

Persuasion for In-home Technology Intervened Healthcare of Chronic Disease: Case of Diabetes Type 2

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Abstract. Currently the world is going through a demographic shift that projects the proportion of ageing population will be more than double in the next four decades. This has serious consequences for our current healthcare systems for the ageing population that are prone to chronic diseases. One possible solution is to provide in-home assisted healthcare through technology intervened approaches. This will also create a change of roles, with the patient having more responsibility for their own well-being. However, through investigations of clinical trials of in-home technology intervened healthcare this paper identifies problems of technology use among patients. This paper argues that persuasive technology can help to motivate patients and support quality and cost-effective in-home healthcare. Focusing on diabetes type 2 as a representative of chronic disease, this paper describes background research and explores the possibility of deploying persuasive technology to support in-home technology intervened healthcare.

1 Introduction

Over the next four decades the baby boomer population of the world will be retiring and ageing, while the proportion of working population comparatively decreases. In the United States the current ageing population is approximately 8% which will rise up to 17% by the year 2050 [1]. In Australia this rise will be from 13% to 25% by 2056 [2]. Chronic illnesses such as diabetes, heart disease, COPD (Chronic Obtrusive Pulmonary Disease), obesity, etc. are more common in the ageing population, so hospital visits will increase. However, the demographic shift negatively impacts the patient/doctor, patient/nurse and patient/hospital bed ratios which will impose a huge demand on the healthcare system. In addition, high-rising costs of treatments and hospitalization raises questions of economic feasibility for healthcare of the future population.

One potential solution for the healthcare problem is in-home technology intervened treatment. These treatments expect patients to have a more proactive role as opposed to the traditional healthcare system [3]. However, even if patients are provided with

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the latest state-of-the-art technology at home, if they don't use them, in-home healthcare technologies will not serve the predicted healthcare crisis.

This paper investigates whether persuasive technology can assist in the future healthcare to keep patients committed to their in-home treatment plan. It describes the early investigations around clinical trials of technology intervened treatments to explore the feasibility of using persuasive. In this early stage this research aims to answer the following questions, however in future it will tailor research questions specifically around ageing factors and persuasion for elderly.

- (1) What are the factors that influence motivation, ability and trigger for diabetes in-home technology intervened treatments?
- (2) How to keep patients motivated in self-monitoring with technology intervened healthcare (and prevent dropouts)?

2 Background

Published literature on in-home technology intervened healthcare identifies the main areas as telemedicine and telehealth [4], ehealth [5] and mhealth [6, 7]. Design and assessment of these technologies generally comes from two main areas: HCI (Human-Computer Interaction) and clinical trials. In HCI, technology is designed, developed and evaluated using user-centered design approaches, whereas, in medical science a new technology goes through rigorous testing in clinical trials with the focus on efficacy to improve medical conditions.

Our investigation of twenty-four clinical trials shows that there are dropouts/withdrawals from every clinical trial – refer to Table 1 for a list of examples. The main reason for dropout from a HCI perspective is motivation. A secondary reason for dropout is lack of time to use the technology. Dropout/withdrawal in the trials raises the possibility of more dropouts in real world practice. This raises the question identified in research question (2): *How to prevent dropouts?*

Fogg's (2002) seminal work on persuasion describes motivation, ability and trigger as the three parameters to change a behavior. Intille (2008) further reviewed that there are four components to an effective just-in-time information through (i) a simple, tailored message easy to understand, (ii) at an appropriate time (iii) at an appropriate place (iv) and using a non-irritating strategy. There are seven persuasive tools [8] that can guide designers to approach the target behavior including, tunneling technology, tailoring technology, surveillance technology. Framework for Persuasive Design System (PSD) provides theory and methods for analyzing persuasive contents [21].

3 Persuasion for In-home Technology Intervened Diabetes Care

Our investigations found several behavioral changes of in-home technology intervened healthcare. For example, Meneghini *et al.* (1998) reported patients to be an active participant and got involved in metabolic control. Glasgow and Toobert 2000 found improvement in dietary behavior of the patients. Similarly Levetan *et al.* (2002)

reported improvement in awareness for reaching better health among all of his 150 type 2 diabetes patients, with an intervention inclusive of a goal followed by a phone call [12]. All of these results unveil a promising fact that if persuasion techniques are added, there could be more benefits to change patient behaviors for in-home treatment.

Table 1. Dropouts in Diabetes In-home Technology Intervened Treatment Clinical Trials.

Author	Type of in-home technology	Dropouts	Reason
Rutten <i>et al.</i> 1990	Handheld portable self-monitored devices	2	lack of motivation
Izquierdo <i>et al.</i> 2003	One-on-one tele conferencing to educate patients	8	lack of time to use
Meneghini <i>et al.</i> 1998	Touch-tone data entry – follow up counseling via voice messages	Not reported	authors urged for work on reasons
Piette <i>et al.</i> 2000	Automated telephone disease management	13	not reported
Glasgow & Toobert 2000	Interactive touch screen CD ROM with immediate personalized data	43	not reported
Tsang <i>et al.</i> 2001	Handheld electronic diary connected to a telephone line	1	not reported
Mckay <i>et al.</i> 2002	Internet based self-management	37	not reported

Utilizing some of Fogg’s persuasive tools, these behaviors could be influenced and motivation could be improved to reach diabetes blood-sugar goal and better management of diabetes. For example, tunneling technology [8] or guided persuasion could be deployed through a CD ROM or an online interactive video tutorial, where the interaction comes through scrolling and answering questions, or preferably a touchpad screen. This could be added in the orientation program for diabetes that a patient goes through during registration or visiting the clinician. The patient would go through the experience of what are the conditions they have to look out for, why they are necessary to look out for, how to do things in which time and how to cooperate with clinicians in time. Thus, a patient could be exposed and educated to many of the diabetes management methods which otherwise would have been difficult to deliver.

Generally diabetes patients are given a common guideline to follow at home and these are only customized during a visit with clinician. Information relevant to individual patient’s blood sugar and patient-specific steps to follow for the day could be provided through tailoring technology. Surveillance technology [8] has a promise in diabetes in-home technology intervened healthcare because clinical trials have shown that just being enrolled in an in-home technology intervened healthcare program for example Biermann *et al.* (2000), some patients have improved their attitude and medical conditions, which they reported as a hawthorne effect [19].

Since a change in target behavior need motivation, ability and trigger as the three parameters[8] , for diabetes in-home patients, this trigger could be a just-in-time sms or automated telephone call that makes them committed to the self-monitoring and send blood glucose data to the clinicians.

4 Next Steps: Planned Pilot Studies

In order to work with real diabetes patients this research will work in conjunction with a clinical trial that is being conducted in Townsville, Northern Queensland by TMML (Townsville-Mackay Medicare Local). TMML is an independent, not-for-profit organization committed to providing quality evidence based aged care education and resources to facilitate integration in aged care [20]. This pilot study employs tablet PC to better educate and manage diabetes type 2 patients and in-home technology intervened healthcare through which patients can connect to their clinicians.

Work will be carried out with the clinical trial subjects (patients) but from an HCI perspective. A combination of instruments (observation, questionnaire and interview) will be used with the patients to identify barriers that make them lose interest. Consecutively causes of frustration, age and ageing factors, lack of time to use it, motivational factors and behavioral effects of the technology will be investigated. It is anticipated that different forms of motivation, ability and triggers of diabetes patients will be identified and proposed. Next, follows the design and implementation of appropriate forms of trigger(s) and finally, follow-on testing of prototypes in studies carried with the patients.

5 Discussion and Conclusion

Preliminary investigations suggest that persuasive technology is promising to change behavior in patients with in-home technology intervened treatments. Particularly for the reason that the technologies investigated did not have a persuasive design consideration, yet they had behavioral positive changes to affect the well-being. So persuasion is believed to help patients to keep motivated in using.

But there are challenges such as identifying the just-in-time trigger, intruding patient privacy especially in the case of surveillance technology where some patients may find it bothersome. Designing the right trigger for diabetes patients requires more research to be done with real subjects during the clinical trials.

It is known that not all discoveries get a chance to be used in healthcare unless it passes through a clinical trial. The significance and difference of this research is, unlike most studies done with few users, this research will work side-by-side with real diabetes type 2 patients participating in a clinical trial, but from an HCI perspective. As it matures, it would formulate research questions to guide the investigations towards making a clear contribution to persuasive technology research.

The demographic shift is causing a paradigm shift in the healthcare delivery model to increase in-home technology intervened healthcare. These will be more successful through persuasive technology. Even though we have the technology, whether people are ready to accept this paradigm shift in healthcare is one highly topical question. This paper presents the promise of persuasive technology to influence patients with increased motivation to use such treatments. This research is still in the beginning phases and has considered the possible work areas and their challenges.

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