TransitionMate: a mobile application for chronic illness transition support

Rafael A. Calvo, Abelardo Pardo, Yu Zhao
School of Electrical and Information Engineering
The University of Sydney, NSW 2006
{rafael.calvo, abelardo.pardo, y.zhao}@sydney.edu.au

Emily Klineberg¹, Mary Lam², Kate Steinbeck¹
¹Sydney Medical School University of Sydney and Academic Department of Adolescent Medicine, The Children's Hospital at Westmead, Locked Bag 4001, Westmead, Australia 2145.
²Faculty of Health Sciences, University of Sydney
{emily.klineberg, kate.steinbeck@health.nsw.gov.au, mary.lam@sydney.edu.au}

ABSTRACT
Adolescent patients with a chronic illness, they eventually undergo the transition from paediatric health care to adult health care. This transition typically occurs simultaneously with other changes in the surrounding environment and patients need to develop skills such as independence and autonomy to improve their overall health. Although these patients have the support of medical personnel, barely any information has been collected to understand this transition and the way it can be better supported. In this paper we describe “TransitionMate”, a mobile phone application that aims at collecting data from patients during the transition to adult care using a variety of interaction modes. The objective is first to engage young adults in the process of thinking about their health and how to improve it, and second to explore which type of interactions are the most appropriate to foster the sense of independence and autonomy. An iterative approach was adopted in the design and implementation of the mobile application to engage potential users and domain experts at an early stage. The on-going research will continue to shed some light on this process and provide an application useful for the patients.

Author Keywords
Mobile application; intervention; chronic disease; behaviour change

ACM Classification Keywords
HCI: Miscellaneous.

INTRODUCTION
Chronic illnesses are long term conditions that might affect a person for her whole life, and if left untreated or incorrectly addressed, they may cause numerous complications that seriously affect the overall wellbeing. To keep the physical health good or stable, a patient with a chronic illness needs to perform disease management tasks and even maintain a lifestyle with specific conditions. The management of the illness can be divided into different stages that differ significantly based on the condition and the age of the patient. The ways in which health is managed can have a strong impact on the psychological wellbeing of the patient, therefore interventions that aim to influence the former need to take into account the latter. One particularly delicate period of time for these patients is during the transition from adolescent to adult care. There is significant evidence pointing out that this transition is done without the required support and communication (Cooley, 2013).

For example, when young people are receiving treatment for diabetes and make a transition from paediatric to adult health care, they become independent from their parents, who may have help them with all the aspects related to their treatment. Additionally, during this transition phase, the treatment itself may change thus requiring an additional level of adjustment. Patients may still maintain the yearly or quarterly appointments with the corresponding specialists, and keep the insulin injection at regular frequencies. But they may need to include their disease management process into their lives which have undergone important changes in their environment such as study, work, or a relationship. In these complex scenarios we can ask "how can we motivate patients to change their behaviours?" yet as the research on Self-Determination Theory (Ryan & Deci, 2000) has suggested this is the might be the wrong question. We should be asking how can we create environments were the patients motivate themselves?

A communication channel is needed to connect young people with a chronic illness to doctors, to enable a constant communication channel during the transition, and at the same time help them to develop autonomy and
independence in self disease-management. Mobile phones are an ideal platform for such type of communication, as they already are very popular among young people and used on a daily basis. Numerous studies have been carried out to evaluate the effectiveness of so-called interventions to foster behavioural changes using different platforms (e.g., mobile phone, browser, wearable devices). But, to date, these studies have focused on treatment compliance (Franklin et al., 2006; Rami et al., 2006), behavioural changes (Dantzig et al., 2012), and illness education (Chen et al., 2011). The review of these previous studies highlights the need for empirical evidence about interventions that promote health self-management together with adherence during transition (Pai et al., 2011), and more generally a rigorous evaluation to increase the evidence that electronic-media provides an effective means of promoting health behaviour change in young people (Hieftje et al., 2013). This is part of a larger research program on what we call ‘Positive Computing’ (Calvo & Peters, 2014; Calvo & Peters, 2013) i.e. technologies that support psychological wellbeing.

We propose “TransitionMate”, an Android mobile application that seeks to:

• allow researchers to better understand health behaviours in young people with chronic illness who leave paediatric health care and transition to adult health care,
• be engaging/attractive/useful enough for young people to continue to provide data for researchers over time, and
• improve young people’s health behaviour.

In this paper, we focus our discussion on the purpose and design of the mobile application. Section 2 explains the research question while Section 3 describes the system design. Finally Section 4 concludes the paper and highlights future research opportunities.

THE MOBILE APPLICATION
“TransitionMate” was implemented on the Android platform, a mobile operating system that has a large market share. Android was chosen as development platform due to the availability of low cost devices running Android and the skill sets in our group.

DESIGN CONSIDERATIONS
The primary purpose of this project is to understand what is the best way to help young adult make a smooth transition from paediatric to adult health care and become independent in future health self-management. However, the data about this age group and the role of mobile applications with respect to the transition is non-existent. This situation requires the application to be able to:

• provide monitoring or communication functionality for doctors or researchers to collect data and better understand the health behaviour of this age group during the transition.
• attract young people during the transition to keep enter information through the application.

• improve the independence of health self-management, and promote autonomy among this age group.

Apart from the previous design considerations, issues with the domain of software engineering, such as privacy, security, data integrity, and system availability have also been taken into account.

Due to the interdisciplinary nature of the topic, an iterative design and implementation approach was adopted with the active involvement of stakeholders, i.e., potential users (young people with chronic illness). Initial feedback from these users has already been included in the design cycle and guided the development and refinement of the mobile application.

Interaction with a Dedicated Server
To take all design consideration described in the previous section into account, we implemented the Android application as a mobile client, which connects to a dedicated server. The mobile application downloads and upload newly entered information from/to the server. The availability of the bi-directional communication channel depends on the availability of wireless Internet connection. The mobile application is configured to use WiFi connection by default, however, if WiFi is not available, it will use the mobile wireless connection to download and upload data from/to the server.

The data on the mobile phone is synced with the server every 30 minutes by default, and whenever the user of the mobile phone enters some information, the mobile application tries to upload the newly entered data to the server; conversely, whenever a doctor or researcher on the server side enters some data to one or multiple mobile user, the data will be sent to all referenced mobile users.

Interaction with a User
We use of three major interaction components with users: target behaviour measurement, emotion and health self-assessment, and self-reflection. These three interactions have been conceived to approach the transition process from different angles, and provide interventions and reflections from different perspectives. In our current research, we are evaluating the effectiveness of these three interactions to find out the most appropriate approach to help young people get independent during the transition.

Target behaviour/Compliance Measurement
The Android application provides a functionality to assess individual’s treatment compliance. This assessment is a direct reflection of how well the patient is managing her own treatment.

The events occurring as part of the treatments are shown with a reminder within the mobile application. Medical personnel or researchers enter these reminders on the server side and reminders are sent to the corresponding devices.

Figure 1 shows a screenshot of the reminder screen. At the top of the screen is a joke sent on a daily basis (as part of a strategy to engage young people with the tool), the
central part of this screen shows the list of all reminders. Completed tasks have a light grey background, and pending tasks (or reminders) have white background.

Each item on the reminder list is clickable and enables the user to enter additional information about the event. Note that there are two types of reminders "How about some walking?" and "consider appointment with Dr Magoo?" are more autonomy supportive than “Take Novolin” that is clearly a directive.

This information may include the current state of a task (completed or not), the outcome of a task (for example a measurement of a body parameter), and a generic comment. If a user tells the application that she has not completed a task, then the application will ask her the reason instead of “outcome/measure”.

All the information entered by the user is sent to a dedicated server for analysis and the result of the analysis will be sent back to the application using a smiling face to indicate good compliance and a sad face to indicate bad compliance.

Emotion and Health Self-Assessment

The emotional and health states of young people during the transition is valuable data for understanding the individual’s perceived emotional and health state and by correlating these data with individual’s treatment compliance information, interesting patterns of health behaviour of individual patients may be discovered.

As it can be seen in Figure 4, the emotion state is collected using a 2-dimension coordinate system. The horizontal axis has a range from negative (left) to positive (right), and the vertical axis goes from high energy (up) to low energy (down).

Similarly, a sliding bar is used to ask about the overall health with five health levels, very bad, bad, normal, good, and very good.
At the bottom of this screen, there is also a comment section, where users can type an open text related to their mood and health.

![Memo Screen](image1)

**Memo Reflection**

The memo functionality is provided to enable and encourage young adult to write short memos for future review and reflection. Reflection through reviewing past scenarios can let individuals to revisit the same scenario a second time and possibly increase their independence and autonomy.

![Write Memo Screen](image2)

**CONCLUSIONS**

In this paper, we presented the preliminary design of TransitionMate, an Android application that aims at helping young people during the transition from paediatric to adult health care. We interact with potential users and medical experts on a monthly basis to gather information as guidance of our design and implementation. We described the design of the application and the three types of interactions supported by the application. The objective is to explore how the communication with these patients can be established as to foster a sense of autonomy and independence with respect to their conditions. We conducted a preliminary interview with diabetic patients and the results proved that the functionality of “TransitionMate” is well targeted and useful in facilitating the transition of chronic illness patients.

The project will conduct an initial trial to analyse the effectiveness of the, and refine and upgrade the application based on feedbacks from participants.

**ACKNOWLEDGMENTS**

R.A. Calvo is also with the Young and Well Cooperative Research Centre.

**REFERENCES**


