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# CONCEPTUAL MODEL OF eHEALTH FOR DEVELOPING COUNTRIES

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# CONCEPTUAL MODEL OF EHEALTH USE FOR PROFESSIONALS IN DEVELOPING COUNTRIES

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## ABSTRACT

Within the context of this paper, we describe the adoption of Information and Communication Technology (ICT) in health care. The adoption of ICT in health care is referred to as eHealth. The health care industry since the inception of eHealth has applied the technology in many areas of his activities; recently research focus is on patient usage of the technology. Unfortunately, health care professionals are yet to optimize the usage of this technology in their operational activities. The notion of this paper is to model the factors that prevent the professionals in the usage of this technology. We also discuss various variables that can contribute to the successful use of the technology and how this variable can be measured based on the theoretical roots of the underlying models that constitute the proposed model.

## Keywords

ICT, eHealth, TAM, DOI

## INTRODUCTION

The ubiquitous use of Information and Communication Technology (ICT) in every facet of our professional and social lives is fascinating in most developing countries. Numerous uses of ICT among professionals were applied in communication and information gathering. Health care is one of the areas where ICT use has seen an increase in the use of applications and health care professionals are experiencing challenges using this technology. In order to rectify and differentiate various application adopted in health care, UNESCAP (2007) coined the term 'eHealth' which is used to describe ICT adoption in different fields in the health care sector.

Since this term was coined, much has been said and written about how eHealth could facilitate effective health care delivery (Lucas, 2008). Recently, there has been research into a patient-centred approach (Nkosi et al., 2011; Mark and Ngwira, 2011; De Allegri et al., 2006) for easy accessibility of health care but in reality, the success in the usage of eHealth technology is yet to be achieved among health care professionals using the technology.

Nevertheless, IT development experts have learned from experience that technical fixes often deliver far less than was promised when faced with the chaotic and sometimes corrupt health systems in many developing countries (Watkins, 1992). This is an agonising situation where longer-term outcomes typically depend on factors such as: the robustness of sophisticated electronic equipment, availability of technical staff to operate and maintain health care equipment, and how the technical staff can cope with complex hardware and software failures, new releases and upgrades.

This paper looks at factors that could contribute to the successful implementation of eHealth, most especially in developing nation. In order to achieve this, the study relies on three established theories from the field of psychology, information systems and education. The triangulation of these three theories enables us to arrive at the proposed eHealth model for health care delivery. The paper further discusses the constructs of the model, the sub-variable, the measurement item, the theoretical root of each of the construct in the model and the reference. Also, effort is made to discuss the hypotheses in the model and finally we come up with the questionnaire items for data collection to measure reliability and validity of the model.

## CONCEPTUAL EHEALTH MODEL FOR HEALTH CARE DELIVERY

The need for a model to study the factors that will impact the effective use of eHealth on health care delivery in South Africa will be used as base model for developing countries. To achieve this, we consider studies in the areas of new services and

application such as eHealth. These studies were adopted to predict users' acceptance of innovations in technology, how health care professionals learn, and system usability, i.e. how friendly the eHealth technology is. This study will therefore employ the three information systems theories: the Technology Acceptance Model (TAM) (Davis, 1989), the Diffusion of Innovation Theory (DOI) (Rogers, 1985) and the Behaviourism Theory (Merriam and Caffarell, 1999) which discuss users' attitudes towards learning.

Variable	Sub-variable	Measurement item	Theoretical root	References
Organisational	Interpersonal	Awareness	DOI, TOE	Davis, 1989; Tornatsky and Klein, 1982; Tornatsky et al., 1990; Albino et al., 2001; Watkins and Marsick, 1992
	Leadership	Evaluation Decision making Leadership		
	Self-management	Drive strength Time management Commitment ethic		
	Intrapersonal	Self-esteem Stress management		
Learning	Behavioural	Anxiety Attitude Concentration	Stimulus-response Theory, Cognitive Theory, Dynamic Label Theory	Merriam and Caffarella, 1989; Arlin, 1975, 1984; Grubber, 1973, Knowles, 1988; Rosenstock et al., 1998; Mezirow, 2002
	Informational	Information Processing		
	Motivational	Motivation Self-testing Selecting main ideas		
	Managerial	Study aids Time management Test strategies		
System Usability	Easy to learn and use	Easy to learn Easy to use	TAM, DOI, TOE	Davis, 1989; Rogers, 1995; Tornatsky and Klein, 1982; Lin et al., 2004 et al., ; Knowles, 1988; Butler, 1985
	Accessibility	Content accessibility User interface Disability access and translation		
	Compatibility	Compatibility		
	Functionality	Accuracy Validity Robustly Speed Availability		
	User satisfaction	Utility Reliability Efficiency Customisation Flexibility		

**Table 1. eHealth model variable, sub-variable, measurement item and theoretical root**

## HYPOTHESIS

### H1: eHealth positively impacts health care organisation

Rogers (1985) says the DOI theory explains how a new idea or innovation propagates the use of technological innovation in a social system. This theory is based on 50 years of research and has been adopted by many researchers in different fields of information systems and health care (Davis, 1989). Carter and Belanger (2004) have adopted DOI to assess citizens in e-government initiatives.

### H2: eHealth positively impacts learning in health care

Taking into consideration users' learning in the context of eHealth, we will study behaviourism as a learning theory. The theory sees learning as a complex process of responses to several kinds of distinct environmental stimuli. Behaviourism comprises several individual theories that have a common theme between them. This common theme is found in the way the theorists define what learning is and how it is accomplished. The common assumptions of these theorists are threefold, as

explained by Merriam and Caffarella (1999). The first common assumption is the emphasis that observable behaviour, rather than internal thought processes, creates learning. Secondly, it is ultimately the environment that creates learning and determines what is learned, not the individual learner. Lastly, it is the ability to understand the overall process - and the ability to repeat or reinforce that process – which is a common thread (Merriam and Caffarella, 1999). The latter theory is most commonly seen in adult learning when organisations engage in repeatable training and systematise them into manageable tasks. The hypothesis behind behaviourist learning theories is that all learning occurs when behaviour is influenced and changed by external factors (Merriam and Caffarella, 1999). Behaviourism disregards any notion that there may be an internal component to human learning.

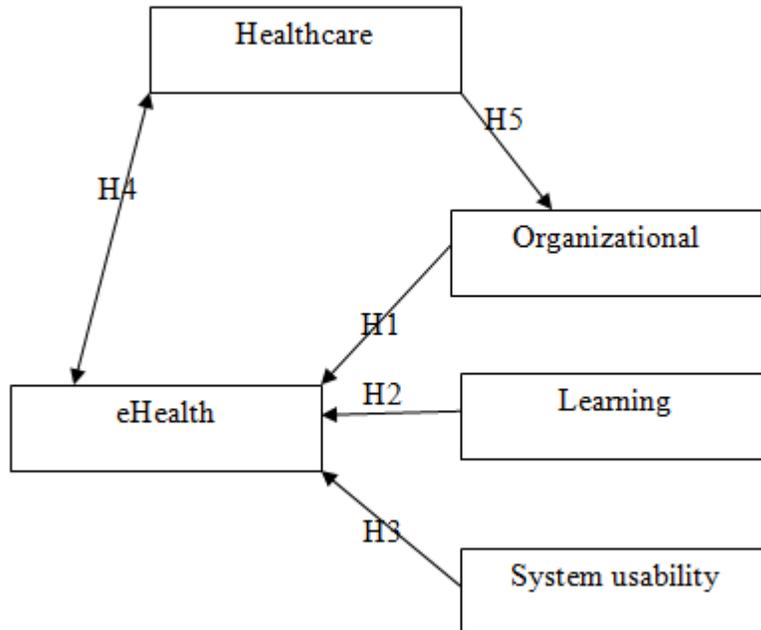


Figure 1. Proposed eHealth model for health care delivery

### H3: eHealth positively impacts system usability in health care

The Technology Acceptance Model (TAM) theory (Davis, 1989) discusses the behaviour of users in accepting new technology. The theory links the role of perceived ease of use and perceived usefulness with system characteristics and the probability of system use as an indicator of system usage success. TAM has found its application in public sector e-services (Al-adawi et al, 2005; Carter and Belanger, 2004) in health care (Lapointe et al., 2002). However, TAM suffers from the absence of significant factors, considering both human and social change processes and the effect on the adoption and utilisation of new information systems (Venkatesh et al., 2003; Davis et al., 1989; Melone, 1990). In applying TAM and DOI to eHealth in health care delivery in South Africa, we will look at the theories from the role of perceived ease of use, perceived usefulness and the primary perceived attribute in complexity, compatibility and relative advantage which are trialability and observability (Rogers, 1995).

### IMPLICATIONS

This study point towards important consideration for further research and the research will still make headway in terms of data collection to ensure the validity of the model. An important issue is how information technologies are utilised in health care organisations. Behaviour towards learning is one aspect towards successful adoption of eHealth in health care. The other consideration is how users accept technology in the health care industry. Lastly, innovation diffusion also brings about changes in the technology, environment and within the health care organisations (Tornatzky and Fleischer, 1990;

Tornatsky and Klein, 1982). This study has put in an immense effort in proposing a model which could be relied on for successful usage of eHealth among health care professionals.

Our study also has considerable implications for practice. Technology acceptance is an important phase for the absorption of an IT innovation, and may even determine the success the company will have in promoting the innovation in the marketplace. Most IT innovations were considered tools for users to attain certain goals within organisations, where performance aspects are considered more important than users' effect on these IT products or services (Davis et al., 1989). However, as more and more IT innovations become commercially available to individual users - in the form of consumer products or services - it is very likely that, in order to attain a high level of technology acceptance, IT product/service practitioners should pay more attention to the users' perceived enjoyment of these IT products or services.

Variable	Sub-variable	Questionnaire item
Organisation	Management	<p>Schedule regular meetings on the use of eHealth</p> <p>Have good communication skills for training on using eHealth</p> <p>Ask for, and listen to, ideas and solutions to resolve issues with eHealth usage</p> <p>Use e-mail effectively to send information updates to various work groups that use eHealth</p> <p>Set objectives and encourage participation of work groups in eHealth</p> <p>Accessible schedule to locate different health care experts while using eHealth</p> <p>Available support for consultation and advice on eHealth use</p> <p>Supports and promote social activities and team building activities for eHealth</p> <p>There is available fund for training and support on effective use of eHealth</p> <p>Performance assessments based on usage of eHealth by health care experts</p> <p>The motivation the health care professional gets for proper use of eHealth</p> <p>The relationships between management and health care experts using eHealth</p> <p>How is the management of health care workers managed while using eHealth</p> <p>The attention paid to the suggestions by health care workers on proper use of eHealth</p>
	Satisfaction	<p>The work condition of health care workers using eHealth</p> <p>Does the knowledge of eHealth usage ensure job security</p>
Learning	Experience	<p>I am experienced at using eHealth in a health-care environment to communicate (e.g. using eHealth to mail)</p> <p>I am experienced at using the health care electronic collaborative group support system</p>
	Training	<p>I received adequate training to use eHealth to communicate</p> <p>I received adequate training to use the eHealth electronic collaborative group support system</p> <p>I have been trained to use eHealth to communicate from and with health care field workers</p>
	Anxiety	<p>I have had training on how to work with other health care field workers using eHealth</p> <p>I feel frightened about using computers.</p> <p>It scares me to think that I could cause the computer to destroy eHealth information by hitting wrong key on the computer keyboard.</p> <p>I hesitate to use eHealth tools (e.g. computer) for fear of making mistakes.</p> <p>I feel intimidated using computers attached to eHealth</p>
System Usability	Easy to learn	<p>I can learn how to use eHealth when provided with an instruction manual.</p> <p>I can learn the eHealth software package when I am provided with an instruction manual</p> <p>I learn eHealth through instructor guidance</p>
	Easy to use	<p>I can set objectives that align with health care goals</p> <p>I can prioritise tasks to use my time effectively</p> <p>I can complete my daily tasks easily through eHealth</p>
	Accessibility	<p>I get a response from my manager for a request for advice or help on eHealth usage</p> <p>I can access appropriate support from support staff easily</p>

	User satisfaction	I can locate my co-workers through the eHealth system It is easy to get support from my co-workers when issues arise  I frequently don't know how to handle issues that occur while using eHealth I cannot figure out what should be done to accomplish my tasks at work. I am always confused about what I have to do while using eHealth for my tasks at work.
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**Table 1. Questionnaire items for data collection**

## CONTRIBUTIONS AND CONCLUSIONS

In order to highlight the value added by the proposed model, it is informative to compare it with information systems usage with respects to technology, organisation and environment (Tornatzky and Fleischer, 1990; Tornatsky and Klein, 1982). To attain the eHealth usage, health care professionals should be required and encouraged to continue using the system. The proposed model is similar to TOE on two grounds: (1) Perceived usefulness and confirmation of expectation both positively influences satisfaction, and (2) perceived usefulness both are positively influenced by the technology, organisation and environment. However, the proposed model is different from TOE on the following grounds:

- Firstly, the explained construct of the proposed model discusses learning, system use as it affects intention or eHealth system usage behaviour. But the explained construct of this proposed model is neither intention nor behaviour. It is the strength of attitude towards learning that is the strength of the linkage between the outcome and actions which will affect eHealth usage.
- Secondly, satisfaction is an influential factor in achieving eHealth usage which is relevant to actions that lead to outcome. But according to TAM, attitude will influence intention (Davis et al., 1989). Therefore, this is influenced by confirmation of expectation. Satisfaction as an attitude is derived as outcome from learning (Tornatzky and Fleischer, 1990; Tornatsky and Klein, 1982).
- Thirdly, the longer the user experience, the more opportunities significant actions will have to attain the activated goal and the stronger the attitude towards learning within the eHealth application domain will be. Hence, the proposed model confirms the influence of user experience. However, TOE doesn't consider the user experience.

Although some research has focused on the patient use of eHealth, our knowledge surrounding the effective use, by health care professionals, of eHealth will influence the attitude of the actual usage of eHealth. The goal of this paper is to focus on the theoretical development of eHealth, identify salient determinants of eHealth usage by health care professionals and to understand underlying mechanisms that influence the variables and the dependent variables. In addition, the goal of this study is theory development. Theory testing will be conducted in future research projects.

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