

Investigating Factors Determining the Use of the Clinical Care Module by Nurses Through the UTAUT Model

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Abstract - Nurses can be empowered in the decision making process if provided with objective diagnostic data. This research applied the Unified Theory of Acceptance and Use of Technology model to investigate the usage of electronic health systems and analyse the factors affecting the intention to use the clinical care module which supports decision making during point of care. Despite the efforts by governments, donors and international partners in rolling out electronic health systems, these systems are 'partially' or not being used by healthcare workers during point of care. The deployed applications are incompatible with nurses' routine clinical practice as they're not customized. There is need to move from using applications which solely supports capturing patients' demographic data to systems customized for clinical care practice. Semi-structured questionnaires were deployed in three hospitals to 200 nurses who have been randomly selected in maternity section. For triangulation purposes, focus group interviews have been conducted in these hospitals. Interviewees were purposively selected from respondents who completed the questionnaires. The results showed that the key constructs for use of the clinical care module in their order of importance are facilitating conditions, performance expectancy and social influence. Healthcare institutes authorities in Zimbabwe must improve conditions that facilitate the use of the clinical module. To derive value from electronic health systems being adopted, the work processes involved need to be redefined and adequate information has to be provided to healthcare workers.

Keywords - UTAUT; clinical care module; nurses; clinical care

I. INTRODUCTION

Informed decision making is made possible by merging nurses' decisions (based on the nurse's clinical experience and patient's narration) and the knowledge that informs nurses. Healthcare workers' clinical practice may be improved through the use of clinical decision support systems (clinical care module). The clinical care module is an application which aids Public Health Workers (PHWs) to make valuable decisions and to collaborate with all authorized healthcare professionals during patient point of

care [18][33]. The clinical care module allows completion of tasks electronically such as making appointments, referrals, accessing and updation of patient records, and making laboratory test requests. Decisions which can be made using the module include writing the correct prescription for the client, deciding whether to refer the case to another provider such as transferring a client to caesar ward or to make re-referral. The clinical care module also support sending of medication alerts messages and aids nurses in carrying out evidenced based care. Nurses are key decision makers and are directly involved in patient care in a healthcare set-up and hence they have to be equipped with knowledge during clinical care. Delay in patient care might be caused by lack of relevant and accurate information for decision making.

[14] pointed out that *'Healthcare involves the use and management of an abundance of information that must be collected, managed, reviewed, processed, and mined. High-quality patient care relies on careful documentation of every patient's medical and family history, health status, current medical conditions, and treatment plans. A clinical decision based on information that has been efficiently managed and processed lends itself to quality care outcomes.'*

The Ministry of Health and Child Care (MoHCC) and the hospital health authorities have managed to deploy hardware and software requirements for the implementation of Electronic Health applications together with the necessary technical expertise [27]. The District Health Information System (DHIS) has been rolled out since 2010 and the platform allows integration of other healthcare systems such as mobile health Short Message Service (SMS) and android based platforms. The DHIS has mainly been used as a tool for capturing patient details, reporting disease surveillance statistics (reporting and analysis needs) by the Health Information System (HIS) personnel and the administrative healthcare authorities. This platform does not have the clinical care module functionality [29]. The

Electronic Health (E-Health) projects rolled out do not offer the clinical services module to aid clinicians during decision making and this has been a trend even in mHealth projects deployed in South Africa [30][35]. The MoHCC also piloted a SAP healthcare solution application at Chitungwiza Central Hospital which is mainly being used as a patient records management system (patients' demographics, and billing purposes). The SAP healthcare solution supports management of patient demographics data, billing of patients and maintenance of clinical records; provides real-time access to relevant patient and clinical information at the point of care; and improves care collaboration [22]. Irrespective clinical care delivery module SAP Healthcare solutions a support, the module is not being by nurses, they're are using the software for management of patient's information [28]. The focus of this research is to relate the UTAUT model to the use of the clinical care module in E-Health projects deployed in Zimbabwe since this might result in improved quality care. The unified theory of acceptance and use of technology (UTAUT) model was used to determine the intention to use the clinical module by nurses without compromising workers' performance and to explore the usage of E-Health systems by nurses. Technology adoption will not improve a firm's competitiveness unless the adopted technology ends up being used [13].

II. BACKGROUND

The MoHCC (Zimbabwe) is supporting health information technology by deploying DHIS and SAP Healthcare solution applications in hospitals and there is need to harness the clinical services module during clinical care delivery. Adoption and use of the clinical module is important for value addition in the healthcare system. This study applied the UTAUT model to investigate the factors that affect the use of clinical care module in deployed E-Health applications and the use of the applications. The DHIS platform is mainly used by the Health Information System (HIS) department in all districts where it has been rolled out. Nurses do not have direct access to patient's information on this platform. The Health Information System (HIS) department personnel such as clerks are the ones with authorization rights to use the system for capturing and retrieving patient information. Nurses obtain patient information upon request to the HIS department personnel who are responsible for accessing the DHIS. There has been adoption of these systems but they are not being used at all (or 'very little use') by nurses in clinical practice [29].

Most researches focused on the factors affecting adoption and diffusion of E-health systems while applying the UTAUT and TAM models. In addition, several studies hinged on adoption and use of IT in healthcare and how to deploy mHealth projects, while little attention has been given to the use of the clinical care module in E-Health applications adopted and used [1][25][34]. However, this research focuses on the use of the clinical care module in applications rolled out and to explore the extent of usage of

projects deployed by nurses. The UTAUT model has been applied in Health Informatics researches but little or no research has been made on the UTAUT model as a tool for ensuring the use of the clinical module of nursing [19]. The use of the clinical care module might result in improved quality care.

III. LITERATURE REVIEW

Improving health outcomes such as access to high-quality healthcare is important for national development and can be achieved through a more effective health force [21]. Nurses' work processes need to be explicitly defined and avoid overlapping. Inter-linking of processes and having good processes results in IT complementing the work processes [2]. The clinical module of nursing is a decision support application designed to improve nursing care [5]. These applications are used in a variety of ways by clinicians such as documentation of patient information, monitoring patients' progress and validating decisions made using paper-based clinical notes [7].

A. The UTAUT Model

The UTAUT model is behavioural factors centric and focuses on four constructs namely: performance expectancy, effort expectancy, social influence, and facilitating conditions to give an overview of problems related to Information Systems/Information Technology (IS/IT) adoption and diffusion. The UTAUT theory was adopted in this research since it mapped and integrated opportunities of eight dominant theories and models including the Technology Acceptance Model (TAM) [32]. Validation and the use of the UTAUT model has been done to investigate diffusion and use of E-Health [1][24][34] while this research applies the UTAUT model to investigate the usage of E-Health systems and determining the factors affecting the intention to use the clinical care module.

Performance expectancy is defined as the extent to which using a technology will provide benefits to nurses in their work processes; effort expectancy is viewed as the degree of ease-of-use of technology by nurses; social influence is the extent to which nurses perceive that local health authorities, the MoHCC, patients and other stakeholders believe they should use the clinical module; and facilitating conditions refer to nurses' perceptions of the resources (ICT infrastructure) and support needed and available to use a technology [3][31]. The UTAUT model has four moderators that influence the perception of the four constructs of the model namely gender, age, experience, and voluntariness of use which are applied in this research [16][31]. UTAUT model constructs were applied to ensure use of the clinical care module. [6] coined that '*Emerging information technology cannot deliver improved organizational effectiveness if it is not accepted and used by potential users.*'

B. District Health Information System (DHIS) and Systems, Applications and Products in data processing (SAP) Healthcare solution

The DHIS is a useful tool for the collection of aggregate health data from all levels of healthcare which is transferred to national server. The analysis of data collected and reports generation is based on national indicators. The challenge with DHIS data is the ability to follow patient cohorts, for which an Electronic Health Record (EHR) should be used. Most EHRs have a functionality which aids in decision making and this concept has to be applied to E-Health systems deployed. EHRs have an integrated view of the patient across health facilities and a Master Patient Index (MPI) for cohort analysis. The use of the clinical module seems to be lagging behind in healthcare institutions, while its use might result in best practices [15][17][30]. New technologies are sometimes adopted and then used very little or not at all [14]. The DHIS is being used by HIS department staff but do not have the clinical care module functionality.

SAP Healthcare solution is SAP's IT software for the healthcare industry. The SAP healthcare solution supports management of patient demographic data, billing of patients and maintenance of clinical records; provides real-time access to relevant patient and clinical information at the point of care; and care collaboration [22]. An integrated system consists of grouped functionalities called modules thus both DHIS and SAP Healthcare solution consists of modules [4][10]. DHIS consists of modules but do not have a module specifically tailored to provide clinical decision support solutions while the SAP Healthcare solution has this functionality but the module with this functionality has to be bought as part of the package. The clinical module supports capturing of patient demographic and clinical health information, clinical decision making and sharing of information between authorized healthcare entities and assist in direct patient care and can be linked with other systems from other sections such as the laboratory and pharmacy [26].

IV. METHODS

The Mixed method approach was employed with the use of questionnaires for numerical data collection and narrative data collection which was mainly done through the use of focus group discussions. 200 nurses in maternity section were randomly selected from three health institutions and have been given questionnaires. 176 nurses returned the questionnaires giving us a response rate of 88 percent. Three FGDs have been held with purposively selected respondents of six on average from each health institution. The interviewees mainly consisted of healthcare workers who completed the questionnaires. The selected hospitals have been selected as pilot sites for implementation of Electronic government projects in healthcare sector. A Sequential Explanatory Design was used, thus the use of

questionnaires followed by FGDs for triangulation purposes [12]. The research focused on investigating the factors affecting use of the clinical care module in perinatal care services. Data was analysed using Statistical Package for the Social Science (SPSS) and the UTAUT constructs tested are performance expectancy, effort expectancy, facilitating conditions, and social influence using descriptive statistics. Thematic analysis was used to analyse data collected using Focus Group Discussion (FGDs). The results were later on merged with the identified statistical relationships from questionnaire data and then interpretation was done. The clinical care module was described to nurses as an application which aids nurses to make informed decisions during patient care.

V. RESULTS AND DISCUSSION

A. Participant profile demographics

Health institution A constitutes 36.4 percent, B 36.9 percent, and C 26.7 percent of the respondents. The median experience was more than 5 years and the median age is 38 years. The majority of the respondents (71.0%) are registered general nurses with midwifery.

B. Mobile devices and applications used

SAP Healthcare solution has the clinical care delivery module which is not being used by healthcare workers since the module was not part of the package when the solution was bought. In addition, the healthcare solution platform was not customized to suit user requirements. There is need for integrating the clinical care module with the DHIS and the SAP platforms since there is a potential to improve care processes and patient care outcomes.

Users of applications such as Google Play store, Whatsapp and Facebook have a more positive perception of the use of technology in comparison to the non-users as they already have experience in computer use. At work PHWs generally use desktop applications while at home 98% use mobile devices to access the internet hence there is need for use of mobile devices such as tablets, laptops at when carrying out clinical activities.

There is need for integrating the DHIS with the nurses' work processes to improve patient care (avoid delay in patient care) and this can be achieved through a clinical module for nursing. For example blood tests might be sent to a laboratory where it will take three or more days to receive the results which results in delaying patient care, hence a link with laboratory services is important to receive the results as soon as they have been processed. PHWs had the opinion that there is need for employing more specialist doctors to avoid unnecessary delays as they also provide informed decisions such as referring patients to appropriate wards. Resources such as personnel, drugs and instruments, etc. for respective departments are essential for good

processes to be in place and then complement them with a clinical module for nursing. The customisation of the clinical module for nursing has to involve users' requirements analysis so that the healthcare workers will not worry about issues such as security, for example, through sharing of summarized clinical notes with authorized healthcare professionals thereby supporting confidentiality [9].

The MoHCC authorities and the hospital's Chief Executive Officers support the deployment and use of healthcare applications by nurses. PHWS concurred that the MoHCC and the local health authorities expect them in using the clinical care module since they have already deployed the DHIS and SAP Healthcare solution and are partnering with local mobile network operators, software development houses and international partners such as European GSM networking companies [8].

Nurses agreed that the use of the clinical module for healthcare processes is useful in their jobs and will augment the accomplishment of tasks more quickly, for example, the hassle of searching a patient file is eliminated. In general, the use of healthcare applications directly linked to patient care was applauded as it was suggested it simplifies documentation of patients' outcomes, reduces medical errors and promotes quality care outcomes [32].

C. User requirements analysis

There is lack of user training since maintenance of clinical records is not comprehensive (medical history is either missing or missing), which results in fear of exploring new concepts by nurses as this might result in errors such as inaccuracy of patient records. The project leader of the company which deployed SAP for Healthcare solution confirmed that users were not trained on use of the clinical care module and its customisation to suit specific wards work processes was not done. Even though other modules of the SAP Healthcare solution are being used, the clinical part might not be user-friendly to nurses. The IT staff is using the platform for capturing patient data rather than supporting nurses in using the system. The use of the clinical module for nursing must actually be done by nurses while the IT staff gives support [11][23]. Effective use of the patient demographic information module will result in easy deployment and use of the clinical care module. The clinical module becomes obsolete as there is no proper user centred requirements gathering exercise hence nurses might protest against the use of the solution as they feel they were not involved and the application is not user-friendly. User requirements gathering is essential for successful deployment of an application. Installation and training of users is essential after deployment of the application. This must be followed by a transition phase of familiarizing with the new system and then data migration will be done by the healthcare workers while the consultants and IT staff play a monitoring role to address any challenges. The consultants

must gradually withdraw their support unless there is need for help. The IT staff must provide support only where necessary while software providers must address major challenges which can be beyond the scope of the IT personnel [9][20].

D. UTAUT constructs outcomes

The UTAUT model was used to measure the variables facilitating conditions, performance expectancy, attitude towards the use of the platform, social influence and effort expectancy. To measure internal consistency (reliability of a series of items), Cronbach's Alpha technique was used and obtained a coefficient of 0.763 which matches with the acceptance benchmark of at least 0.70 [31]. On average, the variable performance expectancy resulted in a mean of 4.227 and a standard deviation of 0.923, social influence resulted in a mean of 4.19 and a standard deviation of 0.849, effort expectancy resulted in a mean of 4.09 and a standard deviation of 0.919 and facilitating conditions resulted in a mean of 3.803 and a standard deviation of 1.351. The results from the three constructs performance expectancy, social influence and effort expectancy show that respondents had a common opinion (95% Strongly Agree) while on facilitating conditions respondents had varied opinions.

95 percent strongly agree that the use of the clinical module is easy since there will be training of users before the use of the system and 'some' of their colleagues are already using desktop applications (DHIS/SAP Healthcare solution), thus they have the necessary skills in using healthcare applications. ICT professionals will be helpful in training them on how to use health informatics products and services though the PHWs feel that some nurses must be trained as IT Experts who reside in wards where the applications run rather than being dependent on the HIS Department personnel. The nurses must be trained to acquire certificates, diplomas or degrees in the Health Informatics field to directly support their work processes. The course in IT must be implemented in nursing curriculum and even during their post basic education.

10.2 percent of the respondents were male and all concurred to the use of the clinical module during patient care while 80.28 percent of females had the same notion as men. This conforms to previous researches that men perceive usefulness of a technology more than women [1][19]. 66.5 percent of the respondents had the qualification Post Basic Diploma of which 33% of them agree and 55.7% strongly agree to use of the module by nurses. Health workers who are above the age of 43 proved not to easily adopt and use clinical decision support systems as they felt it might exert pressure on how they normally carryout their duties, thus showing the element of resistance to change. Middle aged to younger generations who have the passion to learn and have higher social status tend to use a technology early compared to the elderly as proved by other researches Nurses with an experience of at least 2

years had a positive attitude towards the use of technology [19][34].

VI. CONCLUSION

The UTAUT model constructs predicted a moderate to high level of user acceptance and use of the clinical care module. The principal factors that affect the use of the clinical care module are facilitating conditions, social influence and performance expectancy. Healthcare institute authorities must improve healthcare staffs' performance expectancy towards use of the clinical care module and facilitating conditions for use of the platform. The clinical module has to be used as a blue-print for decision making though a clinician must give the final recommendation based on experience. Training of both nurses and HIS personnel is essential for the use of the clinical module after conducting thorough user requirements analysis. The system must have comprehensive patient data unlike the current platforms which have basically demographic data which is incomplete and do not have the clinical notes and other patient medical details. Nurses must be trained to attain professional courses in Nursing Information System related qualifications. Time taken while documenting patient profiles and other related information must be benchmarked not to conflict with daily work processes operations. Management buy-in (MoHCC, hospital Chief Executive Officers and Medical Superintendents) might result in successful implementation and use of the applications as they craft policies and strategies for the use of the clinical module [2].

Teamwork of all parties concerned is important such as the project manager of the consultancy firm delivering the SAP healthcare solution and the project manager of the healthcare institute thus creating the spirit of ownership and total commitment. Key decision makers must be role models in the use of the technology thus encouraging their subordinates. In future other Technology Acceptance Models can be blended with the UTAUT model to ensure full utilization of Clinical Decision Support Systems. There is need to explicitly apply the UTAUT model for the use of the clinical care module in perinatal care services as a software solution while the clinical areas are assessed and benchmarked for improving work processes.

The users of the system must be able to use it with ease and the applications must not be technically user centric, otherwise the platform must provide a detailed user manual. The customisation of applications must be in terms of patients' characteristics (such as age, gender and experience) and societal values centred and to match their level of aptitude (users of the system). Healthcare personnel needs to be trained and receive refresher courses on the clinical module applications upgrades and deployment of new programs as this might help in reducing resistance to change. The necessary infrastructure for rolling out of HIS is important and also government policies and regulations

concerning the use of decision support systems, needs to be considered.

E-health applications are partially used by healthcare workers. Midwives do not have direct access to the DHIS application, they only get patient information they need from the HIS department staff. The midwives need to be authorized to use the system independently in wards since the HIS department closes at 5pm while wards are open 24/7. Nurses who are using the SAP Healthcare solution are making use of it for patient demographic data. There is need for value addition on the DHIS and SAP Healthcare Solution for the use of the clinical care module of nursing. The E-Health maturity model need to be applied for use of mobile devices during clinical healthcare delivery with the aid of the clinical care module and strategies have to be explored for reduced transition period between phases up to the transaction and transformation phases. In addition, a study on how clinical decision support systems can be simulated to reduce delay in healthcare delivery (patient flow) has to be done.

ACKNOWLEDGMENTS

I would like to acknowledge my academic supervisors for their inestimable guidance and encouragement and for consistently being a source of reassurance and support. I would also like to thank the Medical Research Council of Zimbabwe and the Ministry of Health and Child Care (MoHCC) for their approval to carryout research in health institutions. My gratitude also goes to authorities and participants in the hospitals which took part in this study for giving their time despite having busy work schedules. Special mention goes to Mr. T.G Rebanowako for assistance with language editing.

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