Imperative of Health Informatics in the Transformation of Health Care System in Nigeria

[1]Jamila Mohammed Dahiru, [2]Chinwe Comfort Chinanu-Akpuh & [3]Bilkisu Mohammed Bello

[1]Department of Mass Communication Ahmadu Bello University, Zaria, Nigeria

[2]Department of Mass Communication, Babcock University, Ilisan-Remo, Ogun State

[3]Department of Computer Sciences Federal Polytechnic Kaduna

Abstract

The study analytically presents the importance of health informatics for healthcare delivery in Nigeria. Drawing inferences from extant literature with specific reference to Unified Theory of Acceptance and Use of Technology, it was argued that acceptance and application of health informatics is key to the transformation of healthcare delivery system in Nigeria. Such initiative should not only be accepted, but be adequately communicated, using appropriate channels of communication suitable to diverse communities of the Nigerian society.

***Key words**: Health Informatics, Transformation, Health Care Delivery and Health Care System*

Background to the Study

Coined in 1957, Health informatics is a branch of information and computer science that focuses on the study of information processing, particularly with respect to system integration and human interactions with machines and data. It is broadly defined as the intersection of information and communication management in medicine and healthcare dealing with resources, devices and methods required to optimize acquisition, storage, retrieval and use of information and communication in health and biomedicine (Sullivan, 2001; Dinya & Toth, 2013). Applied in the areas of nursing, clinical care, dentistry, pharmacy, public health, occupational therapy, and (bio) health research, it is safe to say that

Information and Communication Technology (ICT) has become a tool in service delivery and has had a revolutionary impact on how we live and perceive the world (Barry, 2008). Consequently, Idowu, Comfort, andBastin (2008) state that ICT touched every aspect of our life giving birth to the contemporary "Es": e-learning, e-commerce, e-governance, e-banking, e-shopping and e-health which is the primary focus of this research.

A drastic shift is observed within the global healthcare arena, with the purpose of maximizing the contribution of Information Communication Technologies, otherwise perceived as health informatics,for theimprovement of the quality of patient care. Scientific statistics indicated varying success stories and acceptance of health informatics within developed nations like Europe, America, and Oceania. Furthermore, extant and empirical studies revealed moderate take-off in some developing countries(Idowu, et al.,2008; Essler, Stavrou & Riodan, 2004).

Aligning with the trend and potential of health informatics crusade, the Nigerian government initiated a National Strategic Health Development Plan for her Universal Health Coverage by 2020towards transforming its health sector into an efficient one, ensuringsustainability and achievingthe country's target of universal health coverage by 2020 as well as complementing the Universal World Health Organization's guideline on e-Health strategy development plan. The priority areas include National Health Management Information System (NHIMS) of which Health Informatics is a part (FMH, 2014). The recent economic policy also stated under section seven (7) the aim to strategisee-Health to effectively link specialized hospitals with the rural health care units via telemedicine and mobile health. The National Information Technology Development Agency (NITDA) in its ICT policy for development called ICT4D Strategic Action Plan includes ICT for health towards achieving national development via adoption and use of technologies in the country. Based on the initiative, this study analytically presents the importance of health informatics for healthcare delivery in Nigeria, the expected benefits of this approach to the country's health system, associated

development, established policies, the extent to which the policies have been implemented, and its challenges to ascertain whether there is a striking balance between the expected benefits and the practical conditions of health informatics for healthcare transformation in Nigeria. Specifically, the study has the following objectives: To discuss

1. the importance and benefits of utilizing health informatics for healthcare delivery in Nigeria.
2. the associated development, established policies and the extent to which the policies have been implemented towards achieving use of health informatics for health care transformation in Nigeria
3. the challenges of utilizing health informatics for healthcare transformation in Nigeria.

Methodology

This study is a discussion paper which uses findings from other studies conducted on health informatics to situate a grounding on the benefits of use of health informatics for health care delivery.The associated developments and established policies as regards use of health informatics in the Nigerian health sector are also established from related reports and empirical studies. Drawing inferences from the assumptions of the Unified Theory of Acceptance and Use of Technology, the study also driveshome the significance of health informatics for health care transformation and effective health care delivery in Nigeria.

Nigeria's ICT for Health Enabling Environment

The Nigerian government through its Federal Ministry of Health (FMOH) expressed interest to strategically and systematically use information and communication technology (ICT) to improve its health sector. In support of the Nigeria FMOH, the United Nations (UN) Foundation, Government of Norway, GSMA and other key partners in Nigeria are working together to leverage ICTs for health (Health Informatics, electronic health, or e-Health). This was based on the realization of the potential of ICTs to improve health as recognized by both the public and private sectors with evidence of success of ICT for health initiatives globally. The

WHO-ITU Toolkit describes a framework for stages of development of the national ICT for health enabling environment and Nigeria is considered to be transitioning from ‘experimentation and early adoption’ to ‘developing and building up stage (UN, 2014).

Based on the WHO, ITU Toolkit (2012), countries at the developing and building up stage are directed to strengthen existing systems, ensure that guidelines and policies are in place and enforced, and to establish funding and planning mechanisms for full transition of the enabling environment and long-term success for health information technology take off in their countries.

Given the multidisciplinary nature of digital health, the FMOH and Federal Ministry of Communication Technology (FMCT) each play important roles in its governance. The Nigerian health care system is divided into primary, secondary and tertiary levels. Local government areas (LGAs) are responsible for primary health care; States oversee secondary care facilities, and the federal government is responsible for tertiary health care. In addition, the federal government, through the FMOH, provides high-level health sector leadership and is responsible for the overall strategic oversight for healthcare in the country.

The FMOH, which is headed by the President-appointed Honorable Minister of Health, has ten departments and six agencies through which it carries out its functions. They include departments of Health Planning Research and Statistics (HPRS), Public Health, Health Services, National Health Policy Development Agency (NHPDA), National Agency for Food Drug Administration and Control (NAFDAC), National Agency for the Control of Aids (NACA), National Health Insurance Scheme(NHIS), National Institute for Medical Research(NIMR), National Institute for Pharmaceutical Research and Development (NIPRD),Subsidy Reinvestment and Empowerment Programme – Maternal and Child Health (SURE-P MCH), and Office of Special Assistant to the President on the Millennium Development Goals

(OSSAP-MDG) (Nigeria National Information and Communication Technology (ICT) Policy [Draft], 2012)
Established in 2011, the FMCT oversees ICT-related policy formation, implementation monitoring and evaluation, as well as the supervision and oversight of most government ICT-related projects and initiatives in Nigeria. The FMCT seeks to improve infrastructure, optimize use of existing resources and build capacity. Similar to the FMOH, the FMCT exerts its operations through its departments and agencies which include Department of e-Government, Galaxy Backbone, National Information Technology Development Agency (NITDA) Department of Planning, Research and Statistics, Universal Services Provision Fund (USPF), and Nigerian Communications Commission (NCC) Nigerian Communication Satellite (NIGCOMSAT) ((Nigeria National Information and Communication Technology (ICT) Policy [Draft], 2012).

Beyond the departments and agencies listed under the FMOH and FMCT, there is the National Council on Health (NCH) and the National Planning Commission. The NCH serves as an advisory board on health issues and will become the highest policy-making body for healthcare in the country upon passage of the pending National Health Bill. In 2013, the NCH issued a mandate for the routine reporting of data from all primary health facilities into the national data warehouse administered by the FMOH Department of Health Planning, Research and Statistics (DPRS). The National Planning Commission, which reports directly to the President, is responsible for setting national priorities and goals and engendering consensus across government agencies.

The burden of financing health care services is borne by individual households who typically pay out-of-pocket for their health care (GSMA mHealth Country Feasibility Report: Nigeria, 2014). Two funding schemes have been proposed which are through the NHIS and the National Health Bill to help address shortages in funding and serve as long-term funding mechanisms for ICT for health. The National Health Insurance Scheme, in particular, is most relevant to teaching hospitals, given its focus at the Tertiary Health

level (Sustainable Financing for Mobile Health (mHealth): Options and opportunities for mHealth financial models in low and middle-income countries, 2013).
The ICT for health workforce consists of health workers who are trained to use ICT systems and ICT workers who are skilled at building, implementing, maintaining, and scaling up these systems along with the infrastructure required to support them. The federal government is committed to capacity building within the ICT and related sectors. A means to carry out capacity building is through formal institutions (i.e., schools, continued education). Institutional capacity training for trainers and trainees alike were said to be strengthened. Core competencies were established and integrated into a training curricula.

Infrastructure (physical infrastructure such as connectivity, electricity, hardware, directory services and software components like, electronic health records (EHRs)/electronic medical records (EMRs), health information datasets) that contribute to the ICT for health enabling environment were provided especially in all the Nigerian teaching hospitals. The telecommunications sector in Nigeria has undergone significant growth. Over 62% of the population has access to a mobile phone and there are over 173 million mobile phone subscriptions. While broadband subscriptions remain low, forecasting indicates that such services will become more affordable. Through the Galaxy Backbone initiative, a national fiber optic backbone (for broadband) will be present in even the most rural areas of the country so as to ensure connectivity of health information technology.

Although the public and private sectors are taking steps to improve infrastructure related to ICT for health, a digital divide exists between rural and urban areas. There are high costs to both consumers and corporations; to consumers the costs are in obtaining services and for corporations, expanding services is costly. Incentives should be identified to promote expansion of affordable services to rural areas. Also, sustainable health financing mechanisms should be established and a sub-set flagged for the improvement and maintenance of facilities, power, Internet

and other infrastructure (GSMA mHealth Country Feasibility Report: Nigeria, 2014).

Services and applications which refer to the actual ICT tools and systems used in the delivery and administration of health in Nigeria is also considered. ICT Services and applications consist of individual electronic health information, health care communications and collaboration, healthcare service delivery, health information and knowledge and healthcare management and administration. Projects in Nigeria span all of the aforementioned uses. Specific examples of types of tools include hospital-based EHRs, decision-support tools, disease surveillance tools, patient monitoring and care and distance learning applications. The concurrently published report, "Assessing the Enabling Environment for ICTs for Health in Nigeria: A Landscape and Inventory", described 84 ICT for health projects at varying levels of scale and technological maturity (UN, 2014).

Most e-Health services in Nigeria are SMS-based, data applications, pre-loaded applications or accessible through web-based portals. Furthermore, there is a precedent for national coverage as 22 of the initiatives reported nationwide coverage. Moreover, most states have more than 20 on-going ICT for health implementations. These efforts combined show the efforts of the federal government towards improving the health sector of the country towards attaining a healthy nation.

Theoretical Framework

The study is anchored in the Unified Theory of Acceptance and Use of Technology.The Unified Theory of Acceptance and Use of Technology (UTAUT) is an outcome of reviews, consolidation, incorporation, and testing of variables of eight famous theories and models in diverse disciplines that have previously been employed to explain information systems usage behavior or users' technology acceptance to simplify the understanding of factors impacting the acceptance and use of information technologies (Venkatesh, Morris, Davis,& Davis, 2003).The Theory posits that there are variables related to the behavioral intention to use

information technology or to the actual use of information technology. These variables could be grouped into four categories which are:

1. Performance Expectancy, which is from an individual context, represents the extent to which using a technology will enable users to improve their job performance. In other words, it is the degree to which an individual believes that using the system will help him improve job performance.
2. Effort Expectancy, which is from the system context, represents the degree of ease associated with the individual's use of the system/technology. This is regarded to be of great concern to users during their initial use of the system.
3. Social Influence has to do with the level of influence exerted by the individual's social settings which could influence his/her intention towards using the technology. In order words, it is the degree to which an individual perceives that important stakeholders believe he or she should use the new system. Social influence is believed to be one of the constructs that directly influence intention to use technology systems application.
4. Facilitating Condition is about organizational context which emphasizes any organization's influence or support on one's information technology use. It represents the level of support and infrastructure present in an organization, which could enable system adoption or usage (Or et al., 2011; Legris et al., 2003).

Further, the theory posits other constructs including gender, age, experience, and voluntariness of use which the more profound of the theory believe can moderate the impact of the four key constructs on usage intention and behavior. These additional demographics are said to also have an impact in the way a user accepts and usesa new technology (Venkatesh et al., 2003).

The Unified Theory of Acceptance and Use of Technology is adopted for this research being that it is relevant in explaining the reasons of the increasing the adoption and integration of technology into all sectors such as business, education, and health.

The Nigeria government worked to ensure availability and implementation of health informatics in its health sector. Based on the discussions so far, this study therefore agrees that constructs such as social influence and facilitating conditions are related to use of health informatics for the health care transformation in Nigeria. According to this paper, performance expectancy is the extent to which Nigerian government believes that using health informatics will improve the country's health care delivery and hence it worked hard to ensure it is included in its health policy drive. Social influence and facilitating conditions werealso found to be present looking at the level of influence and support (health informatics infrastructures provided for in the Nigerian hospitals) exerted by the government and hospital managements towards adoption and usage of health informatics.

Imperatives of Health Informatics for Health Sector

The advent of ICT in many developing countries can be linked to international organizations (such as World Health Organisation, World Bank, United Nations Development Program, etc.), research institutes and educational institutions (Braa & Nermunkh, 2000). The Nigerian history of ICT can be traced to the 1950s when electronic and print media were formed, although it suffers a little progress until in the early 90s when the National Broadcasting Commission (NBC) and Nigerian Communication Commission (NCC) came into existence. They brought with them the development of some wireless telephone operators paving ways for ICT to prosper in the country. It is therefore evident that Nigeria, since then, has significantly improved in terms of ICT adoption and usage almost in all of its sectors. Another key factor for ICT adherence in the country was with the establishment of National Information Technology Development Agency (NITDA) in 2000 to see to the implementation of proper ICT policy in Nigeria (Dahiru & Ozohu-Suleiman, 2019).

In the health sector, benefits of health information technology are evident from the healthcare management and personnel to the patients as well. According to O'Carrol et al. (2003) and Remlex, (2007) as mentioned in Idowu et al. (2008), Health management

and personnel, the ICT's for health can help reduce the cost of running hospitals; introduce potential sharing of patient files easily without threats to patients' privacy, use for hospital management such as admission and appointment;improve the efficiency of medical personnel by reducing waiting time, minimize paper works where information is available to personnel in an easily readable form. With it also the results of patients test are easily updated and decision support for practitioners.

On the other hand, the patient's benefits from use of ICT include: assisting patients to locate the health facility and personnel, giving 24-hour access to health information through encryption, ensuring that patients' data are confidential through password protection, and improvingdelivery and effectiveness of health services through disease management and patient safety. According to Bath (2008), Health information technology can:

i. Transform the delivery of healthcare of patients by aiding easy and effective communication and storing medical data for patient management and diagnosing.
ii. Assist in defining strategies by health care and information professionals, health service managers and planners to drive down healthcare cost in terms of paper use, transfer and access to information.
iii. Help in disease management through research and teaching and in improving patient safety and decision support for practitioners.
iv. Help reduce clerical work required of professionals, help avoid redundancy and allow access to centralized patient care data.

Challenges to Use of Health Informatics

From the foregoing, the use of health informatics by health practitioners can improve health care delivery; however, the gains will only ensue when workers have increased access to these technologies. One of the central factors identified for computer skills among physicians is ownership of a personal computer and access to the Internet for better information-handling, knowledge and favorable perception of the system. Studies on the accessibility of IT among health workers indicate the difference between

developed and developing world. Skills and utilization of ICT among health students as well as healthcare providers in developing countries such as Nigeria compared to advanced countries are also poor.

William (2005) explained that the challenges facing informatics are the need for standard structures for representing biomedical knowledge patient data, people who can certify that products are in compliance with various standards, a payer system with incentives for installing the informatics infrastructure for people to use it, and the need for new skills such as data-driven practice improvement to perform well in this new environment. Similar to thesechallenges mentioned in a baseline survey on ICT penetration and usage in Ethiopia (Ministry of Finance and Economic Development (MFED) of Ethiopia, 2006) are lackof necessary equipment (accessories) and absence of ICT strategic plan as the challenges to use of health informatics.

Bath (2009) and Anderson (2013) listed 8 barriers to use of health informatics in developing countries which include investment required to develop health, implement and maintain e- health initiatives as the major one; health professionals and managers' scepticism about such developments, particularly when they are satisfied with current methods of working and wish to maintain the status quo, perceiving such initiatives as diverting financial resources away from under-resourced clinical care; individual and shared feelings about perceived value of IT systems; resistance to the development of ICT systems by health professionals and managers; greater concern on security measures incorporated into the design system (threats to patients privacy and confidentiality of data); lack of financial support; high initial costs; and fear of quality within the health informatics.

According to Idowu (2015) cited in Dahiru and Ozohu-Suleiman (2019), there are seven challenges of successful implementation of health informatics in Nigeria. The challenges stemmed from three factors: people, government and ICT infrastructure. The obstacles identified are 'epileptic' electric power supply, government's attitude, cost of ICT peripherals, telecommunication, internet

connectivity, resistance to new technology and lack of maintenance culture.

Review of Previous Studies

Odusanya and Bamgbala (2000) found in a Nigerian teaching hospital that computer and internet use by first year clinical and nursing students was only 43% and only 23% had used the Internet for health research. This is similarto what Ojuwan, (2003) found in Ethiopia that only 33% of the health workers use computers for various purposes.Access to the computer by health students in Africa is also reported low when compared to the developed world. A study in the MUCHS, Tanzania, by Jens (2004) showed that health student to computer ratio is 100:1 when compared to 35:1 in Portugal, 9:1 in the UK and 5:1 in Norway. This figure is in stark contrast with Samuelet al.'s (2004) study on the availability of computer at home which is 71.7% in Aarhus and 86% in Denmark, California, and USA against 76% of MUCHS students. Similar to this is a study conducted in Ile Ife University Teaching Hospital, Nigeria which showed that only 26% of the respondents owned a computer.

Asurvey study conducted by Bello, Arogundade, Sanusi, Ezeoma, Abioye-Kuteyi, and Akinsola (2004), on the knowledge and utilization of information technology among health care professionals and students of University Teaching Hospital in Ile-Ife, Nigeria among 180 healthcare professionals and medical students, found that 80 respondents (54%) reportedly had received some form of computer training and 77.7% of the respondents demonstrated knowledge of computer even though a majority of them did not own it. There was also good attitude (39.9%) and utilization habit (33.8%). The study also found variation among the knowledge and attitude of computers among different departments wherethe doctors were better than the record officers who are supposed to be better by having only 4.3%. Hence, the study signifies that good knowledge of computer and IT leads to sub-optimal utilization pattern. The fact that the health records officers by virtue of their profession had better training opportunities did not translate into better knowledge and utilization habits, hence the

need for a more structured training, one which would form part of the curriculum.

Mohammed, Andergie, Meseret, and Girma (2013) also conducted a quantitative cross-sectional study among 304 health workers selected using stratified sampling technique from all governmental hospitals in Addis Ababa to test their knowledge and utilization of computer in health. Their study found that computer knowledge and utilization habit of health workers is very low and access to computers and delivering training on the use of computers for workers to facilitate the rate of diffusion of the technology to the health sector is necessary. Significant predictor variables were average monthly income, job satisfaction index and computer possession. It also indicated an association between computer knowledge/skill and health care delivery competence. So far, this study goes in line with the area of this research owing to the fact that both are about knowledge and utilization though theirs is about ICT in general; the fact that health Informatics is specific to health sector makes this study more relevant. Similar to their method of sampling, this study also use stratified sampling technique being that this research aimed to compare between specializations. Although the location of the study varies with Nigeria in terms of technology advancement, its findings are a strong indication of the potential benefits of using technologies for health care delivery in terms of communication and information and that knowledge and utilization of those technologies are significant for effective work delivery.

Another survey study conducted in an out-patient clinic of Children's Cancer Hospital (57357) Cairo by Daniel and Oyetunde (2013) on informatics system revealed a significant difference between knowledge of nursing informatics system according to total practice and total attitude of nursing informatics system. Although the study aimed to compare knowledge and attitude rather than the focus of our research which is utilization, their study concluded that nurses are responsible for a substantial part of the patient record and hence are particularly affected by the computerization. The applicationof an information system into

nursing provides important advantages of the nursing personnel's data and contributing to the improvement of the operating effectiveness of the nursing service. This also is to emphasize the importance of knowledge of health informatics for effective healthcare delivery particularly the role it playsin nurse's work. The fact that this study focused on medical doctors against their study is for the recognition that health informatics is also very relevant to medical doctors.

Similarly, a cross-sectional study on knowledge and utilization of computers in Ethiopia by Alwan, Awoke and Tilahun (2015) was conducted among 554 health professionals working in 7 hospitals, 19 primary health centers, and 10 private clinics to determine the level of knowledge and identify determinants of utilization of information communication technology.The findings revealed that, out of 482 (87.0%) of the response rate, 90 (18.7%) demonstrated good knowledge of computers while 142 (29.5%) demonstrated good utilization habits. Health professionals who work in the primary health centers were found to have lower knowledge (3.4%) and utilization (18.4%). Age, the field of study, level of education and previous computer training participation were found to be significantly associated with computer utilization habits of health professionals.Thus the study identifies that computer knowledge and utilization habits of health professionals, especially those who work in primary health centers,are low and thus the need for training and continuous follow-up as necessary measures to increase the likelihood of the success of implemented e-Health systems in those settings. What is interesting in this finding is the demographic aspect signifying that they have an impact on knowledge and utilization habits of medical workers towards the use of computers in support of this study.

Conclusion and Recommendations

Evidently health informatics has succeeded in improving the deliverables in the health care system globally, with the developed nations maximising itsfull potential with little or no limitations.However the same cannot be said about the developing nations such as Nigeria as access to ICT which isan essential

component to the success of health informatics in the health care system is widely limited.And just as information is critical to the operation of health professionals so is access to computer and Internet at the workplace for health workers to be able to update themselves on new developments like using health informatics for health care service delivery.

From the literature reviewed also, it is apparent that challenges to health informatics usage are related to issues of system, knowledge, and skills among the practitioners as well as the patients. The study recommends the need for further studies to investigate level of knowledge of health informatics among the practitioners across the country.This will give more basis for training and retraining of health practitioners on the importance, skills and use of the ICT for health. Such research will also form the basis for direction on what better health ICT tools and systems should the government provide for use in all hospitals across the nation not only in the Teaching hospitals. The study submits that acceptance and application of health informatics in order to transform healthcare delivery system remain vital. Such initiative should not only be accepted but be adequately communicated, using appropriate channels of communication suitable to diverse communities of the Nigerian society.

References

Anja, M. (2002). Information system development in developing countries.In SeppoPuuronen, MarjaLeena, Tynkkynen & PekkaOlsbo(Eds.),*Risk managementandSustainability Analysis in Nigeria Software Companies*(pp. 27-54).

Bath,A. P. (2009).Healthinformatics: Current issues and challenges. *Journal of InformationScience,* 5(1), 10-18.

Barry, N. J. (2008). Implications of the competing values framework for management information systems. *Human Resource. Man*, *32*(1), 175–201.

Braa, J. B. &Nermunkh, C. (2000).*Health information system in Mongolia; A difficult processof change.*In Avgeuru, C.&Walsham, G.(Eds.),*Information technology in cdntext: Perspective from Developing countries*(pp.). UK: Ashgate.

Dina, L. G., Borzekowski, L. &VaughnI, R. (2001). Adolescentcyber surfing forhealthinformation.*Arch PediatrAdolescent Med*,155, 813-817.

eHealth Initiative(2006). Improving the Quality of Healthcare through Health Information ExchangeeHealth Initiative's, Third Annual Survey of Health Information Exchange Activities at the State, Regional and Local levels, September. https://www.researchgate.net/publication/healthinformatics

FMH (2017). Assessing the enabling environment for ICT's for health in Nigeria:A review ofpolicies. https://www.healthpoliciessinnigeria/ictson

Gatero, G. (2011). Utilization of ICTs for accessing healthinformation by healthprofessionals in Kenya: A case study of Kenyatta National Hospital. *Journal of HealthInformatics in Developing Countries*, **5**(1),

Hersh, W. (2009) Stimulus to define health informatics and health information management inBMC medical and decision making,9(24).http/www,informatics.biomedcentral.com/14726947/9/24.

Idowu, B., Ogunbodede, E.,& Idowu, P.A. (2003a). Information and communication technology in Nigeria: The health sector experience. *Journal of Information Technology Impact*, 3(2), 69-79.

Idowu, P.A., Adagunodo, E.R.,& Ogunbodede, E. O. (2003b). Distributed resource sharing system for hospitals in Nigeria. *Journal of Biomedical Soft Computing and Human Sciences*,9 (2), 1-7.

Idowu, P.A.,Adagunodo, E.R., Aderounmu, G. A.,& Ogunbodede, E. O. (2004). Electronicreferral system for state hospitals in Nigeria. *IfeJournal of Science*, 6 (2), 161-166.

Idowu, P. A., Cornford, D., &Bastin, L. (2008). Health informatics deployment in Nigeria.*Journal of Health Informatics in Developing Countries, 2*(1), 8-26.

Idowu, P.A. (2015). Information and communication technology: A tool for health careDelivery in Nigeria. Computing in Research and Development in Africa: Benefits, Trends, Challenges, and Solutions. Netherland: Springer

International Retrieved fromhttp://www.jhidc.org/index.php/jhidc/article/view/11

Jha, et al. (Ed.). Building a better delivery system: A new engineering/healthcarepartnership. Washington (DC)http://doi.org/10.1186/1756-0500-6-106. https://www.ncbi.nlm.nih.gov/pmc/articles/PMC3610130/

Keepanasseril, A. (2011). Top ten challenges facing healthcare in informatics domain: Anopinion paper.*PHILICA.COM Article number 285*.http://philica.com/display_article.php?article_id=2851

Kivuti-Bitok, L. W., McDonnell, G., Pokhariyal, G.P., &Roudsari, A.V. (2012). Self-reporteduse of the Internetby cervical cancer clients in two National Referral Hospitals in Kenya. *BMC Research Notes*, **5**(1), 559.

Legris, P., Ingham, J., & Collerette, P. (2003). Why do people use information technology? A critical review of the technology acceptance model. *Journal of Information &Management,* 40(1),191–204.

Mohammed, E., Andargie, G., Meseret, S.,& Girma, E. (2013). Knowledge and utilization ofcomputer among health workers in Addis Ababa Hospitals. Ethiopia: Computer LiteracyIn the Health Sector. *BMC Research Notes6* (106).

Nwachuku, M.A. (1994). Development of information technology in Nigeria.In Drew, E.P. &Foster, F. G. (Eds.),*Information technology in selected countries.*https://www.researchgate.net/publication/healthinformatics

O'Carroll, P. W., Yasnoff, W. A., Ward, M. E., Ripp, L. H., Martin, E. L.(Eds.). (2003). Publichealth informatics and information systems. UK:Springer.

Shittu, L. A. J., Adesanya A.O.C., Izegbu, M., Oyewopo A. O., Arigbabuwo A., Ashiru, A. O.,(2007). Knowledge and perception of health workers telemedicine application in new teaching hospital in Lagos. *Scientific Research and Essay,*2 (1).

Sullivan, F.M. (2001). What is health informatics? *Journal of Research and Policy,* 6 (4), 251-254.

Thomas, D. Singh L., & Gaffar K. (2013). The utility of the UTAUT Model in explaining mobilelearning adoption in higher education in Guyana. *International Journal of Education and Development using Information and Communication Technology (IJEDICT*), 9 (3), 71-85.

University of Illinois Chicago (n.d.) Brief history of health informatics. http://healthinformatics.uic.edu/resources/articles/a-brief-history-of-health-informatics/

Venkatesh, V., Morris, M. G., Davis, G. B. & Davis, F. D. (2003). User acceptance of information technology: Toward a unified view. *MIS Quarterly*, 27 (3),25–478.

Venkatesh, V. (2000). Determinants of perceived ease of use: Integrating control, intrinsicmotivation and emotion into the technology.

Venkatesh, V., Thong, J.Y.L. & Xu, X. (2016).Unified Theory of Acceptance and Use ofTechnology: A synthesis and the road ahead. *Journal of the Association for Information Systems*, 17(5), 328–376.

Williams, D.M., Rana, P.N., &Dwivedi, K.Y. (2015). The Unified Theory of Acceptance and Use of Technology (UTAUT): A literature review, *Journal of Enterprise Information Management*, 28(3),443-488.