# Insufficient Behavioral Change Skill Hampers Adoption of Ehealth Services

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Abstract: This study aims to get, starting from behavioural change theories, a better understanding of the perceptions of patients regarding their own responsibility for promoting their health and to translate this into requirements for development and implementation of eHealth services. Nineteen patients with Diabetes Type 2 and nine older adults (>65 years) with lower limb or hip fracture were interviewed. The topic list was based on the Self-Determination Theory, the Theory of Change and the Social Cognitive Theory and included Autonomy, Relatedness, Competence, Motivation, Skills and Knowledge. Results show that both patient groups have insufficient knowledge about proper health management. In addition, patients with Diabetes Type 2 appear to be insufficiently motivated for life style changes with outcomes that become apparent mainly in long-term. Patients with lower limb or hip fractures are in contrast highly motivated but lack autonomy, competence and skills. Both patients groups feel positively influenced by relatives, rely to a large extent on or have a wish for more in depth involvement of the professionals. These issues will probably hamper patients from becoming proactive in improving their health and using technology but are expected to be solvable when addressed in the development of the technologies as well as with implementing in daily health care.



## 1 INTRODUCTION

The increasing number of older adults as well as our unhealthy lifestyle put an increasing pressure on our western health care systems, both in terms of demand for care and costs. In addition, due to the dejuvenation the labour capacity in health care is expected to decrease. These trends make that there is an urgent need to find solutions that keep our health care sustainable and affordable. Solutions are sought in the field of prevention, improving self-management of patients, technological innovations or a combination of these. eHealth services are considered promising in this respect. eHealth is defined (WHO) as the use of information and communication technologies for health. However, the term characterizes not only a technical development, but also a state-of-mind, a way of thinking, an attitude, and a commitment for networked, global thinking, to improve health care locally, regionally, and worldwide by using information and communication technology (Eysenbach, 2001). Examples of eHealth are digital information provision, remote monitoring, remote treatment, e-consultation and online patient-to-patient or professional to professional contact.

In contrast to the huge amount of eHealth products developed and tested in research projects, the penetration of eHealth into daily care practice is still very limited. Partly motivated by this, acceptance of technology has been studied to a large extent and has resulted in several theoretical frameworks. These frameworks state that technology acceptance is influenced by various factors. Technology acceptance that refers to an attitude towards a technology is different from technology adoption. Technology adoption is a process – starting with the user becoming aware of the technology, and ending with the user embracing the technology and making full use of it. Someone who has embraced a technology is likely to replace the item if it breaks, find innovative uses for it, and



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cannot contemplate life without it. Adoption as such can only be studied after implementation. In community-dwelling older adults this research is still scarce (Peek *et al.*, 2014). (Heart and Kalderon, 2013) showed that modern technologies have been adopted (albeit selectively) by older users, who were presumably strongly motivated by perceived usefulness They showed that, concerning health related ICT, adoption of technology by older adults is still limited, though it has increased. Particularly worrying are the effects of health, perceived behavioural control, and the fact that many older adults do not share the perception that ICT can significantly improve their quality of life. As such, health-related ICT should be kept simple and demonstrate substantial benefits, and special attention should be paid to training and support and to specific personal and cultural characteristics.

This latter is indeed is considered important as a lot of eHealth services requires the patient to take action and become pro-active. Something they probably did not do before in relation to receiving care. Obvious advantages of this approach are a more equivalent position of patients with respect to health care professional and patients get more possibilities to influence their own care process and their quality of life. However in clinical practice doubt often rises whether patients have the capacity to take this responsibility. We assume we can learn here from behavioural sciences by the fact that taking a pro-active role when not having done this before can be considered a behavioural change. We all know that changing behaviour is notoriously difficult. There are several theories that try to understand the process of behavioural change. Examples are; the *Transtheoretical Model* (Prochaska and DiClemente, 2005) which assumes that in the behavioural change process various stages are discerned, i.e. precontemplation, contemplation, preparation, action, maintenance and termination; the *Social Cognitive Theory* (Bandura, 1977) in which one the main constructs is self-efficacy. Self-efficacy focuses on an individual's belief in one's capability for change; and the *Self-Determination Theory* (Ryan and Deci, 2000) which is a theory of motivation and is concerned with supporting our natural or intrinsic tendencies to behave in effective and healthy ways. This theory differentiates between intrinsic and extrinsic motivation and proposes three main intrinsic psychological needs that motivate the self to initiate behaviour. These include the need for competence, autonomy, and psychological relatedness (Ryan and Deci, 2000). Taking these theories together, changing behaviour occur along different stages. People move from one stage to the other but can also fall back. Changing behaviour will be enhanced when patients are motived and this is more likely when this changed behaviour contributes to competence, autonomy and relatedness. However, merely motivation is not sufficient. To be able to change successfully, patients must be convinced of the need to change and feel that they can show the desired behavior.

So far, hardly any attention has been devoted to the behavioural change readiness of older adults to adopt eHealth technology as well as to its consequence for the development and implementation of eHealth. We hypothesize that adoption of eHealth services by older adults is hampered as they are insufficiently equipped to change their behaviour. Assumptions for this come from literature that states that older adults might experience problems in recognising relevant issues and act in advance and care dependency rises when people grew old (World Health Organization, 2015). In addition, literature shows that older adults seemed to eschew pro-active coping by prioritizing present emotional well-being and avoiding thoughts of future risks, (Gould *et al.*, 2015). Not all of them are future oriented or inclined to prepare themselves for potential goal threats to the same extent (Ouwehand, de Ridder and Bensing, 2008).

The aim of this study was to get, starting from behavioural change theories, a better understanding of the perceptions of patients regarding their own responsibility for promoting health and translate this into requirements for the development and implementation of eHealth services. We performed a qualitative study in two separate populations, 1) patients with complicated Diabetes Mellitus type 2 treated at the outpatient clinic of a hospital and 2) older patients (age >65 years) with a lower limb or hip fracture who, after surgery, had been dismissed from the hospital to a geriatric rehabilitation ward or a nursing home.

# 2 METHODS

A qualitative research was conducted.

## 2.1 Participants

**Diabetes Patients.** Patients with diabetes type 2 visiting the outpatient clinic of Internal Medicine were asked to participate. Patients were included if 1) diagnosed with diabetes type 2, 2) aged 18 years or older and 3) follow-up is taking place in the

outpatient clinic in the hospital. Participants were excluded if they: 1) had severe general disease or mental disorders making participation impossible and 2) suffer from drug abuse. During the time period set for inclusion of patients for this research, 28 patients were approached for inclusion. Of these 28 patients, 9 were hindered due to personal circumstances or illness. In total, 19 patients participated.

**Older Adults with Lower Limb or Hip Fracture.** Participants were recruited from four nursing homes working together with the hospital where patient underwent the surgery. Patients were included if they 1) were 65 years of age or older, 2) were diagnosed with a lower limb or hip fracture, 3) treatment goal was to return to their own living situation before fracture, 4) were able to communicate in Dutch, 5) had no marked cognitive impairment(s). Participants were excluded if they 1) had progressive neurological disease (e.g., Parkinson's disease), 2) had severe multi-morbidity (somatic, psychiatric and/or psycho-geriatric). A total of 9 participants participated in this study. The study is registered as non-WMO research and got a feasibility approval from the hospital.

All participants signed informed consent prior to participating in this study.

## 2.2 Interview

Semi structured interviews were performed at premises of the health care institute. The topic list for the interviews was derived based on the Self-Determination Theory, the Theory of Change and the Social Cognitive Theory and developed in brainstorm sessions with social researchers. The topic list included the following items: autonomy, relatedness, competence, motivation, skills, knowledge and use of technology.

## 2.3 Analysis

The interviews were recorded and afterwards transcribed in Microsoft Word. The analysis of the interviews was performed differently for both cases.

For the diabetes patients, the transcribed interviews were uploaded in Atlas.ti 8.0 and coded by means of a coding scheme. One researcher coded the interviews. Each code was based on the topics included in the interviews, as mentioned above. Hereby for each topic the codes were divided into the different answer possibilities, negative or positive, in order to allow evaluation of the codes based on their frequency, per code. Sentences corresponding with more codes were coded double, so that each of the codes is covered. When in doubt, a code was not assigned to a sentence.

For the patients with a lower limb or hip fracture it was difficult to follow the structure of the interview as defined. Patients were not always able to interpret the questions correctly and began to talk about common things. However, with help of the topic list, face-to-face contact and observation of the patient, interesting information could be distilled regarding the topics of interest. A thematic analysis (Braun and Clarke, 2006), a method for identifying, analysing, and reporting patterns (themes) within data, was carried out according the following steps. First the transcripts were read and re-read and checked for patterns of themes among the data. It was decided to remove all information deemed unnecessary from the interviews. The unnecessary information consisted mainly of answers that were not related to the various components. The result was a list including all important quotes. For every important quote we checked whether it was related with an item of the topic list: autonomy, competence, relatedness, knowledge, skills, motivation, and technology or not. It was possible that in certain quotes several components were involved.

# 3 RESULTS

## 3.1 Patient Characteristics

Table 1 presents the characteristics of the patients that participated in this study.

Table 1: Patient characteristics.

| | Characteristics | Diabetes (N = 19) | Lower limb or hip fracture (N=9) |
|---|---|---|---|
| Gender number (%) | Male | 12 (63) | 1 (11) |
| | Female | 7 (37) | 8 (89) |
| Age average (standard deviation) | | 64 (11) | 86 (4) |
| Diabetes Complications number (%) | Any type of complication | 14 (74) | |
| | Macrovascular complications | 5 (26) | |
| | Microvascular complications | 13 (69) | |
| Fracture number (%) | Hip fracture | | 7 (78) |
| | Pelvic fracture | | 2 (22) |
| Cognitive impaired (yes/no) | Yes | | 3 (33) |
| | No | | 6 (67) |

## 3.2 Interview Results

### 3.2.1 Diabetes

**Autonomy.** Almost all patients mentioned to be able to make their own choices with regard to their diabetes control as well as with respect to treatment choices like medication, doctors, contact moments, healthy exercise, nutrition, et cetera. Only a small part of the patients reported not to be so sure about the ability to make own choices and they just do what the doctor says.

**Competence.** When we talk about competence, we refer to self-efficacy, which means in this study: one's belief in their ability to succeed in taking own responsibility or accomplish a task or activity. Nearly all patients stated to be positive about their capabilities and mentioned that they do not need any support to further improve.

**Motivation.** A majority of the patients is intrinsically motivated to perform actions that improve their diabetes outcomes on short notice i.e. their blood glucose levels and/or general feeling of wellbeing. Concerning lifestyle habits, patients want to change their lifestyle but only in case this immediately affects their diabetes or fitness level. Though patients in general have insufficient knowledge whether and which habits do have positive influences. In addition, they state to have difficulties to maintain these healthy habits.

**Relatedness.** Most patients are positive about support by relatives like family and friends. Concerning caregiver support, patients mentioned to be positively informed by their diabetes doctor, diabetes nurse, or dietician. However, patients consider professional support only minimal, and not very in-depth

**Knowledge.** Patients were asked to answer 12 questions about the impact of nutrition and exercise on diabetes and its complications. Results showed that most of the patients showed insufficient knowledge (less than 6 questions properly answered) concerning health lifestyle.

**Skills.** A majority of the patients indicate to have sufficient skills to adequately deal with their diabetes. The minority which is not, mentioned problems with medication, blood glucose measurements, insulin injections, healthy exercise and nutrition. Concerning exercises the majority of the patients is able to perform exercises. Those who are not mentioned external factors or other diseases withholding them to do so.

### 3.2.2 Lower Limb or Hip Fracture

**Autonomy.** All patients with lower limb or hip fracture lived in their own home before admission to the geriatric rehabilitation ward of the nursing home. Some needed help from home care and/or lived in a sheltered housing accommodation. Once in rehabilitation patient often referred to the home situation before admission. They were fine with this situation and hope to return to this situation again. After the fracture almost all participants experience less or no autonomy. Autonomy increases during rehabilitation for all participants, however, each at their own pace and to their own degree. The autonomy of patients for their own rehabilitation program is rather low. With the help of the physiotherapist the exercises can be performed, but the exercises are barely pursued independently. No or only little own initiative was taken to fulfil exercises or a activity such as walking around the corridor.

**Competence.** After the fracture, the level of confidence is rather low in almost all patients. Most of them report to be afraid to fall again. As a consequence, they fully rely on the care professionals to tell them what they are allowed to do.

**Relatedness.** The participants feel very related to the nursing staff, and other professionals who are helping them during the rehabilitation process. This is not unexpected because of their increased dependency after the fracture. However, this dependency creates a certain hierarchy between the nursing staff and patients that hampers the patient to take initiative or ask something. Another aspect that appears to be important here is support from family which strongly motivates the patient. In addition they also give the patient a feeling that their competence and skills are sufficient to take own responsibility.

**Motivation.** Many participants have already reached a certain age and are satisfied with what they did. They are intrinsically motivated to recover because they want to go home again and do the things they did before, like doing the groceries and other household chores.

**Knowledge.** Most participants have very limited knowledge about the rehabilitation process. They do not understand that all activities they perform during the day is actually rehabilitation. In addition they have limited knowledge about the exercises offered in terms of why and how they need to be performed. The participants do the exercises that they have to do only during the physiotherapy

**Skills.** Skills are present to perform the exercises at the physiotherapy. However, cognitive skills are often low which hampers executing exercises, independently. In addition, physical condition is often reduced meaning that skills needed to go for a 'long' walk are absent.

The results presented above are summarized in table 2. It becomes clear that both patients with diabetes type 2 and patients with a lower limb or hip fracture are insufficiently equipped on one or more behavioural change aspects. For patient with diabetes type 2 this concerns knowledge and motivation. For patients with lower limb fracture all aspects, except motivation, are insufficiently present.

Table 2: summary of the interview results.

| Topic | Diabetes | Lower limb or hip fracture |
|---|---|---|
| Autonomy | Sufficient | Low |
| Competence | Sufficient / variable | Low, fear of falling |
| Relatedness | Positive for relatives/health professionals. Wish for more in depth support from health professionals | Dependency of health professionals. Relatives important to enhance all other factors |
| Motivation | Sufficient when direct effects. Low for long term | High intrinsic motivation |
| Knowledge | Insufficient | Insufficient |
| Skills | Variable due to other health problems | Insufficient Variable due to cognitive problems or other health problems |

## 3.3 Requirements for Development and Implementation of Ehealth Services

Those behavioural change aspects that are insufficiently present will probably impede patients in deploying a proactive behaviour in their health management. It will also hinder the adoption of eHealth services that are developed for this purpose in case these aspects are insufficiently addressed during its development and implementation. Our finding that the two patient groups score different on the respective elements demonstrates that the requirements for development and implementation of eHealth services are also different to some extent.

### 3.3.1 Development

Diabetes patients will be capable of using technologies. Technologies that support them in lifestyle choices thereby improving their short-term diabetes outcomes will have the highest chance on adoption. In contrast, technologies that support them in lifestyle choices that aim at long term outcomes will probably not be used or lose attention after a period of time. One aspect that needs to be considered here is patients' knowledge regarding the importance of healthy lifestyle. As this is insufficient they are unable to fully understand its importance. *Knowledge transfer* is as such a prerequisite for future technologies. The fact that patients are motivated to come into action when direct effects on their diabetes outcome are experienced, requires the technology to incorporate *motivational strategies with feedback on short term outcomes*. Feedback on blood glucose levels when focusing on active lifestyle will as such be more suitable than feedback on steps taken. Patients feel instantaneously better by proper blood glucose levels but proper blood glucose regulation is also positive for outcomes on long term. As patients differ in knowledge level and skills, technology should be *personalized* and it should incorporate *small incremental goal setting* possibilities.

The patient with a lower limb or hip fracture will probably not be able start using technology by themselves. As they are intrinsically highly motivated to go back to their home situation and rely on the health professionals they will probably adopt and start using technologies when others 'prescribe' or use the technology with them. In this case *technology that starts the interaction* might be very useful. In addition, the technology for this patient group should focus on enhancing competence, knowledge and skills. For competence, technology should convince the patient that they can act safely or technology should act like the nursing staff and relatives are doing and give the patient *the feeling that they can rely on it*. An example of this is incorporating *affirmative cues when being used* or a *virtual presentation* of the person(s), patients rely on. *Knowledge transfer* is considered to be important to overcome their knowledge gap but

since cognitive skills are often insufficient for this purpose, *technology that acts as an extension of the patient's cognition* is expected to be more effective. This holds true for example when the technology acts as a memory (provides reminders or provides a schedule), guides and coaches the patients when performing a complex task. Again, there is high between-patient variability in feeling of competence, the cognitive and physical skills, which warrants the technology to be *personalized*.

### 3.3.2 Implementation

Next to the impact on development, the results do also have consequences for the implementation of eHealth services in daily care practice. As most diabetes type 2 patients and patients with lower limb or hip fracture have insufficient knowledge, patients need additional support to gain this knowledge. It is doubtful whether this can be reached by technology solely. So in this respect it is important that *professionals support patients to gain more in depth knowledge*. This knowledge is necessary before start using technology but probably also during the usage of technology. As such, technology should be implemented as a *blended care concept*. As patient and especially patients with lower limb or hip fracture rely to a large extent on health care professionals, it is important that the health care professionals become more aware of this and either *'prescribe' the technology* but even better guide the patient in the process to come to *shared decision making*. In this shared decision making the caregiver supports the patient in becoming well-informed on the subject of their illness and possible options for improvement. In this improvement plan, it is again important that the professionals support the patient in adequate goal setting in which the patient's preferences and possibilities are carefully considered. Here it is also important to discuss what is expected from the patient and what can be expected from the professional. Both patients with diabetes type 2 and patients with lower limb or hip fracture feel positively supported by relatives. For patients with lower limb fracture this even goes one step further as the closest family is considered an extended self for each of the behavioural change elements. Based on this it is very important that *relatives are explicitly involved* in the implementation process.

# 4 DISCUSSION

The aim of this study was firstly to get, starting from behavioural change theories, a better understanding of the perception of older patients regarding their own responsibility for promoting their health. Secondly, to translate this into requirements for development and implementation of eHealth services. Results show that both patients with diabetes type 2 and patients with a lower limb or hip fracture, are insufficiently equipped to become proactive in improving their health as well as in using technology for this purpose. These problems can be addressed and solved when explicitly considered in the development of the technologies as well as taken into account when implementing these technologies in daily health care work flows and processes.

An important finding of this study is the difference between the patient groups. Where patients with diabetes type 2 score low on knowledge and motivation and to some extent on skills, patients with lower limb or hip fracture are highly motivated but have low levels of autonomy, competence, knowledge and skills. These differences can partly be explained by intrinsic differences between the patient groups. The diabetes type 2 patients investigated here suffer from this disease usually more than ten years and have a history of disappointments from previous initiatives aimed to improve their lifestyle, such as weight-loss. This significantly affects their motivation. Patients with a lower limb or hip fracture, in contrast, are dealing with the consequence of a sudden single event that can heal again. As such they are highly motivated to contribute to this. Another difference between both groups is the age. The high age of the patients with lower limb or hip fracture probably has affected their competence, skills and knowledge. These differences also result in different requirements for the technology but remarkably not for the implementation in daily practice

Concerning the development, technology should have a function as information channel for both patient groups. For patient with diabetes, special attention should be paid to motivational strategies. Currently, various motivational strategies are being developed like short feedback loops with motivational messages (Achterkamp, Hermens and Vollenbroek-Hutten, 2016) and gamification (de Vette *et al.*, 2015). As patients will be most motivated when they see or feel direct benefits, feedback on blood glucose level is considered to be most effective. For patients with lower limb fracture

it is suggested that technology that acts as extended self could be an option. The thought behind this is comparable with a detachable or permanent prosthesis (Murray, 2004) that is accepted as part of their body and in this case as a cognitive prosthesis. A cognitive prosthesis implies that the information gathered is an extension of the individual's cognitive understanding, can be used to outsource work (de Preester and Tsakiris, 2009) and make the job done easier. Another way forward in the development for this patient group might be technology that is a virtual representation of those they rely on being health professional or relatives and speak and deal with the patients as natural persons do.

Concerning implementation aspects that need to be considered are more equal between both patient groups and concern: implementation as blended care concept, working to shared decision with optimal involvement of relatives. This will urge our health care system to educate health care professionals in doing so.

# 5 CONCLUSION

Uptake of eHealth services by patients is hampered by the fact that patients are insufficiently equipped for this. The age of patients and the disease history are partly responsible for this. In addition the pro-active role being asked for is also considered a phenomenon patients are not used to. Uptake of eHealth can be enhanced when these behavioural changes elements are explicitly considered in the development of the technologies as well as when implementing these technologies in daily health care work flows and processes.

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