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An extension of the UTAUT 2 in a healthcare context

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An extension of the UTAUT 2 in a healthcare context

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Abstract

With a significant rise in smartphone ownership, and a rapid expansion of the healthcare applications market, it is important to explore the factors that impact user acceptance of mobile technology in healthcare to better tailor applications to meet the needs of end users. Whilst theoretical models for technology acceptance have been thoroughly explored there is sparse literature regarding its use in a healthcare context. Qualitative primary data collection in the form of focus groups was conducted for three age groups, 15-30, 31-50, and 51+. Views on acceptance of mobile technology in healthcare and the factors that affect the adoption of technology for healthcare purposes were explored using thematic analysis. The results of this study identified 17 mechanisms by which age moderates the 7 constructs of the UTAUT2 model and the extent to which each of these mechanisms had an impact on the constructs. Based on these findings an extension to the UTAUT2 model for mobile IT in a healthcare context has been proposed, which may be used in the development of future applications (Apps).

Keywords: Application, Healthcare, Mobile Technology, UTAUT2, Age

1. Introduction

In recent years global smartphone ownership has increased from 19% to 35% (1)with a vast array of healthcare apps being made available. It is therefore important to understand the factors that affect acceptance of technology to meet end user needs. Understanding how and why people accept technologies has been the subject of a large body of IS research (2,3)and numerous models have been proposed to illustrate this. A widely accepted model in this field is the UTAUT2 model (4) shown in figure 1, which represents an attempt to combine dispersed literature and develop a single theory for technology acceptance to end users. Its foundation in a consumer use context means that the paradigm is most relevant to *public* healthcare. It outlines seven constructs which have a direct impact on behavioural intent and actual use of technology. Whilst age has been shown to be a moderating factor on these constructs, the rationale behind the underlying mechanisms of this is scant. Age is often an important consideration, especially in healthcare technologies. With increased age, individuals can show a decline in psychomotor skills (5), processing capacity, and increased distraction when using technologies, however they have the capacity to

continue to perform at a high level(6). Additionally, whilst it is known that younger members of society engage more with mobile technologies, it is important to understand the reasons for this. A review of the current literature was undertaken, which focused on the impact of age on usage behaviour on (mobile) IT in a healthcare context. The impact of age on technology acceptance has been explored well in a commercial setting, but there is a deficiency of literature that is applicable to the healthcare setting, specifically in addressing technology acceptance of the general public rather than health professionals as the intended end users.

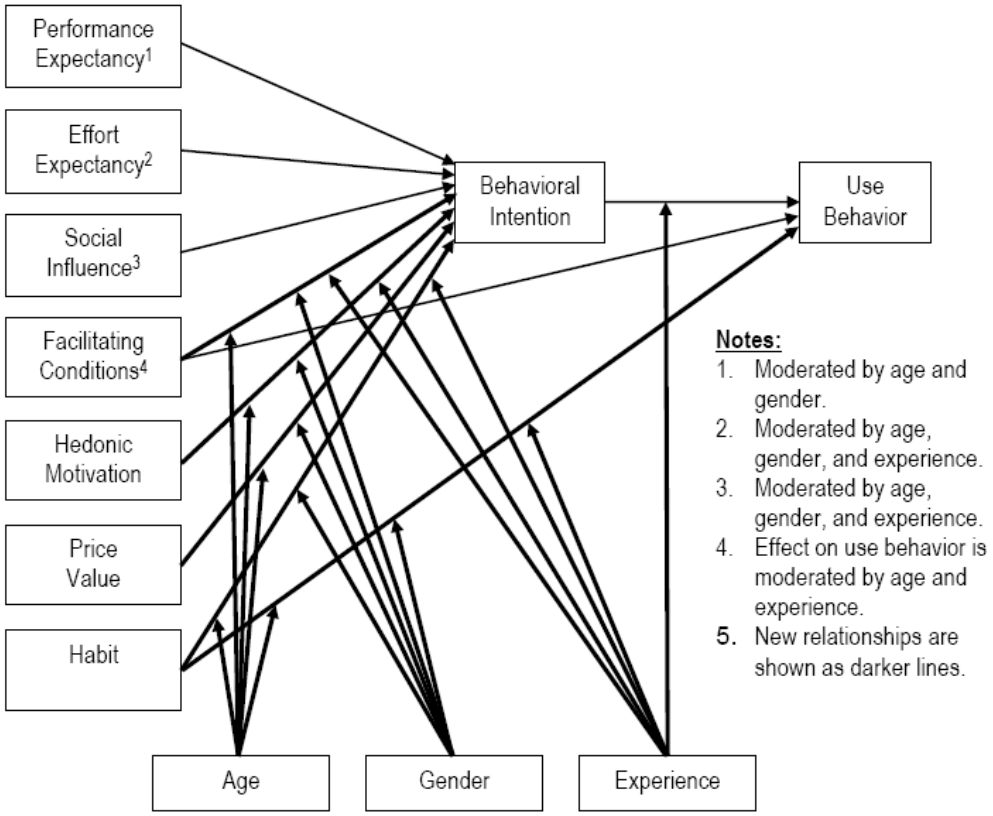


Figure 1. UTAUT 2 Model

The majority of the existing literature surrounding mobile phone use in healthcare focuses on young people. These studies mainly reported on confidence and comfort of using a mobile-based system for reporting symptoms (7) and acted as a vehicle through which personalised health messages were sent (7,8). This included the use of mobile phones to complete questionnaires regarding symptoms amongst a young cohort. The benefits of such a system were greater control of symptoms by ‘self care’,

better relationships with health care professionals and the improved ability to identify early warning signs.

In contrast, the elderly people are often neglected with regards to mobile technology, making acceptance of mobile IT difficult as the requirement of particular groups of end users are not often addressed. Gibson and colleagues(9) identified the importance of the interface design, which was particularly apparent in an elderly population. Whilst they addressed an 'elderly population' their cohort age ranged from 36-79, and thus was not truly representative of an older age category. In addition there was scarce literature on mobile phone usage across a wide age range so attitudes across age ranges could not be compared and contrasted.

Only a few studies fully concentrated on the constructs as defined by Venkatesh in the UTAUT2 model(10). The constructs that were addressed in the literature included effort expectancy, which was found to be a crucial consideration, with young individuals finding mobile IT relatively easy to use (7), with physical and cognitive limitations likely to affect an elderly population (9). There was scarce information on the impact of social influence despite its importance in the model. Thackeray and Hunter outlined the power of social networking through mobile phone applications in a young population that is likely to influence the behaviour of others(11). Whether this effect exists in an older population was assessed in our study. Hedonic motivation (8,12) and price value(13) were considered in a young population with hedonic motivation being one of the decision criteria for IT acceptance within the 2 studies identified, however they were both neglected from an adult and elderly population.

This study sought to analyse the underlying mechanisms by which age affected public acceptance of mobile IT in healthcare, with a view to extending the UTAUT2 model (Fig. 1) in order to give it a greater relevance in a healthcare setting.

2. Methods

Qualitative primary data collection was undertaken with semi-structured interviews in designated focus groups. Three age groups were formed, 15-30, 31-50, and 51+ (discussed as younger, adult and older groups respectively), and interviews followed using topics identified from the literature review on mobile technology. A mobile web

application (HTML-2) for recording Patient Reported Outcome Measures (PROMs) was used for participants to interact with, and this interaction formed the basis for the discussions. The identical paper-based PROMs questionnaire was later added to identify the difference in experience.

PROMs are standardised, validated questionnaires that are completed by patients to measure their perceptions of specific symptoms related to a particular condition and have the ability to report on overall wellbeing (14). Traditionally, they are collected on paper-based questionnaires which are particularly useful if completed by patients at two different points in time to evaluate either medical interventions or monitor medical therapies. The PROMs questionnaire that was used has been described in earlier papers; it is currently used to collect data on four elective surgical procedures to assess outcomes after surgery(15).

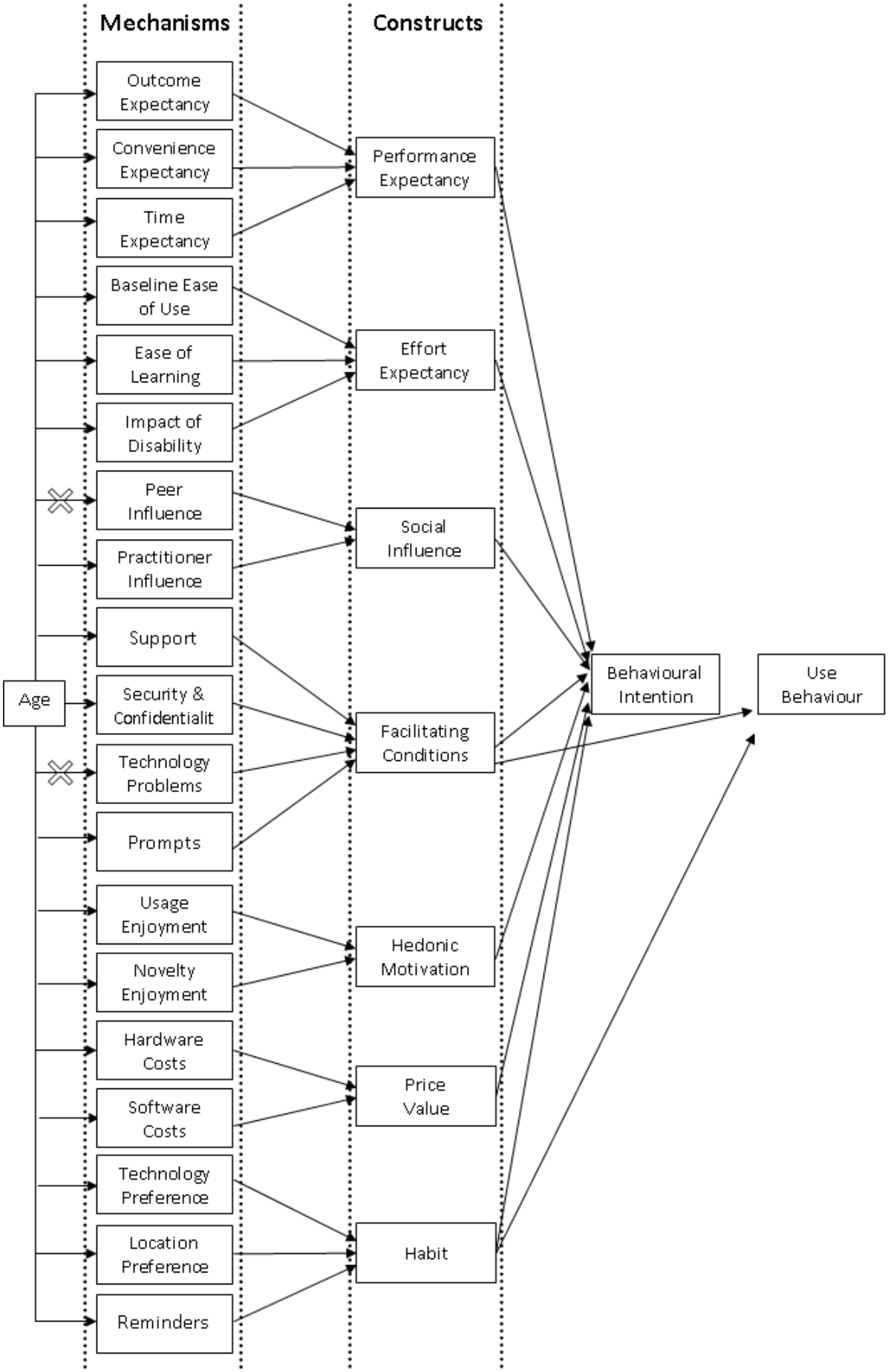
Grounded Theory was performed in order to analyse the qualitative data collected. This theory is an inductive analytical process involving continual sampling and analysis of data gathered from concrete settings such as focus groups (16). Adopting this 'bottom up' approach to the analysis allowed us to follow the leads that emerged from our results while minimising the risk of forcing preconceived ideas and theories onto our data.

Systematic coding of the 3 focus group discussions was performed to analyse the data collected. In the interest of reflexivity, three individuals performed coding independently. The analyses were compared before a consensus was reached on recurring themes. Themes were categorised and defined in line with the Six Steps in Analytical Process (17). These categories form 17 distinct mechanisms through which age impacts on the seven constructs of the UTAUT2 model to influence technology acceptance in a healthcare setting.

3. Results & Discussion

The relationship between age, the mechanisms and the constructs is illustrated in Figure 2 and each mechanism is discussed individually below.

Figure 2. Proposed Extension of UTAUT 2 Model



1 Performance Expectancy

Defined as the degree to which an individual believes that using the system will help end users healthcare experience (4). The mechanisms that influenced this construct were identified as convenience expectancy, outcome expectancy and time expectancy.

1.1 Convenience Expectancy

The convenience expectancy mechanism showed that older individuals would rather access IT healthcare at home via a computer, and younger and adult age groups were more comfortable with using smartphones, suggesting that availability on a wide range of platforms should be offered.

1.2 Outcome Expectancy

The outcome expectancy mechanism revealed that communication improved outcomes via feedback and this was consistent across all groups. Feedback was found to play an important role in developing relationships between healthcare providers and users in addition to facilitating self-care, a finding that is consistent with current literature(18,19). However feedback preferences differed between age groups. The younger group wished for immediate electronic feedback and the older group agreed feedback from their practitioner would suffice. However, the adult group wished for feedback in the way information was being utilised for improvement in healthcare e.g. statistics.

1.3 Time Expectancy

The mechanism focuses on the desire to know how long it will take to use a technology, and the results showed consistency across all groups who universally agreed that the willingness to invest time was positively related to the potential benefit gained. However, the time taken was dependant on age due to factors such as proficiency. In order for technology to be accepted within healthcare it was agreed the time taken to use it should be clearly stated and it should not be longer than any alternative.

2 Effort Expectancy

The ease of use of a system was found to be dependent on three factors, previous experience (baseline ease of use), ease of learning a new system and the impact of disability(4) described below.

2.1 Baseline ease of use: Reduced confidence and inexperience with technology, more common in the older group, could lead to resistance to use of technology and negatively influence acceptance. As a result developers must consider both the type of technology suited to age groups and the design of the interface. Effort expectancy of participants was governed largely by previous experience, with ownership of technology increasing the confidence and competence in using it. Likert scores showed a greater ease of use for the younger participants, with greater confidence in use noted. Lack of confidence has been shown to be due to low levels of computer literacy (6). Whilst all participants universally found technology difficult to use if it was 'badly' designed, there was a varying threshold of tolerance for unintuitive design across the groups. Indeed if older participants encountered problems they were less willing to continue using the technology.

2.2 Ease of learning The findings suggest a link between reduced confidence and willingness to learn. This effect is pronounced in light of the rapid advancement of smartphone technology. Older participants cited difficulty in adapting to new technologies and stated that they would appreciate increased standardisation across different forms and models of technologies as they had too much to learn. Andersson et al (20) found that willingness to learn within an elderly population was heightened if the technology was easy to learn, easy to use and easy to understand. The adult group were all computer users (most had worked in an office environment) and felt relatively comfortable learning to use smartphones. Both participants from this group who did not own smartphones were able to use the application and felt able to learn how to use them if they were to own one. The younger group were very willing to learn to use technology and embrace the challenge.

2.3 Impact of disability: The older group, recognised visual impairments and manual dexterity as important factors as the prevalence of illnesses such arthritis and deteriorating eyesight increasing with age (21)and have been shown to be a barrier to technology acceptance (5,6). The size of the screen of smartphones is particularly

important compared to devices with larger screen such as tablets and PCs. This was a consistent across all groups.

3 Social Influence

Defined as the degree to which an individual perceives the importance of the views of peers and whether they should use the new system (4). The following two mechanisms were identified: practitioner influence and peer influence, and are described below.

3.1 Practitioner influence: The results shows that levels of compliance towards healthcare technology were very dependent on practitioner influence within the older group, whilst within young and adult groups personal preference was of greater importance.

3.2 Peer influence: This is shown to be important in all age groups with users more likely to adopt technologies if they knew others who had already done so. As a result age was found not to be a moderating factor as it was consistent across all ages.

4 Facilitating conditions

Defined as the degree to which an individual believes that an organisational and technical infrastructure exists to support use of the system (4). There are four important mechanisms; support, security and confidentiality, technology problems and prompts.

4.1 Support: This study found that the desired amount and type of support that an organisation offered regarding healthcare technology varied with age. Support was of key importance to the older group for whom the greatest barrier to utilisation was difficulty using the technology, with personal support (having an individual present to guide them) viewed as the most useful type. Studies of older populations where personal support was provided saw improved levels of use (18), while the young group preferred the least obtrusive and most convenient types (e.g. electronic messenger support). Goel et al (22) found the younger group were the least likely to solicit support and preferred support as an option that was not overwhelming.

4.2 Security and confidentiality: Views on security and confidentiality varied greatly with age. The young and older groups were comfortable with possible risks to security

but for different reasons. The younger group were comfortable with technology and entering personal data in such systems as this was viewed as commonplace, whereas the older group were both ignorant of the risks to security and dismissive of the danger of personal data being lost or stolen. The adult group were aware of possible issues as in the young group but much less comfortable with these risks.

4.3 Technology problems: The third mechanism within facilitating conditions is that of technical problems. This includes all the technical shortcomings of mobile IT, which could affect its acceptance. Whilst age affects the way in which users may go about solving technical issues, it does not affect their response to issues, which are not due to understanding, but rather due to hardware or technical infrastructure. Examples discussed include issues such as battery life and network coverage.

4.4 Prompts: Across all age groups the idea of receiving electronic prompts was considered useful, and discussion covered the idea of reminders helping to build new habits. A distinction was also drawn between organisational prompts and routine reminders. There was, however, a concern about receiving too many prompts, and as such it was suggested that they should be customisable to allow end users to set the optimal level best suited to them.

5 Hedonic Motivation

Defined as the fun or pleasure derived from using a technology (10). For this construct 2 mechanisms were outlined; usage enjoyment and novelty enjoyment.

5.1 Usage enjoyment: The middle group found using the app to be more relaxing and engaging than the paper equivalent. The lack of enjoyment with using the app in the older group was found to stem from their frustration and inability to operate the technology confidently whilst the young age group enjoyed using the app. Literature that focused on a young population using specific mobile based information technology (8,12)found that compliance was linked to how enjoyable the technology was to use. This implies that this age group is more receptive and concerned with this construct and as a result poses an area of interest to developers.

5.2 Novelty enjoyment: The older group seemed generally frustrated with novel technology and its rapid change. Conversely the younger group expressed how they had become familiar with this rapid development. This familiarity and acceptance of new technology meant that the sense of innovation in new technology far outweighed any fears of not being able to use it.

6 Price Value:

Costs related to the use of technology were an important construct identified by Venkatesh et al (10) and explored within this study. Venkatesh defines price value as "consumers' cognitive trade-off between the perceived benefits of the applications and the monetary cost for using them". The mechanisms identified for this construct were hardware costs and software costs.

6.1 Hardware costs: Perceptions of hardware costs were very age dependent and were linked with ownership and experience (10). The older group assigned less everyday value to technology in general, and therefore were less willing to pay hardware costs. However, there was discussion regarding who should bear these costs and with no clear pattern in any of the age groups. Further analysis should be carried out into the current technology ownership by the respective groups of patients, across age groups.

6.2 Software costs: The younger group were the only to consider software costs as a deciding factor. Upon further discussion, it was apparent that individuals across the age groups were reluctant to pay a significant amount of money, especially for an application with such short-term usage.

7 Habit

Habit refers to automating behaviour from initial learning to regular use of a technology (10). The nature of the app was such that it did not require habit formation and as a result few conclusions can be drawn. Whilst technology preference, location preference and reminders were identified as mechanisms that influenced this construct, more research needs to be undertaken to further explore their validity.

4. Conclusion

This study explored an established technology acceptance model (UTAUT2) (10), which guides research towards the importance of age in a healthcare context. Findings from this literature review and qualitative research builds on this previous work and offers an extension of the UTAUT2 model. The authors propose an extension to the UTAUT2 model for mobile IT in a healthcare context. Specifically, 19 mechanisms relevant to the acceptance of healthcare technology were suggested, which underlie the 7 constructs proposed by UTAUT2. Age moderates these constructs through 17 of these identified mechanisms. Few studies have looked at these mechanisms and this paper provides a number of theoretical contributions in order to add to the body of literature in the field.

Furthermore, the research has shown that considerations regarding age are often overlooked and are crucial in the introduction of interactive healthcare technology. The extended framework and additional findings have been used to make recommendations for the PROMs application with the intent of improving response rates.

Further research is necessary to confirm the validity of the proposed mechanisms. Post validation our study can provide healthcare App developers a framework to influence behavioural intent and actual use, which a focus on age demographics.

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