2016

# Applying UTAUT in Clinical Informatics Research

Kehinde Abayomi Owolabi Mr
*Department of Information Studies University of Zululand South Africa*, yomiowolabi2000@yahoo.com

Evans Neil Dr
*Department of Information Studies , University of Zululand, South Africa*, evansn@unizulu.ac.za

Patrick Thokozani Mhlongo Prof
*Dept. of Nursing Science University of Zululand, South Africa*, mhlongot@unizulu.ac.za

# Applying UTAUT in Clinical Informatics Research

By

Owolabi Kehinde Abayomi,

yomiowolabi2000@yahoo.com

Neil, Evans.

Department of Information Studies

and

T.P Mhlongo

Department of Nursing Science

University of Zululand

South Africa

**Abstract**

The paper discussed unified theory of acceptance and use of technology UTAUT as theoretical foundation for clinical informatics research. Highlighting the efforts to promote the use of clinical informatics in sub-Sahara Africa cannot be over-emphasized. UTAUT theory has evolved to become a key model in understanding factors that influence human behaviors toward acceptance and rejection of technology.

Qualitative content analysis through conceptual and literature analysis was used to explore previous studies in the research domain. Research has been conducted on application of UTAUT in various fields such as internet use, mobile banking and e-learning. But not much has been done on application of UTAUT in clinical informatics research. The research used SCOPUS database to find out that the number of research that used UTAUT between the years 2005 to 2015. The finding revealed that 1,582 articles, journals and conference paper used the theory, in which USA has 311 publications followed by Malaysia with 166. Coming back to Africa, South Africa came first with 45 publications followed by Nigeria with 06. The result indicated that

there is a gap in knowledge due to paucity of literature on application of UTAUT in clinical informatics particularly among studies from Africa researchers. Based on this, the study provides insightful knowledge on academic literature on application of UTAUT in clinical informatics research and contributes to discussion on UTAUT. The study recommended the need to include the teaching of theoretical frame work as a part of research methodology in the universities.

**Keyword:** Social informatics, clinical informatics, ICD4D, UTAUT, and healthcare.

## Introduction and background of the study

The importance of theoretical framework in clinical informatics was reinstated by Ocholla and LeRaox (2011) who claim that theoretical framework enhances clinical informatics research clarity, promotes appropriateness of research and ensures effectiveness in research work. Also, Grix (2010:174) highlight the relevance of theoretical framework in clinical informatics by arguing that theoretical framework provides a guideline to research design, result interpretation and data analysis. It is important to note that the application of theoretical framework in research activities has played a great role in research development (Brink et al., 2013:27).

Despite this, many researchers are not aware of the importance of theoretical framework in social informatics studies particularly in sub-Saharan Africa. A search database revealed that there is paucity of literature on the use UTAUT in clinical informatics studies. SCOPUS database which is the largest abstract and citation database of peer review of literature (Sirisathikul and Sirisathinkul, 2015), the data based was used to access the number of articles/papers that have employed UTAUT to underpin their studies between the years 2005 and 2015

Based on the analysis of Scopus data base, it was revealed that about 1,582 articles, journals, books and conference papers used UTAUT in their various studies. With USA have a total publication of 311, Malaysia, 166, China141, UK 136, Taiwan, 126. Coming back to Africa, South Africa takes the lead with 46 publications that used UTAUT from the year 2005-2015 has stated in the methodology, followed by Nigeria with 06, Sudan,03 and Ghana 02. Surprisingly, amongst all these publications only few were tailored toward clinical informatics research. Only

four studies used UTAUT to inform their clinical informatics research in South Africa while other countries in the continent failed to record a single study that employed UTAUT to inform their clinical informatics research. Compared with what we have in advanced countries where majority of their studies employed UTAUT to inform their clinical informatics studies.

Studies have found that clinical informatics resources are underutilised among medical doctors in many healthcare facilities which they claimed are causing medical errors and damages to medical operations. In providing solution to this, many technology acceptance theories have been develop to examine information technology acceptance of medical doctors, one of the theories is UTAUT. UTAUT has proven to be a very powerful theoretical tool in the analysis of acceptance, rejection of ICT. Despite this, there is very poor usage of the theory among social informatics scholars. Thomas, Singh and Gaffar (2013) attributed poor use of UTAUT theory to many inconsistencies in research results. Meanwhile, the use of the theory is a very important area of study that examines the relationship between information technology and various professionals such as medical doctors. Yet, many scholars in the field of clinical informatics have not been able to tap the full potential of UTAUT in their studies. This indicates knowledge gap in the application of UTAUT in clinical informatics research.

Based on the foregoing, the study will be examined the relevant of UTAUT in clinical informatics research in order to create awareness about the need to apply the theory in clinical informatics and social informatics studies. The paper started with the introduction and background of the study, methodology, application of the theory, appraisal critiques and application of the theory to clinical informatics.

## Methodology for the literature review

One of the crucial stages in a research is the literature review. Ridely (2012:3) defines a literature review as the selection of available documents from published and unpublished sources which contain information ideas, data and evidence written from a particular standpoint to fulfil certain aims or express certain views on the nature of the research or topic and ways in which it will be investigated and the effective evaluation of these documents in relation to research being processed. Literature review is very important for any scientific research. The effective literature

review create a solid foundation for academic research, for knowledge advancing and it facilities theory development in academic study.

For the purpose of this research a literature review that synthesizes published work on application of UTAUT in clinical informatics was conducted. There is general review of the relevant publications on the topic and it was not limited to specific years or specific journals.

In order to identify relevant publications addressing the subject matter of the research a structured approach suggested by Webster and Watson (2000) was applied which suggested the following: (1) using keyword to search in relevant journal databases (2) selection of relevant publications with matching criteria (3) intensive reading of identify publications. The literature search for the study was undertaken in a four month period May to September, 2015 as part of my doctorate thesis.

For the purposes of the review, the SCOPUS, EBSCO Host and Goole Scholar were used. Various search strings were used to get relevant information from the data bases which include UTAUT and clinical informatics, ICT in healthcare and e-health. Searches were limited to publications in English.

## User acceptance theory

The use of clinical informatics is growing rapidly in healthcare delivery, medical doctors' acceptance of it has not always been impressive (Yarbroughm, 2007). As a result many studies have tried to investigate the behavioural factors that affect the use of clinical informatics among medical doctors (Mourad, 2012;Abubakare et al,2013 and Olasina et al 2014) .Esmanellzadeh et al (2011:18) observe that user acceptance to technology in healthcare environment has not always been successful. Contributing to this, Pyno et al (2013:15) note that adoption of clinical informatics by medical doctors has lagged behind in developing countries. Pare and Trudel (2007:23) note that there is an urgent need to promote the use of clinical informatics by medical doctors in healthcare environment particularly effective in health facilities .They identified various supporting factors that need to be put in place for effective use of clinical informatics which include the provision of technical supports and adequate trainings for medical doctors on its use. On the other hand, Lin and Cheng (2015), point out what factor that determines user

acceptance and use of technology such as clinical informatics is actually the user's intention. Based on this there is need to examine the meaning of user acceptance theory

There are many theories relevant to a study of user acceptance of ICT and many of these theories focus on people's intention to engage in a particular behaviour (i.e. adoption and use of ICT) as a relevant conceptual framework. Olasina (2014) notes that research on access and use of information and communication has been informed by a number of theories which include the following are among the accepted models :UTAUT by Venkatesh et al. (2003) , Theory of Reasoned Action (TRA) (Fishbein and Ajzen 1975), The Theory of Planned Behaviour (TPB) (Ajzen 1991),The Technology Acceptance Model (TAM) (Davis 1989), the Combined-TAM-TPB (Taylor and Todd 1995) ,Model of PC Utilization (MPCU) (Thompson et al. 1991), Motivational Model (MM) (Davis et al., 1992), Social Cognitive Theory (SCT) (Bandura 1986), Innovation Diffusion Theory (IDT) (Rogers 1995) , IS Successful Model (DeLone and Mc Lean, 2003) and Technology Fit Model (Goodhue and Thompson,1995).

All these models are being widely used in information related research and their use has been received and adopted within clinical informatics studies as well. For the purpose of this study, UTAUT will be employed and the justification for it will be fully discussed in the later part of the research work. The medical profession is information-driven because medical personnel need information for diagnosing, treating and for making decisions on patients' treatment. Ingweren and Javelin (2005:386) describe information seeking for medical practice as a way by which a medical doctor seeks information through the examination of various information sources with the intention to diagnose and treat their patients and also use information for decision making on issues relating to solving medical problems. Marchionini (1995) states ways by which medical doctors can seek for information. This includes the internet, books, journals, professional colleagues, conferences and training.

Information and communication technology is a very important medium of information for the healthcare sector, particularly medical doctors because it has the potentials to improve the quality of services that healthcare users receive, enhances health safety, reduces healthcare costs, reduces medical errors, improves standards and promotes efficiency. Contributing to this,

Lapointe and Rivard (2005) maintain that medical doctors should be encouraged to always use technologies in performing their duties. More-over, the growing rate of the use of information and communication technology in various healthcare facilities around the globe has led to the recognition of technology acceptance as an important issue in the implementation of technology in healthcare facilities (Hu et al, 1999:94; Sun et al 2013:187).

However, Kaplan and Kimberly (2009:291) note that over 40% of adoption of ICT in various hospital environments in the USA has witnessed failure and abandonment. They identify various reasons that could be responsible for this to include lack of adequate knowledge and technical skills on how individuals and firms can adopt information communication and technology for effective job performance. Lewis et al (2011) maintains that effective ICT implementation in any hospital environment is a function of individual acceptance and users' utilisation.

To buttress this, National Centre for Chronic Disease Prevention and Health Promotion (2009:1) observes that United State of America spent huge amounts of fund on ICT in healthcare delivery in the past years without any considerable results. Mahony et al (2013) attributed the failure to poor acceptability and use of ICT by the people involved. It can be inferred from this that ICT cannot improve performance in any organisation if the users are not ready to embrace and accept it.

In addition, failure of users to accept the use of technology in any organisation will constitute a big hindrance to the successful adoption of information technology system in such organisation. David et al (1993) had early noted that user acceptance is an important determinant of the success or failure of any new information and communication technology project introduced to a system. From the foregoing, user acceptance can be described as the ability and willingness of user groups to employ technology for the tasks it is designed to perform or support

**The Theory**

Medical practices are information intensive professions and clinical informatics tools play very important roles in hospital informational services, particularly in making decisions about patients' treatment and the promotion of evidence-based medicine ( Nwargu and Adio, 2012). Access to clinical informatics tools make the work of medical doctors easier, quicker and more

effective due to the provision of the opportunity for effective and quality healthcare service delivery.

Medical doctors' access to information cannot be in one direction, they need to seek information from various sources for effective treatment, diagnosis and prescription. However, there are various factors that determine medical doctors' access to and use of clinical informatics. These are social factors which include motivation and care (Yiu and Law 2012) and technological factors (Anwar and Kumar, 2014:176).

Brink et al (2013:30) classify the factors that can influence access and use of clinical informatics by medical doctors into individual, technological and implementation. The individual factor involves the level of computer skills, computer self–efficacy and the degrees to which medical doctors believe that using clinical informatics will improve their job performance while technological factor is the perception of medical doctors about the importance of technology. Implementation factor include adequate funding of ICT tools in healthcare sector , provision of good ICT policy and changing from the traditional bureaucratic paradigm to knowledge based requirement that will be flexible , and allow for organisational innovative that will support effective service delivery in health care sector(Gichoya, 2005:175)

In another development, Chau and Hu (2002), state that user acceptance theory is built on three factors which include the individual context, the technological context and the implementation context. The argument in this direction is that for effective control and use of clinical informatics tools by medical doctors, there need to be a well-conceived understanding of the factors affecting individuals with regards to clinical informatics' access and use. Furthermore, the proper understanding of various factors affecting individual medical doctors would promote the adoption and use of the tools which, in consequence, will promote effective healthcare delivery.

This research accepts the positions of Brink et al (2013:27) on the need to consider individual interest, organisational intention and technological status before any theoretical framework can be selected for any user acceptance study. In addition, the UTAUT theory will be appropriate for the study because of its strong theoretical foundation, comprehensiveness and very good explanatory power. Moreover, a gap in literature occurs which revealed that there is paucity of

literature on studies on clinical informatics that underpin their studies with the application of UTAUT. Based on this, the studies will examine the application of UTAUT in clinical informatics research.

**The Unified theory of acceptance and use of technology (UTAUT)**

Unified Theory of Acceptance and Use of Technology (UTAUT) is a user acceptance model created by Venkatesh et al in 2003. The model is an acceptance and adoption model coming from the field of business and management at four universities (University of Maryland, University of Virginia, University of Minnesota and University of Arkansas).These researchers introduced a model that examines people intention to use technology and adoption behaviours. For instance, this model can be very useful to examine the medical doctors' adoption behaviour of clinical informatics; it is also suitable for use in hospital environments if one wishes to know the degree of medical doctors' motivation when adopting new technology (Yoo, Han, and Huang, 2012).

UTAUT is one of the new models in the field of technology acceptance model and its purpose is basically to explain user's intention to use technology and to examine usage behaviour (Taiwo and Downe, 2012). The theory was based on a review of eight other models which are theory of reasoned action, technology acceptance model, motivational acceptance model, theory of planned behaviour, model of PC utilization, diffusion of innovation theory and social cognitive theory (Evans , 2014).The essential of the combination of the eight models is to form a unified model which will take care of existing models and will be more robust.

On the other hands, Venkatesh et al (2003:467) identify reasons for creating a unified theory which is basically to make it easier and simpler for researchers to select a theory without necessary making reference or contribution to other theories. The UTAUT model condensed the thirty two variables found in the existing eight models into four main effects and four moderating factors (Ventakesh et al. 2003:467). However, the combination of the existing constructs has increased the UTAUT predictive efficiency to 70%, which is a major improvement over the previous TAM theory (Oye, Lahal and Rahim, 2012;83).

**UTAUT model constructs**

Venkatesh et al (2003:447) explain the constructs of UTAUT to involve four determinants which are performance expectancy, effort expectancy, social influence and facilitating condition. He went further to identify the four moderators which include acceptance of technology, gender, age, experience and voluntaries of use.

**Performance Expectancy**

Venkatesh et al (2003:447) describe performance expectancy as the degree to which an individual believes that using Information and communication technology will assist him or her to achieve better results. It can be said that performance expectancy is a very important determinant of behavioural intention. Venketesh et al (2003:447) and Ghalandari (2012:802) observe that five factors from the earlier theory were used in the formulation of performance expectancy. The variables that the theory is comprised of are perceived usefulness (Technology acceptance models), external motivation (motivation model), job fit (PC Utilization model) relative advantages (innovation diffusion theory) and outcome expectation (social cognitive theory). However, a critical examination of the five variables that made up the construct are laying emphasised on perceived usefulness of technology by users in order to measure the extent in which technology has improve their job functions.

Performance expectancy is basically about the benefits the user will enjoy with new technology, compared with the old system as related to his job performance. Venkatesh et al (2003) reveal that performance expectancy is the strongest determinant of behaviour intention. Aarts and Koppel (2009) note various ways in which medical doctors can benefit from using clinical informatics which include provision of adequate information such as clinical reminder, medical interaction and allergy alerts. Clinical informatics is assumed to be an essential mechanism in resolving major healthcare issues because it has the capability to promote efficiency and effectiveness of healthcare. MacDonald (2008) observes that clinical informatics is expected to reduce healthcare cost and at the same time promote productivity amongst medical doctors.

However, various studies have been conducted to measure the behavioural intention of various professionals including medical doctors, particularly in the use of ICT resources. Pynoo et al (2012:90) reveal that the medical doctors in Belgium are likely to accept clinical informatics if

they discovered that clinical informatics will enhance their job performance. Anja, Heiko and Ulrich (2014) identify free flow of information in hospitals as a major reason why medical doctors in Germany accepted to use clinical informatics. This implies that clinical informatics provides adequate access to information for better and improved healthcare services delivery. Venkatesh et al (2003) had earlier observed that performance expectancy construct is the most powerful determinant in the UTAUT model.

**Effort Expectancy**

Effort expectancy can be described as the degree of ease of access and use of technology (Venkatesh et al, 2003). There are three constructs that capture the concept of efforts expectancy which are perceived ease of use (TAM/TAM2), complexity (MPCU) and ease of use (IDT) (Venkatesh et al, 2003:450). From what obtains in the reviewed literature, it can be said that effort expectancy can be compared with TAM's perceived ease of use. Contributing to this, Venkateshet et al (2003) state that effort expectancy is moderated by gender, age and experience and it has influence on behavioural intention. It can be inferred from the assertion that age has an effect on user ability to operate new technology and user with adequate experience on technology will operate it effectively.

Venkatesh et al (2003:450) examined various researches (Bem and Allen, 1974; Bozionelos, 1996 and Ventatesh and Morris, 2000) and their results revealed that effort expectancy is more prominent among females than males. Effort expectancy was proven as a major factor in clinical informatics acceptance among medical in Australia (Schaper and Pervan, 2008).However, it has no effect on behavioural intention among medical doctors in Hong Kong (Chau and Hu,2002)

Nuq and Aubert (2013) note that effort expectancy could be a factor by medical doctors to use of clinical informatics in developing countries due little or poor ICT skills. Kifle ( 2008) notes lack of experience with clinical informatics as a challenge to use of the tools. He argues further that effort expectancy is a very important factor in measuring clinical informatics acceptance among medical doctors in developing countries.

Effort expectancy plays a very active role in voluntary and mandatory usage contexts, but not more important in the second time of use because the users must have gained necessary skills to

manipulate the system and also familiar with the system (Sepeame and Ajala, 2013:9). Some literature has revealed that effort expectancy is a significant determinant of users' intention to use technology among medical doctors in Greek hospitals (Aggehdis and Chatzoglou, 2009). To buttress this, Cilliers et al (2013) conducted a study on telemedicine use among health workers; majority of the respondents admitted the system is user-friendly. Seventy-one percent (71%) claimed that they can use the technology with ease and 69% admitted that the system is very easy to learn. That the majority of the respondents admitted that the technology is very easy to use may be due to the computer knowledge earlier gained and the training that the staff had undergone.

**Social influence**

Venkatesh et al (2003) describe social influence as the extent to which an individual allows the opinions of others to influence their decisions to use the system. This construct is related to TRA, TAM, TPB and C-TAM-TPM and it can also be traced to MPCU and DOI as social factors .Olasina,( 2014) and Venkatesh et al (2003) and Evans (2013) observe that age, gender, experience and voluntariness are some of factors that moderate the influence of social influence and behavioural intention which they maintained is stronger in women than men.

Gronland (2010:20) note women are more prone to social influence than men. He argues further that social influence are more noticeable among older people but always decrease with experience. Anja and Heiko (2014) and Kim and Kankanhalli (2009) state that negative attitude of senior medical doctors toward the use of clinical informatics may affect the attitude of young medical doctors towards the use of the tools. This implies that if senior medical doctors are not using clinical informatics tools, it may negatively influence others' decision to use them.

**Facilitating conditions**

Facilitating conditions is the degree to which users believe that organisational and technical infrastructure will support the use of information and communication technology (Venkatesh et al., 2003). Olasina (2014) observes that facilitating condition has a strong influence on effort expectancy. He argues further that environmental factor has an influence on ICT use. It can be deduced from the foregoing that that facilitating condition is related to TAM's perceived ease of

use, combined facilitating conditions (MPCU) and compatibility (DOI). The assessment of the models reveals that the connection between intention and his construct in each model is similar in both voluntary and compulsory settings in the first training period but such influence disappears after implementation (Kholoud et al, 2015).

Venkatesh et al (2003:455) postulates that the influence of facilitating conditions on usage will be moderated by age and experience, such that the effect will be stronger for older workers, particularly with increasing experience. The point enunciated here is that age and experience are moderating factors that influence facilitating conditions; it may be said that users that acquire enough experience on the job will be able to use the computer well enough and with age, they would have gained enough skills that will enable them to use the computer very well.

Facilitating conditions work as a direct determinant on use behaviour and it has no significant effect on behavioural intention (Evans , 2013) .Venkatesh et al, (2003) note that facilitating conditions may predict behavioural intention if effort expectancy was not a part of the theory. Age and experience are being identified as moderators for facilitating conditions and the effect of facilitating condition will be more known for older and experienced people (Venkatesh et al, 2003). It can be said that an experienced worker will find a way to get help when he is facing difficult in the use of ICT tools while old people will be asking for assistance in performing their duties compared with young people (Venkatesh et al, 2003).

Holden and Karsh (2010) note that facilitating conditions in healthcare acceptance technology is very important. They argue further that availability of resources which include technical knowledge and adequate knowledge of computer are some of the facilitating conditions that promote the use of clinical informatics. In another development, Kijasanatoyin et al (2009:406) note that facilitating conditions is very important to medical doctors for the acceptance of clinical informatics' use because it significantly explain technology use . This may be due to the importance of clinical informatics to patients' diagnosis, treatment and evidence-based medicine. Cillers, Stephen and Flowerday (2013) highlight the various resources that promote facilitating conditions in hospitals as including technical services, knowledge of the system and compatibility with other systems already in place. Extant literature has affirmed that when medical doctors

have the right attitude toward ICT, their intention to use the technology in their hospitals tends to be positive ( Melas, et al., 2011).

**Behavioural Intention**

There are some factors that determine Behavioural Intention of the intended users of technology which include main constructs such as performance expectancy, effort expectancy, social influence and facilitating condition and some other external variables such as gender, age and experience etc (Jung, 2008). However, Phichitchaisopa et al. (2013) describe behavioural intention as intention of user to accept and use a new technology. On the other hand, the behavioural intention is an individual's subjective awareness of user to perform a specified behaviour and factors that determine the actual usage behaviour ( Kuo and Yen,2009)

Research into the behavioural intention to adopt information technology has been widely acknowledged. It has always be a very significant research in information management (Davis, 1989; Kuo and Yen, 2009).

**Mediating factors**

Apart from the four main constructs, UTAUT has other four moderators which are gender, age, experience and voluntaries of experiences (Liu, 2013:30). However, the four mediating factors which are not determinant factors when comparing with other such as performance expectancy, effort expectancy, social influence and facilitating conditions, all these four constructs can be used in examining user acceptance levels.

**Gender**

Gender can be used to moderate performance expectancy, effort expectancy and social influence and it has been observed that men tend to have higher expectancy than women because they are inclined to a task oriented and at the same time task achievement which is very important to them (Minton and Schineider, 1980). In addition, Bozionelo (1996) notes that effort expectancy is more significant to women compared to men. Concerning social influence, it was on found out that women tend to be more responsive than men and, at the same time, social influence is more salient in user acceptance technology to women than men (Venkatesh et al, 2003).

**Age**

Age is another mediator factor that can influence all the four main constructs (Liu, 2013). Concerning performance expectancy, younger people tend to be smarter by extrinsic rewards than older people. It can be said that effort expectancy is the most important factor in user acceptance of technology, particularly among older people than younger people. As regard the facilitating condition, older people are more subjective to environmental set up due to their way of learning which is more passive and their experience (Liu, 2013).

**Experience**

Experience is very important in user acceptance of technology. Relating the relevance of experience to social influence and facilitating conditions, Evans (2013) note that experience is the degree of manipulation and level of proficiency in using a technology that a user gains over a period of time. He argues further that with people that have little experience with a new system, effort expectancy will become a more salient factor, particularly in predicting behaviour intention.

**Voluntariness of use**

Voluntariness of use can only mediate the social influence's effect on behavioural intention. Social influence can exert its influence to fullness under a mandatory context because it has a direct effect on intention, while more effort is spent to impact behavioural intention under voluntary context (Venkatesh and Davis, 2000).

Minton and Schneider (1980) observe that gender, age, experiences were moderating factors in the theory .They go further to say that gender as a moderating factor in the theory revealed that men seem to be highly task-oriented .On the other hand , Venkatesh and Morris (2000) maintain that age plays a role in technology acceptance research. Contributing to this, Liu(2013:32) notes that experience of an individual is a factor to be considered in the voluntariness of use which indicated whether or not an individual will be able to use a particularly system

**UTAUT and clinical informatics research**

Several research works have used UTAUT theory to examine technology acceptance within healthcare organisation particularly the perceived factors promote the usage among the medical doctors (Ami-Narh and Williams, 2012:1384). Nuq (2009) applied UTAUT to examine clinical

informatics marketing services in developing countries .The attitude of medical doctors and other health workers toward was examined by Seligman ( 2001).On the other hand Chiu ( 2008) employed UTUAT theory in clinical informatics among Chinese Canadians members dementia. Maillet et al (2015) applied UTAUT theory to examine acceptance and satisfaction of nurses using electronic patient record. Schaper and Pervan (2007) note that healthcare sectors lag behind compare with the other organisations in the use of clinical informatics. Chismar Wiley-Patron, ( 2003) observes that many medical doctors are reluctance to use of clinical informatics , this justify need the need to conduct a research on factors influence the use of clinical informatics among medical doctors

**Studies on clinical informatics research that employed the use of UTAUT theory**

| Authors | Studies |
|---|---|
| Duyck et al. | Monitoring the PACS of Health care system(UTUAT) |
| Carlsson, Carlsson, Hyvonen, Puhakainen and Walden | Adoption of mobile devices (UTAUT) |
| Schaper | ICT and occupational therapists, E-health (UTAUT) |
| Lubrin,Lawrence, Zmijewska and Navarro | Health care wireless sensor(UTAUT) |
| Chau and Hu | Telemedicine(UTAUT) |
| deVeer et al | Intention to use clinical informatics (UTAUT) |
| Ami-Narh and Williams | Investigation acceptance of clinical |

| | |
|---|---|
| | informatics (UTAUT) |

UTAUT has been accepted as a model for measuring use acceptance because the model has been tested, applied and explained user behaviour (Taiwo and Downe, 2013). User acceptance of technology is about how people accept and adopt technology to use. The major purpose of technology acceptance studies is to motivate technology users and at the same time to find out challenges facing the acceptance and use of technologies ( Louho et al,2006: 15).

Helck et al (2009) state the importance of adoption of clinical informatics among medical doctors to include the need for the reduction of medical errors and improve quality of care. The acceptance of technologies in healthcare has reduce costs and increase efficiencies. Medical doctors are now using various patient-centric technologies to provide the information they need particularly when they need it (Ajamo 2013). Kijanayotin et al (2009) observe that the clinical informatics acceptance and use is one of the major determinants of effective healthcare delivery.

**The justification for using the theory**

Prior to the advent of UTAUT theory, scholars employed technology acceptance model to examine users' behaviour. However, UTAUT theory has been used in various organisational settings which include banking and health organisations. Among these works in healthcare are Holden and Karsh (2010), Ifinedo (2012), Cilliers, Stephen, and Flowerday (2013), Kijasanatoyin et al (2009), Nworgu and Adio (2014) and Williams et al (2015). All these works applied UTAUT theory in medical research. Many research works have been done in various health organisations in developed countries but there is paucity of literature on the application of UTAUT in clinical informatics research among scholars in Africa.

In addition, UTAUT has been widely acknowledged in technology acceptance model research as theoretical lens and pillars for scholars conducting researches on user acceptance (Williams et al, 2015).They argue further that UTAUT original theories by Venkatesh et al (2003) has been cited over 5,000 times with particular reference to technologies used in hospital, tax payment system and mobile technology. This assertion supported the submission of Olasina (2014) that a number of theories have been employed to describe the adoption of new technology among medical doctors

but none of them have been able to provide successful explanation on technology adoption, particularly for medical doctors. Based on this, the present study has employed UTAUT theory which is a more recent theory that accommodates other eight theories from existing models. As a result the present study will employ the use of UTAUT theory in the context of clinical informatics' access and use in Nigeria and South Africa. The theory will be used in this study sue to its comprehensiveness and high explanatory power**.**

Furthermore, Oshlayansky, Cairs and Thimleby (2007) observe that UTAUT is more robust than other technology acceptance models, particularly in evaluating user acceptance of technology. Likewise, Venkatesh et al (2003), the theory is robust because it encourages a unified theoretical opportunity for technology acceptance that has been used to explain user behaviours in a number of fields. As a result, the theory has been used in various fields, particularly when conducting adoption and diffusion studies.

Another justification for using the theory is that based on the assertion of Venkatesh (2003) that UTAUT has the highest power and capability in explaining behaviour intention and usage of technology, compared to other theories .As a result of this, the theory gives better explanation about various factors that determine behaviour intentions to adopt and use technology .The reason for this may be how UTAUT condensed the eight other theories on user's acceptance (TRA, TAM, TPB, C-TAM-TPB, MM, SCT, MPCU, and IDT) which makes the theory to be more robust and more detailed.

In addition, UTAUT is the mostly widely used theory to examine user acceptance after TAM. This assertion was supported by Marchewka, Liu and Kostiwa (2007) that UTAUT hold up to 70% of the difference in user acceptance studies and almost 50% of the technology acceptance use (Venkatesh, Thong and Xu, 2012). This high ranking of the theory gave the theory the opportunity for enhancement credence and an understanding of the theory in technology acceptance studies which will be of relevant to this study.

Also, Venkatesh, Thong and Xu (2012) note that the theory has been used in various organisations such as banking, health, education and e-government which involved various participants such as

medical doctors, nurses, bankers, computer programmers and corporate managers etc. In addition, the theory has been used in various countries such as Taiwan, USA, China, Iran and Saudi Arabia. Applying the theory to a study on health, clinical informatics access and use in developing countries healthcare system will surely expand the understanding the model's robustness in acceptance and use of technology research. The theory has being used as a base-line to the study of technologies in various organizational and non- organisational settings (Venkatesh 2012; 158).

The justification for using the UTAUT in the technological acceptance studies particularly in the context of clinical informatics access and use is due to four basic factors (Olasina,2014).

(1) It is mostly widely utilised technology acceptance based theory after TAM (Olasina,2014).
(2) It has been widely used when conducting studies on organisational adoption of technology(Marchewka, Liu and Kostiwa, 2007; 25)
(3) It has been observed that a synthesis can be accomplished when the strength of some of the most widely used models in acceptance studies particularly in explaining individual behaviour (Olasina,2014) and
(4) Baker(2011) notes that UTAUT could be employed with the strength of the healthcare framework to explain medical doctors' clinical informatics acceptance and use behaviour

Given the significant role that clinical informatics has played in effective healthcare delivery, it is very necessary that the use of technologies by various health workers, particularly medical doctors, is examined and evaluated to ensure it fulfils the purpose of implementation. Having justified the relevance and applicability of UTAUT to this the study, the current investigation is to cater for one of the research objectives which is to determine the extent to which UTAUT constructs influence the condition of use of clinical informatics among medical doctors in the selected teaching hospitals in Nigeria and South Africa.

**UTAUT: strength and weakness**

The research was to examine the application of UTAUT in clinical informatics research. The theory is the one of the most influential models for acceptance and adoption of technology by individuals in the frameworks of UTAUT (Alawadhi,2008). One of the contributions of the study is to examine

variety of factors that determine medical doctors' choice of using clinical informatics. Davis et al (1989) note that it is very important to conduct a study on the attitudes of employee, because the attitude will indicate the reason for not using the system. Based on this, the strengths and limitations of the theory will be discussed.

Wu, Tao and Yang (2008) state that the theory has a very reliable explanatory, power in technology usage which is up to 70 % higher than other user acceptance theories and the other models accounted for between 17% and 53%(Han et al,2004). With this high level of accuracy and wide application in user acceptance study, the theory is well rated among other theories and it has become a better choice for researchers that are conducting research work on user acceptance of technology. In addition, Olasina (2014) observe that the theory is a dominant theory of user acceptance, adoption and diffusion. This may be due to the strength derived from the other eight theories. In addition, the UTAUT model has been acknowledged for its ability to inform the understanding of various factors which determine the acceptance of impending difficulties facing new technology in hospital environment.

The theory has been appreciated for its ability to inform and provide opportunity to understand various factors which determine the user's acceptance of new technology. Al-Hakim(2007) notes that despite the fact that the theory is quite new in technology acceptance theories. That the theory popularity is become high with technological acceptance researchers compared to the other theories in the same class. UTAUT stability, validity and viability in users acceptance theory studies revealed that the theory is very useful in examining factors, which influence the acceptance of new technology ( Jaeger and Matterson, 2009).

The limitation identified for the theory is its inflexibility and difficulty to adapt to different contexts and situations. Supporting this, Gahtani , Hubona and Way (2007), in their research finding about ICT acceptance in Saudi Arabia, discovered that the cultural difference of the country from other countries creates a challenge for them to use UTAUT theory to examine the workers' adoption of ICT. Saudi Arabia workers' have different work-related values from workers in western countries. The difficulty in the use of the theory may be due to the fact that UTAUT was developed and tested in America and using it in another

Bagozzi (2007) observes that UTAUT is another expansion of TAM and that despite the fact that all variables that influence intention and usage are in UTAUT, the theory may not be considered acceptable because these variables are in piecemeal parts in technology acceptance. In the same vein, Gronland (2010), UTAUT is another offer from TAM which he condemns as patchwork on TAM with no integration and coordination with the model.

**Implication and application of the theory**

There are many theories that examined the behaviour of individual, professional and organisational intention to accept and use ICT among them are TRA, Combined TAM and TPB, MM and SCT. However, all of them proposed to give various explanations to ends users acceptance behaviour. The most recent and richest theory that is very useful in explaining users' acceptance and use of technology is UTAUT

There are many research studies that have applied UTAUT theory to underpin their researches either from innovation process of adopter or to examine the perceived factors influence use of ICT. UTAUT has also been applied in educational technologies, commercial products and healthcare development. However, in comparison to other sectors, the healthcare sector is lagging behind other organisations in the application and use of the theory. Chrismar Wiley-Patron (2003) observes that many medical doctors are very reluctant to use clinical informatics.

Despite the fact that the use of UTAUT is very low among clinical informatics studies. Its stability, strength, and practicability in technology acceptance in health related context is very necessary. UTAUT model is very useful for research in healthcare research because it has a very strong theoretical foundation, adequate comprehensiveness and the rigor which promote its development. The constructs of UTAUT such as performance expectancy, facilitating conditions, effort expectancy, and social influence are used to explain user intentions to the use of technology. The theory is more robust than other technology acceptance models. UTAUT works has been widely accepted in various fields with highest supports from the business, management, information system and technology

The theory has been applied in a number of industries particularly hospital environment in developed countries attempting to examine the application of the theory in developing countries is not encouraging. Many studies have demonstrated the theory usefulness across country contexts

and technology applications and revealed that UTAUT can be usefully applied through incorporation of additional factors. Application of UTAUT in clinical informatics research is a function of concepts that indicate that clinical informatics is very useful and not difficult to use for medical practices and medical doctors believes that he should use it for effective healthcare delivery. This implies that application to use clinical informatics is a function of determination and intention to use the technology. The implication of this study can be summarised as followings: UTAUT theory is a very robust technology acceptance model. The theory can be used to examine the factors that influence the behavioural intention to use technology before the actual execution.

## Conclusions and recommendations

There have been various discussions on the usefulness of clinical informatics in effective healthcare systems but limited application of theory (UTAUT) in clinical informatics research. UTAUT suggests that when users such as medical doctors are presented with a new technology for effective health care, various factors influence their decision about whether or not to accept or reject the technology. It should be of note that UTAUT theory in ICT research has been widely accepted in recent studies based on the relevant of the theory in explaining user intention and subsequent usage of technology. The theory is very strong and robust because it was based on eight previous theories of technology acceptance.

The theory has implication for policy decision in the area of clinical informatics amongst medical doctors in developing countries. A literature review of the theory will provide insights into various factors that facilitate increase in the use of the resources among medical doctors. This will enable the hospital managements, government, policy makers and others interested in the use of clinical informatics to ensure that the critical factors for the acceptance of clinical informatics are looked into and addressed particularly in the implementation process. Thus, the study contributes to the debate and development of the theory particularly concerning the importance of the theory on research on clinical informatics particularly in the content of developing countries. The study will also lead to increased knowledge of the use and adoption of clinical informatics. The study contributes to Information System research by providing insightful to literature on UTAUT. The recommendation was basically on the need to include the teaching of theoretical frame work has a

part of methodology curriculum in the universities in the continent

**Reference**


Abubakar,F.M.. and Ahamad,H.,(2013) The moderating effect of technology awareness of the relationship between UTAUT constructs and behavioural intension to use technology; a. Australian Journal of Business and management research 3(2)

Aggelidis, V. P., and Chatzoglou, P. D. (2009). Using a modified technology acceptance model in hospitals. International Journal of Medical Informatics, 78(2), 115-126.

Ajzen, I. (1991). The theory of planned behavior. Organizational Behavior and Human Decision Processes, 50(2), 179-211

Ami-narh, J. T., and Williams, P. A. H. (2012). A revised UTAUT model to investigate E-health acceptance of health professionals in Africa. Journal of Emerging Trends in Computing and Information Sciences, 3(10), 1383–1391

Bandura, A. (1986). Social foundations of thought and action: A social cognitive theory. Englewood Cliffs, NJ: Prentice- Hall, Inc

Bem, D. J., and Allen, A.( 1974) .On Predicting Some of the People Some of the Time: The Search for Cross-Situational Consistencies in Behaviour. Psychological Review 8 (6), 506–520

Bozionelos, N. (1996). Psychology of computer use: prevalence of computer anxiety in British managers and professionals. Psychological Report, 78(3), 995-1002.

Brink ,H. van der Walt, C.V. and van Rensburg, G. (2012). Fundamental of research methodology for health care professionals 3rd ed, Cape Town: Juta &Co.

Brink, H. Van der Walt ,C., and Van Rensburg, G.(2013) Fundamentals of research methodology for healthcare professionals .3rd Juta. Cape Town

Brink,H. Vander Walt,C., and van Resburg.G. (2013)Fundamental of research methodology for healthcare professionals 3rd ed.Juta and Company.Cape Town.

Chau ,P., and Hu.,P.,(2002) Investigating healthcare professionals' decisions to accept telemedicine technology: an empirical test of competing theories Information Manage 39 297-311

Chau, P.Y.K., and Hu, P.J.-H.(2002) Investigating healthcare professionals' decisions to accept telemedicine technology: an empirical test of competing theories, Information and Management (39) 297-311

Cillers,S. and Flowerday,V.(2013) Health information systems of improve healthcare: a telemedicine case study . South Africa Journal of Information Mnagement 15(1)

Davis, F, D.Bagozzi, R.P and Warshaw, P.R. (1989). User acceptance of computer technology: a comparison of two theoretical models. Management Science 35(8), 982-1003.

Davis, F.D. (1989). Perceived usefulness, perceived ease of use, and user acceptance of information technology. MIS Quarterly, 13. 35(8), 982-1003.

DeLone, W. H., and Mclean, E. R. (2003). The DeLone and McLean model of information systems success: A ten-year update. Journal of Information systems Management, 19(4), 9-30.

Esamaeilzadeh,P., Sambasvan,M Kumar,N and Nezakhati,N. (2011) UNESTCCIS 264 17-30

Evans,N.D., (2013). Predicting user acceptance of electronic learning at the Uniersity of Zululand. Phd thesis Department of Information Studies .

Fishbein, M. and Ajzen, I. (1975). Belief attitude, intension and behavior reading Massachuset Addision-Wesley

Ghalandari.,K. (2012) The effect of performance expectancy ,social influence and facilitating conditions on acceptance of e-learning in Iran :the modelling role of age and gender . Middle –East Journal of Scientific Reseach 12 (6) 801-807

Gichoya,D.,(2005).Factors affecting the successful implementation of ICT projects in government The Electronic Journal of e-Government 3(4) 175-184

Goodhue,D. L.,(1995) Understanding user evaluations of information systems, Management Science, 41 (12) 1827-1844

Grix J.(2010)., The foundations of research. London: Palgrave Macmillan.

Grondland, M.(2010) User acceptance of information technology:an empirical study of the learning. Master thesis submitted to the Department of Computer Science, Norergian, Univerity of Science and Technology

Holden, R. J., and Karsh, B.-T. (2010). The Technology Acceptance Model: Its past and its future in health care. Journal of Biomedical Informatics, 43(1), 159-172.

Hu, P. J., Chau, P. Y. K., Liu Sheng, O. R., and Tam, K. Y.( 1999). Examining the technology acceptance model using physician acceptance of telemedicine technology. Journal of Management Information Systems 16 (1) 291-112.

Ingwersen ,P., and Jrvelin,K., (2005).ACMSISIGIR Forum 39(2)

Jung S, (2008) The perceived benefits of health care information technology adoption : construct and survey development : Master thesis Submitted to Department of Agricultural Louisiana State College.

Kaplan,B., and Kimberley,D., (2009) Health IT success and failure ; recommendations from literature and AMIA workshop .Journal of Medical Informatics Association 16(3) 291-299

Kifle,M.,(2008) A telemedicine transfer model for sub –Saharan Africa. Proceedings of the 41st Hawaii International Conference in System Science

Kijsanayotin, B., Pannarunothai, S., and Speedie, S. M. (2009). Factors influencing health information technology adoption in Thailand's community health centers: Applying the UTAUT model. International Journal of Medical Informatics, 78(6), 404-416.

Kim,.H.W., and Kankahalli ,R.,(2009). Investigating user resistance to information systems implementation; a status quo bias perspective. Management Information System Quarterly 32(3)

Kuo, Y. F., and Yen, S. N.,(2009) Towards an understanding of the behavioral intention to use 3G mobile value-added services, Computers in Human Behavior, 25(1) 103-110.

Lapoinde.L ., and Rivards,Z., (2005) A multi-level model of resistance to information technology implementation .Management Information System Quarterly 29( 93)

Lewis,D., Hodge,H., Gamage,D., and Whittaker ,A., (2011) Understanding the role of technology in health information sytem.Health Information System 17

Liu,J (2013) E-learning in English classroom ;Investigating factors impacting on ESL (English as second language ) the Modular Object-oriented dynamic learning environment (Mooodle Learning Environment (Moodle) Phd thesis Lowa State University

Mahony, D.O .Wright, G. Yogeswaran and Goverance ,N (2013) Knowledge and attitudes of nurses in community and attitudes of nurses in community health centers about EMR. Journal of the Democratics Nursing Organisation of South Africa 37(1)

Marchionini, G. (1995). Information seeking in electronic environments. England: Cambridge University Press

Minton, H.L., and Schneider, F.W.(1980). Differential Psychology. Prospect Heights, IL:

Mourad,N. (2012) Perceived factors influencing acceptance and adoption of mobile technology by clinicians in practice ;A master thesis submitted to the Faculty of Health Policy and Management at the University of Minnesota

National Centre for Chronic Disease Prevention and Health Promotion(2009) .The power of prevention: chronic the public health challenges of the 21st century.

Neuman, W. .L.,(2015)Social research methods: qualitative and quantitative approach 7th ed., Pearson..Pearson Education Limited Harlow.

Neuman, W. .L.,(2015)Social research methods: qualitative and quantitative approach 7th ed., Pearson..Pearson Education Limited Harlow.

Nuq.A., and Aubert, B.(2013) Towards a better understanding of the intention to use ehealth services by medical professionals . The case of developing countries. International Journal of Health Care Managemnet 6(4)

Nwagwu ,W. and Adio ,A.(2013) Contexts of utilsation of ICT by medical practitioners in private hospitals in Osun State, Nigeria. World Jouranl of Scince Technology and Sustainable Development 10(3) 229-246

Ocholla,D.N. and LeRoux,J.(2011) Conceptions and misconceptions of theoretical frameworks in Library and Information Science research. Presented at the 6th Biennial Prolissa Conference .Pretoria 9-11, March.

Olasina,,G., (2014) Predictors of legislators ICT acceptance and use in the performance of legislative functions at the Nigerian National Assembly Phd thesis submitted to the Department of the Information Studies in the University of Kwazulu-Natal Pirtermariburg

Olasina,G and Popoola ,T.(2014) Predictors of the use of e-medicine by medical doctors. Journal of Health Medical Informatics 5 (166)

Olorunisola.A.O..(2008) Design and development of conceptual frameworks in post graduate research In Methodology of basic and applied research proceeding of a workshop .Post Grd

Oye, N. D., A.Iahad, N., and Ab.Rahim, N. (2013). The history of UTAUT model and its impact on ICT acceptance and usage by academicians. Education and Information Technologies, 19(1), 251-270

Paré, G., and Trudel, M. C. (2007). Knowledge barriers to PACS adoption and imple-mentation in hospitals. International Journal of Medical Informatics, 76(1), 22-33

Pynoo,B.,(2013) IT –acceptance by autonomous professionals: factors that contribute to successful or failure .Phd thesis. Faculty of Psychology, University of Gents,Westernscappae

Ridely ., (D) .(2012) The literature review a step-by-step guide for students 2nd ed.London,Sage.

Rogers, E.M. (1995). Diffusion of innovations (4th edition). The Free Press. New York

Schaper, L. K. and Pervan, G. P. (2008). Ict and ots: A model of information and communication technol ogy acceptance and utilisation by occupational thera- pists. International Journal of Medical Informatics, 76:S212–S221

Sepeame,, M., and Ajala., E. B.,(2013) Investigating factors affecting adoption and implementation of m-government in the South African department of home affairs: an ongoing Research. International Journal of Computer Science and Business Informatics 5( 1), 1-12.

Sun, N., and Rau,P.P. (2013).How to promote patient safety in social media; a comparison between message in social media: a comparison between messages cross-cultural design International Conference held as part of HCI International Heraklion,Crete Greece,June.

Taiwo, A., and Downe, A. (2013). The theory of user acceptance and use of technology (UTAUT): A meta-analytic review of empirical findings. Journal of Theoretical and Applied Information Technology, 49(1), 48–58.

Taylor, S. and Todd, P. (1995). Decomposition and crossover effects in the theory of planned behavior: A study of consumer adoption intentions. International Journal of Research in Marketing, 12, 137-156.

Thomas, D., Singh, L. and Gaffar, K. (2013). The Utility of the UTAUT Model in Explaining Mobile Learning Adoption in Higher Education in Guyana. International Journal of Education and Development Using ICT, 9(3).71-87

Thompson, R. L., Higgins, C. A., and Howell, J. M. (1991) Personal computing: toward a conceptual model of utilization. MIS Quarterly 15(1) 125-143

Venkatesh, V. Morris.G. Michael G.; Davis, G, and Davis, F. D.( 2003) .User Acceptance of Information Technology: Toward a Unified View. MIS Quarterly, (27) 425-478

Venkatesh, V. Morris.G. Michael G.; Davis, G, and Davis, F. D.( 2003) .User Acceptance of Information Technology: Toward a Unified View. MIS Quarterly, (27) 425-478

Venkatesh, V., and Davis, F.D.(2000). A theoretical extension of the technology acceptance model: Four longitudinal field studies, Management Science. 46 (2) 186-204.

Venkatesh, V., and Morris, M.G. (2000) Why Don't Men Ever to Stop to Ask for Directions? Gender, Social Influence, and Their Role in Technology Acceptance and Usage Behavior ,MIS Quarterly 24 (2) 115-139.

Yarbrough,A.(2007) Technology acceptance among physicians a new take on TAM. Healthcare Sciences and Services 22(89)

Yoo, S. J., Han, S. H., and Huang, W. H. (2012). The roles of intrinsic motivators and extrinsic motivators in promoting e-Learning in the workplace: A case from South Korea. Computers in Human Behavior, 28(3), 942-950.

Yunus, O.M., and Tambi,A.M.,(2013) .Essentials of research methodology