systems of care and to understand their effect on the population served.

3. Personal context: concept and design

The nearly ubiquitous presence of mobile technology among our patients and families coupled with the idea to make post-discharge communication an electronic "push" from the caregivers (rather than a "pull" from patients) resulted in the structure for the case study. The clinical team was composed of three physicians, a nurse practitioner, and a nurse manager. Our technical team consisted of two software engineers and a program manager well-versed in the development of healthcare technology tools. We held serial meetings with our technology group, orchestrated by our in-house Innovation Acceleration Program to review and strategize on the design and content. The opportunity to embark on this project was supported by the creation of small seed grants to promote in-house development of software solutions to common challenges in our hospital environment. Our primary goal was to build a program to push follow-up questions to patients while minimizing workflow disruption for follow-up nurses and to evaluate the feasibility of this design and development process.

4. The problem

The current follow-up system for inpatient medical discharges is non-standardized and fragmented: staff nurses and/or physicians call patients if they deem a call necessary and this outreach is not concretely tracked or recorded in a standard fashion within the medical service. While cost data for our current hospital program is not available, similar programs report costs upward of $60,000 to employ nursing personnel for follow-up outreach.[12]

Our primary aims were to provide an alternative means for communication at discharge between patients and discharging providers, via electronic messaging, and improve the triaging of follow-up needs. To accomplish this, we had to balance the heterogeneity of clinical environments with care transitions as well as limitations in what could be technologically accomplished and implemented.

5. The solution

Early on, we utilized a modified "design thinking" approach to help explore the potential solutions. This approach, which is used primarily in the product design and business industry, organizes the problem solving process into five steps: Empathize, Define, Ideate, Prototype and Test.[13] Essentially, when initially considering a solution to a problem, a group must first evaluate the needs of the user (empathy), use this work to determine which processes are important for users (define), explore a large quantity of possible solutions (ideate), transform those ideas into a physical form (prototype) and lastly, test the prototypes out with your users. The model has many similarities to conventional quality improvement studies in medicine. We modified the process slightly as we did not have the opportunity to perform extensive user research, but rather relied on available literature and experience of the professionals in our group.

Our end-users included the patient and/or caregiver, the follow-up nurse, the discharging physician and in some cases, the primary care physician. Our clinical team brainstormed challenges existing in the current follow-up structure. Though we did not hold focus groups or standardized interviews with end-users, our diverse clinical team brought numerous reflections from each individuals practice. In addition, we reviewed available literature detailing patient, caregiver and clinician frustrations with current follow-up systems.

Because our goal was to design a simple and automated follow-up tool, our aim was to keep our follow-up questions brief yet purposeful. As such, we were unable to conduct extensive pre-implementation surveys on what variables should or should not be included in electronic follow-up. However, we developed questions based on prior literature surrounding post-discharge communication and follow-up. While there have been numerous studies on discharge preparedness and improvement, Project RED remains one of the most widely successful programs.[14] The study identified multiple domains upon which improvements in education and communication could be made, including but not limited to: discussion of pending tests, follow-up appointments, medication instructions, discharge instruction comprehension and a review of a discharge plan.

As our goal was to make a relatively simple text application that parents could use, we aimed to prioritize questions asked. Recent studies on phone follow-up after discharge have identified key variables at follow-up that are frequently sought after by patients, though data exist from adults.[12,15] The most commonly encountered issues are 1) difficulty with or questions regarding follow-up appointments, 2) challenges to obtaining a discharge medicine and 3) questions about discharge medicine.[12,15] We utilized this prior research to develop our main goals for our follow-up system and narrowed them to 1) performing or attempting outreach to the patient and/or family, 2) ensuring that medicines were obtained, 3) ensuring that follow-up appointments were obtained and 4) determining if any parental or patient concerns were present. These goals, abstracted from prior research on patient concerns and challenges with discharge as noted, formed the basis for our follow-up questions. The process, however, started with consideration of a more simplified outreach – a single message inquiring if the patients had any questions regarding the recent discharge. This was abandoned as our team felt more targeted questions may improve response. We additionally considered adopting a more detailed approach such as that used in Project RED. Questions considered here included querying whether patients knew about pending tests, the degree of comprehension of discharge instructions, had questions about medications or side effects and to establish parent knowledge of return precautions. We elected to prioritize brevity with an open-ended response that would elicit a callback from a follow-up provider rather than include more comprehensive questions that may deter patients from completing the tool.

During ideation we considered various possible mechanisms for follow-up, not limited to electronic mediums. The process allowed for further refining of our goals and we frequently circled back to the needs of the users including patients, clinicians and the hospital system. For example, we initially considered email-only deployment, or deployment via a newly-developed patient-portal, but eventually decided that scalability may be easier with an email and SMS-based system, though this was not based on literature review. In addition, while considering possible expansion capability of the system we designed, we hypothesized the multiple other environments that such a follow-up tool could be used. This process involved unstructured interviews with other discharging services to determine what their potential needs might be. For example, while our tool was designed for follow-up, we also