ASSESSING THE TECHNOLOGY ACCEPTANCE OF CELL PHONES WITHIN THE CONTEXT OF THE PRIMARY HEALTH CARE SYSTEM OF SOUTH AFRICA

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ABSTRACT

The use of cell phones for health services and communication (mHealth) can potentially strengthen health systems in South Africa. This study is particularly concerned about the feasibility of cell phones to address the problem of limited access to health care in South Africa.

One of the success factors in the use of technology for service innovation is the degree of technology acceptance. The acceptance of mHealth in the South African context is not known.

The technology acceptance model (TAM) can be used to evaluate mHealth acceptance in South Africa. In this paper the evolution of the technology acceptance model (TAM) is reviewed, together with variations of the model that is applicable to mHealth services. A pilot study was performed in the private health care sector of the Western Cape, which showed a mean neutral response to using mHealth. Strong notions against using mHealth balanced as many positive notions towards using mHealth.

Future work includes a full scale study considering elements from both the TAM, together with e-business adoption elements.

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1 INTRODUCTION

1.1 What is eHealth and mHealth?

1.1.1 eHealth

The word “eHealth” (also written e-health) comes from a combination of “health” and the “e” in electronic. The term was first used by with other “e-words” to convey the new opportunities that the Internet could bring to healthcare [1]. A variety of definitions exist for eHealth, and no standard definition has been agreed upon. From a systematic review of published definitions [2] two universal themes of “health” and “technology” was identified. For this study, the definition from Vital Wave Consulting [3] is used, namely “the use of information and communication technologies (ICT) for health services and information.”

1.1.2 mHealth

The word “mHealth” (also written m-health or mobile health) is the combination of “health” and the “m” in mobile. The term was first defined in 2003 by Istepanian [4] as “the exploitation of the mobile telecommunication and multimedia technologies and their integration into new mobile health care delivery systems”. mHealth form part of eHealth, seeing that mobile phones are part of ICT. The definition for mHealth used for this study is also from Vital Wave Consulting [3] used, being “the use of mobile communications for health services and information”.

1.2 A problem in South African healthcare

In 2002 the UN launched the Millennium Development Goals (MDGs) which define various targets for nations to reach by 2015. Three of these goals are health related [5]:

- MDG4: Reduce mortality of children under 5 years of age (target two-thirds reduction 1990-2015)
- MDG5: Improve maternal health (target three-quarters reduction of maternal mortality per 100 000 live births 1990-2015)
- MDG6: Combat HIV, AIDS, malaria, and other diseases

From 1990 - 2009 South Africa has shown a reversal of progress on MDG 4, with no progress on MDG 5, and insufficient progress on MDG 6 [6]. In 2009 child mortality was 69 per 1000 live births, with maternal mortality being 400-625 per 100 000 live births [7].

The primary health care system of South Africa has limited resources to address these health care needs. With only 0.13 doctors per 1000 patients and 1.9 hospital beds available per 1000 patient in the public sector [8], access to health care in South Africa is limited.

1.3 The Potential of mHealth to address this problem

The large scale uptake of mobile phones has created a platform that can be exploited to increase access to healthcare services and information. Mobile phones are able to reach further than any other technology or health infrastructure [3]. In South Africa over 99% of the population is covered by a mobile phone network [9], with 90% of households having a functional mobile phone in their dwellings [10].

Both the United Nations (UN) and the World Health Organization (WHO) have recognized the potential of using mHealth [11]. In a global survey on mHealth [3] 112 countries reported at least one mHealth initiative.

With mHealth being a new development, concrete evidence is still growing to show the benefit of using mHealth. Thus far, the following benefits have been shown [3]:

820-2
Increased access to healthcare information
Improved ability to diagnose and monitor sicknesses
The delivery of health information that is both more appropriate and applicable
Increased access to continual training for health workers

1.4 Technology acceptance

Even though the need for mHealth services exists, the acceptance of using cell phones for health care services has to be investigated. One model that is extensively used for technology acceptance prediction is the technology acceptance model (TAM). The main factors for the TAM’s wide spread use is given below: [12]

1. It is economical, IT-specific, and offers adequate explanation and prediction on diverse populations in diverse contexts
2. It is grounded in sound theory with well researched and validated psychometric scales
3. It has gained much empirical support for its explanatory ability and has become a leading model for acceptance of technology.

2 PURPOSE AND METHODOLOGY

The purpose of this paper is to investigate the assessment of technology acceptance for cell phones within primary health care system of South Africa.

This accomplished firstly through a review of the technology acceptance model (TAM), together with variations of the model that is applicable to mHealth services. Secondly, a pilot study is described in which a technology acceptance questionnaire was administered amongst a sample of private health care facilities in the Western Cape.

Future work is described, including the model that will be used to assess technology acceptance of cell phones.

3 TECHNOLOGY ACCEPTANCE MODEL (TAM)

3.1 Origins

The technology acceptance model (TAM) was first proposed by Fred Davis in 1985, based on the Theory of Reasoned Action by Fishbein and Ajzen [13]. The model suggested that motivation to use a system can be explained by three factors: Perceived ease of Use, Perceived Usefulness and Attitude towards Using [14].

In 1989 Davis, Bagozzi and Warshaw modified TAM to include the variable “behavioural intention to use”. After a longitudinal study in 1989 they concluded that perceived usefulness (PU) and perceived ease of use (PEOU) have a direct influence on behavioural intention (BI), thus eliminating the need for the attitude towards using variable. The TAM was finalized in 1996 by Venkatesh and Davis into the model as shown in. [14]
3.2 Development

Although TAM predicted system usage, it could not explain the reasons behind users’ perception of system usefulness. In 2000 Venkatesh and Davis [14] addressed this limitation by developing TAM 2 which includes additional variables that act on perceived usefulness (PU). They continued to work on TAM by including variables in an extended model of TAM in 2000 to explain factors that act upon perceived ease of use (PEOU) [15].

In 2003 Venkatesh, et al [16] combined previous research on information technology acceptance into the unified theory of acceptance and use of technology (UTAUT).

A study by Cilliers and Flowerday [17] applied the UTAUT to health information systems in the Eastern Cape Province. A population of clinics were surveyed with telemedicine systems already implemented. Results showed that social influence and facilitating conditions influenced acceptance of using telemedicine. Lack of awareness and lack of knowledge were identified as barriers to implementing telemedicine.

3.3 Extensions

The TAM has been extended or combined with a variety of models in order to describe technology acceptance in a diversity of fields. In the research field of cell phones, mobile commerce has received a lot of attention [18]. Models extending TAM has also been
developed for mobile commerce [19], but this study focusses on the field of using cell phones for health care. Applicable models are hence reviewed.

### 3.3.1 E-Health

Wilson and Lankton [20] tested the TAM, motivational model and an integrated model (Figure 3) on users registered for an e-health service. It was found that all three models predicted behavioural intent well. The integrated model did not predict behavioural intent better than the other two models. Perceived usefulness extrinsic motivation (PUEM) was common for the models and predicted 68% of the variance in the behavioural intention (BI).

**Figure 3: Motivational model (left) and integrated model (right) [8]**

The above study showed that perceived usefulness (PU) is a major predictor of behavioural intention (BI).

### 3.3.2 Mobile service

López-Nicolás et al. [21] extended the TAM in order to describe user acceptance of mobile services (Figure 4). Variables related to the theory of diffusion of innovation (DOI) were included in the model, in term of social influences. All relationships were found significant except between perceived status benefits and perceived usefulness.

**Figure 4: Concept model for mobile service acceptance [9]**
The above show that attitude towards innovations have a significant influence on behavioural intention (BI).

### 3.3.3 Mobile health care

Wu et al. [22] combined the TAM with the model from theory of planned behaviour in order to describe hospital professionals’ acceptance of mobile health care (Figure 5).

![Figure 5: Adoption model for mobile health care [10]](image_url)

Significant influences of the behavioural intention antecedents were reported. Perceived usefulness in particular was found to be a key factor in promising the use of mobile health care. Larger hospitals were also found to have a higher intention to use mobile health care, likely due to resource availability and responsibility for quality health care services.

### 3.4 Summary

TAM is a flexible tool to use, and has good empirical evidence for predicting technology acceptance. For the field of mobile health care TAM has been adapted for the specific context. Additional variables have been included to better predict behavioural intention.

### 4 PILOT STUDY

A pilot study was done in order to explore the South African environment for mobile health care services.

#### 4.1 Method

The population for the pilot study consisted of private health care facilities, with pharmaceutical businesses making up most of the respondents. Surveys were given through e-mail or telephonically.

The survey was based on the integrated model (See section 3.3.1), to investigate a broader field of “using mobile phones for work purposes in health practices”. The model considers the factors behavioural intention (BI), internal motivation (IM), perceived ease of use (PEOU), and perceived usefulness external motivation (PU-EM). Statements were created to describe these factors for which respondents rated their level of agreement to the statements. The scales reached from 1-7 ranging from strongly disagree to strongly agree, with 4 being neutral.
4.2 Results

Of the 83 surveys that were sent out, 13 surveys were completed in full, with one incomplete survey being discarded. Hence, the response rate was 15%. Table 1 shows the results from a descriptive analysis of the responses, with Figure 6 showing a frequency analysis of responses.

<table>
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<tr>
<th>Table 1: Pilot survey descriptive results</th>
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<tr>
<td>Median</td>
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From Table 1 it can be seen that the medians for the factors were neutral or near neutral. The behavioural intention had the least positive responses, showing an overall neutral or negative response. The perceived ease of use had a small inter quartile range, with the most positive responses. This shows that a high perceived ease of use does not necessarily reflect a high behavioural intention. Perceived ease of use may be a qualifier for behavioural intention in this context of cell phone usage.

From Figure 6 it can be seen that responses were either strongly negative or positive skewed to the right. Perceived ease of use (PEOU) received the highest positive ratings, with perceived usefulness external motivation (PU-EM) receiving the most negative responses.

4.3 Discussion

The percentage of respondents could be increased with more rigorous screening of potential respondents. The pilot study showed neutral median responses, with strong opinions for those that were against the use of cell phones for work purposes. Behavioural intention was not found strongly positive, even though perceived ease of use was found mostly positive.

Additional comments from the surveys showed that some employees were not allowed cell phones at work, and that some managers were strongly against the use of cell phones by employees. Other managers indicated that they saw no need for cell phones at work, seeing that they have sufficient ICT infrastructure. This could explain some of the strong negative responses.
5 CONCLUSION AND FUTURE WORK

In view of pilot study, the research focus of the full scale study will be from the perspective of health care institutes regarding the exploitation of the customer’s cell phone for providing value adding health care services (using mHealth services). The population will be managers from private health care facilities including pharmacies (both retails and service) and hospitals. For the full scale study, a model will be used that combines results from research as reviewed in this paper. The following section describes the model and the basis of elements used.

5.1 Model

5.1.1 Elements for TAM

In order to measure the technology acceptance of managers, the following elements will be used in the model:

- Behavioural intention
- Perceived usefulness
- Attitude
- Institution Size

These first three elements were chosen because they directly work upon the behavioural intention, which in turn works on the actual use. Perceived ease of use will not be included, as it is expected to be high for cell phones, regardless of behavioural intention. The size of the facility was included, seeing that larger hospitals were found to show a greater behavioural intention (see 3.3.3).

5.1.2 Measuring context

In order to measure the context behind responses to technology acceptance, a model regarding the business’s technology adoption will be included. An extensive review of models used in determining technology adoption at firm level was conducted by Oliveira and Martins [23]. One model, also by Oliveira and Martins [24], investigated e-business adoption. This model was tested extensively and concluded that the following factors influence a business’s adoption of e-business:

- Perceived benefits and obstacles of e-business
- Technology readiness
- Competitive pressure
- Trading partner collaboration

Including these factors in the survey, together with factors from technology acceptance, will give a wide picture of the acceptance of the private health care sector for cell phone based health care services. The proposed model is shown in Figure 7.
Figure 7: Proposed acceptance model for cell phone based health care

5.2 Conclusion

By applying the above model, empirical data concerning the market for using cell phones in primary health care of South Africa can be determined. This information could be used to develop systems to improve health services and information delivery.

6 REFERENCES


