

THE IMPORTANCE OF PATIENTS' USER EXPERIENCE WITH A TELEHEALTH SYSTEM FOR THEIR EVALUATION OF ITS PSYCHOSOCIAL IMPACTS

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ABSTRACT: Drawing on the unified theory of acceptance and use of technology model, this study presents the preliminary results of an intervention study that explored how the usability and acceptability – two dimensions of user experience (UX) – of a home telehealth system (THS) shape patients' perceptions of its impact on their functional independence, well-being and quality of life. Fifty-five patients with at least one chronic condition (diabetes and/or hypertension) tested a home THS for five months. All participants in the non-probability sample were recruited in a Community Health Centre in Slovenia. A multilinear regression model was run on the data collected after a three-month trial period. The positive psychosocial impacts of the home THS (PIADS-10) utilisation were higher among the patients who reported higher values of usability (TUQ), regardless of their self-assessed physical and mental health (SF-12), control over health (PAM) and frequency of THS use. The results also showed no association between psychosocial impacts and technology acceptance (SUTAQ). Overall, the findings suggest that UX is an important aspect of patients' engagement with a home THS.

1 INTRODUCTION

Owing to the longevity and increased prevalence of chronic illnesses [1], [2], the need for new and sustainable models of integrated care supported by smart technology has never been greater [3], [4]. According to Barbabella et al. [5], patient-centeredness, which is the heart of integrated care [6], [7], can be substantially improved by the application and exploitation of telehealth systems (THSs). THS can be defined as services supporting a remote exchange of physiological data between a patient at home and medical or nursing staff to assist in diagnosis and monitoring [4]. If scaled to a societal level, THSs have the potential to enhance healthcare [4], [8]–[10] – specifically for people with long-term chronic conditions – by improving their access to healthcare services, facilitating care coordination and integration, enabling self-management, supporting decision-making by clinicians and enabling monitoring, risk analysis and proactive intervention of care professionals [5]. Despite its recognised vast potential [11]–[14], THS is not yet a major component of publicly funded healthcare systems [5].

A large body of literature deals with the benefits of THS for end-users [4], [15]–[17]. However, prior research provides inconclusive results about how user experience (UX) shapes the benefits of THS [1], [2], particularly with reference to the evaluation of quality of life and empowerment of people with wide-spread chronic diseases such as diabetes and hypertension [20]–[24]. Cartwright [24] notes that the evaluations of THS innovations have to assess the effect from the

patient's perspective using self-report measures such as quality of life, psychological outcomes and acceptability of services.

To tap this gap, we examined how patients' UX with a home THS shapes their perceptions of its utilisation on their functional independence, well-being and quality of life. We draw on the unified theory of acceptance and use of technology (UTAUT) as a conceptual framework. UTAUT poses four technology adoption factors that are relevant for THS: 1) performance expectancy, 2) effort expectancy, 3) social influence and 4) facilitating conditions. We focused on usability and acceptability because prior evidence-based research suggests that important criteria on which patients decide how well THSs accommodate their needs are effectiveness, affordability, operability and dependability [25].

2 METHODS

2.1 STUDY DESIGN AND PROCEDURE

We conducted an intervention study based on a repeated measurement research design. Ambulant patients in a Slovenian Community Health Centre were recruited by health professionals who actively participated in the intervention. Only patients who fulfilled a set of inclusion and exclusion criteria were eligible for the study. The inclusion criteria were type 2 diabetes or hypertension diagnosis, ability to use a home THS and follow the instructions given, good sight and willingness to participate in the study. Exclusion criteria were severe cognitive impairment (e.g. dementia), not being able to follow the instructions on how to use a home THS owing to a mental disease, poor sight or hearing and high health risk.

The selected participants answered a survey at the baseline (M0), after three months (M3) and after five months at the end of the intervention (M5). At all three stages, self-administered questionnaires (SAQ) were used: M0 was administered to the participants at recruitment, whereas M3 and M5 were sent by postal mail. The M0 questionnaire measured patients' perceived health (SF-12) [26], patient activation (PAM® survey) [27], personal wellbeing (PWI-A) [28] and demographic data with standardised survey inventories. The M3 and M5 questionnaires contained instruments from the M0 and survey measures presented in Section 2.4. Participants received no financial incentive for participating in the study. The study received IRB approval commencing the field work (nos. 801-2018-040/JG, 0120-86/2017/7).

2.2 APPARATUS

Patients with chronic diseases tested a THS-connected solution [8] based on ISO-certified medical equipment that enabled the patients to monitor their blood pressure and/or blood glucose. The bundle comprised a glucose metre and/or a blood pressure monitor, both connected to a dedicated tablet or a special smartphone application to transmit measurement data. All participants took part in a two-hour training session in which a monitoring nurse instructed on self-care and self-blood glucose/hypertension monitoring, while the staff operator of the equipment supplier provided guidance for the use of the home THS. The participants monitored their clinical observations in accordance with the clinical protocols for

the entire duration of the intervention. All measurement data were transmitted to the members of the health professional health team (nurse and physician) via a secured line. The professional health team reviewed the trends of the readings to instigate a treatment plan for stabilising a patient's long-term condition.

2.3 SAMPLE

A non-probability purposive sample of 55 patients with diabetes or/and hypertension was recruited at baseline (M0). Among those, 51 patients completed the M0 and M3 questionnaires. Ten patients had diabetes, 20 patients were diagnosed with hypertension and 21 patients were affected by both chronic conditions. The sample was 60.8% female; 15.7% of patients were younger than 50 years, 58.8% patients were 51–64 years old and 25.5% patients were 65 years or more. A total of 77.1% of patients reported that they used the home THS at least once a week during the first three months of the intervention study.

2.4 INSTRUMENTS AND ANALYSIS

Usability and acceptability, as two dimensions of UX of the home THS, were evaluated with two standardised survey instruments, telehealth usability questionnaire (TUQ, measured on a 7-point Likert agreement scale, scored 1 to 7) [29] and service user technology acceptability questionnaire (SUTAQ, measured on a 6-point agreement Likert scale, scored 1 to 6) [30], respectively. The psychosocial impacts of THS utilisation were measured with the short form of the psychosocial impact of assistive devices scale (PIADS-10), measured on scores ranging from -3 (maximum negative impact) through 0 (no perceived impact) to +3 (maximum positive impact). [31]. All inventories were translated from English to Slovene using the translation, review, adjudication, pre-testing and documentation procedures (TRAPD) [32], showing acceptable to excellent internal consistency. Notably, the 10 items of the unidimensional PIADS-10 reported a Cronbach alpha (α) value of .949. The six SUTAQ subscales [30] formed a single composite score ($\alpha = .733$). Likewise, TUQ comprised 21 items capturing six different dimensions ($.847 \leq \alpha \leq .928$) that were combined into a single composite score ($\alpha = .924$).

As control variables, we included the SF-12 health survey [26] as a short-form generic self-assessment inventory of physical (SF-12 [PCS]) and mental (SF-12 [MCS]) health status. A short version of the patient activation measure (PAM) which assessed patient knowledge, skills and confidence for self-management [27] was also used. Finally, frequency of the home THS use was entered in the model as a dummy variable (0 = less often than weekly, 1 = at least weekly).

The data were entered into a multiple linear regression model. Owing to missing responses, the analysis was performed on the preliminary data of 45 patients with PIADS-10 regressed on TUQ and SUTAQ and controlled by PAM, SF-12 (PCS [MCS]) and frequency of the THS use.

3 RESULTS AND DISCUSSION

The regression model was statistically significant ($F(6, 38 = 2.971)$; $p = .018$), with independent variables explaining 21% of the variance of the dependent variable (Table 1). TUQ was the only significant predictor in the model ($\beta = 0.553$; $p = .009$), with a high mean score of 5.63.

Tellingly, the usability of the home THS assessed with TUQ seems to play the most important role in understanding why a patient would positively evaluate the effects of using THS in terms of his/her increased competence, adaptability and self-esteem reflected in the PIADS-10 score, which was in general on the positive side (mean score 0.90). Conversely, the SUTAQ score (with a high mean score of 5.00) did not significantly predict ($\beta = -0.048$; $p = .806$) the psychosocial impacts of THS utilisation at home. According to the UTAUT model, such finding is somewhat surprising because patients with higher performance expectancy are generally presumed to get more engaged with a wider range of THS-enabled features. In turn, an intense and persistent engagement with THS should lead to more pronounced outcomes, which would imply that a larger beneficial effect of THS-enabled telemonitoring on long-term diabetes and hypertension control is likely to be perceived by patients. However, the trial period of three months may be too short to make patients cognizant of a wide array of either positive or negative psychosocial outcomes of their THS utilisation at home.

Interestingly, the effects of using the home THS were not conditioned by patients' physical condition ($\beta = -0.013$; $p = .928$), mental condition ($\beta = -0.128$; $p = .400$) and PAM score ($\beta = 0.220$; $p = .175$). Hence, we cannot argue that more active patients – with better skills, knowledge and motivation to participate as effective members of the care team – recognise the (positive) effects of using a home THS to a larger extent. Finally, the frequency of home THS use had no significant association ($\beta = -0.126$; $p = .405$) with its psychosocial effects: the group of patients which reported that they used the home THS at least weekly did not assess its impact on their functional independence, well-being and quality of life to be different from the group which used it once a month or less often.

Table 1: Results of multiple linear regression model with PIADS-10 as the dependent variable

Variables	B	SE(B)	β	p
Intercept	-1.400			.214
TUQ	0.387	0.140	0.553	.009
SUTAQ	-0.062	0.251	-0.048	.806
PAM	0.018	0.013	0.220	.175
SF12 (PCS)	-0.001	0.012	-0.013	.928
SF12 (MCS)	-0.009	0.010	-0.128	.400
THS use (1 = At least weekly)	-0.259	0.308	-0.126	.405

Notes: N = 45, $F(6, 38) = 2.971$, $p = .018$, adj. $R^2 = 0.21$.

In summary, the present study demonstrates that in our sample of patients with diabetes and/or hypertension, the psychological impacts of home THS utilisation were influenced by its usability but not by its acceptability, regardless of patients' (control over) health and frequency of THS use. This may have been a consequence of the relatively small sample of stable patients who are not required to conduct frequent monitoring. It is possible that an intervention with a longer time-span of THS utilisation and with patients having advanced diseases or those who are just discharged from a hospital (where a strict adherence to recommended treatments is needed) is required to demonstrate an association between psychosocial impacts and technology acceptance.

While we have used validated telehealth patient perception measurement instruments, further research is needed on how THSs can be incorporated within conceptual frameworks that would consider the specifics of telehealth acceptance. In particular, the theory-driven understanding of the association between different dimensions of UX and psychological outcomes needs to be strengthened by contextualised and customised variations of the UTAUT model for studying the acceptance and outcomes of home THS.

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