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# Comparative Analysis of Hospital Information Management Systems Among Healthcare Workers in Two Selected Hospitals in Kenya

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## **Introduction and Background Information**

Healthcare especially in the developed world is characterized by rapidly increasing use of information technology in patient care, increasing documentation, coding and billing, and management. Rise of health information technology worldwide is increasing the efficiency of health service delivery, reducing medical errors, improving quality of care, and providing better information for patients and physicians (Pollak and Lorch, 2007). The overall goal of the information management function is to obtain, manage, and use information to improve health care and medical services, performance, governance and management and support processes.

The importance of healthcare to individuals and governments and its growing costs to the economy have contributed to the emergence of healthcare as an important area of research for scholars in business and other disciplines. Information systems (IS) have much to offer in managing healthcare costs and in improving the quality of care (Kolodner et al. 2008). In addition, Piontek et al., (2010) asserts that healthcare influences the quality of human lives and function in the society. Healthcare mistakes have serious consequences that can affect ability to carry out social and productive endeavors. Recent reports highlight the gravity of adverse events in hospitals and the dangers such events pose to individuals and the public. Healthcare information systems have changed the healthcare industry drastically over the last decade as well as the last few years (Abraham & Junglas, 2011).

The forces of competition and advancements in healthcare technology are pushing hospitals to follow the trend. Paperless healthcare systems have become inevitable and any healthcare institute that doesn't follow this trend will fall behind the rest in the industry. Health information system is a must and the faster this is adopted the more successful the healthcare facility will be. (Swanson et al. 2010). DeLone and McLean (2003) being one of the most cited models in the fields of information systems seeks to provide a comprehensive understanding of information systems success by identifying, describing, and explaining the relationships between six success variables categories: systems quality, information quality, user, user satisfaction, individual impact, and organizational impact. The same author notes the model provides a comprehensive frame work for measuring the performance of the information system and enhances the understanding of information systems success.

World Health Organization (WHO, 2008) cautions that, the goal of a health information system is often narrowly defined as the production of good-quality data. The ultimate goal is to produce relevant information that health system stakeholders can use for making transparent and evidence-based decisions for health system interventions. Health information management system performance should therefore be measured not only on the quality of data produced, but on evidence of the continued use of data to improve health system performance, respond to emergent threats, and improve health (WHO, 2008). Improving health information systems in terms of data availability, quality and use often requires interventions that address a wide range of possible 'determinants of performance'.

Health information systems recognizes that although new developments in technology, including the use of the internet and other modes of communication offer great potential in the flow of information amongst the providers and recipients regarding the provision and management of

healthcare services, the Kenyan health sector remains far behind in taking advantage of such developments to improve reporting (HIS, 2008). Despite vast amounts of resources and time invested in the development and implementation of health information systems, health data is barely used by health workers for service delivery planning and decision-making. Performance is grossly under reported with developments to improve information management lagging behind other sectors improvement activities; the whole culture of information generation and use remain under-developed; and mechanisms for validating and assuring reliability are not optimally functional (HIS, 2008).

## **Research Context**

Research was carried out in two leading private and public hospitals in Kenya. Primary mandate of the public hospital is to provide specialized health-care services to patients on referral from provincial and district level hospitals. The hospital facilitates medical training, research and participates in national health-care planning. In rural areas, health centres and dispensaries offer diagnostic services, obstetric care, and outpatient treatment. The public hospital embarked on the use of a hospital management information system to provide faster documentation, retrieval, and management of patient information. The system did not only provide a reduction in patient waiting time but also enhanced staff accountability and resource management. The electronic medical record system is part of the management initiative towards implementation of fully integrated hospital management information system. The system was implemented at all patient entry points and in the wards. Every item being used on the patients are ordered and charged through the system.

The private hospital mission is to deliver timely and compassionate medical services to the patients and families to the highest possible standard through the provision of qualified staff, most appropriate equipment and staff training programmes. The hospital also seeks to contain its cost of operation such that the cost of medical care charged to patients remain as low and affordable as possible to as many patients as possible and such that the viability of the hospital, employment and investment are maintained in line with the ethos of the founders. Hospitals deal with the life and health of the patients. Good medical care relies on well-trained doctors and nurses, high-quality facilities, modern equipment and also good record keeping practices. Without accurate, comprehensive up-to-date and accessible patient case notes, medical personnel may not offer the best treatment or may in fact misdiagnose a condition, which can have serious consequences. Records, such as X-rays, specimens, drug records and patient registers, must also be well cared for if the patient is to be protected. Effective records care ensures the hospital's administration runs smoothly and saves time and resources. Records also provide evidence of the hospital's accountability for its actions and form the key source of data for medical research, statistical reports and health information systems. Patient care is adversely affected if correct records are not maintained, records are inadequately managed or there is no means of co-ordinating the health care the same patient receives in different departments. Structured and effective records management programme, covering all departments and all resources irrespective of media, is the aim of every hospital. Selected hospitals use integrated hospital management information to be able to handle and support the patient records and all other departments.

## **Statement of the Research Problem**

Reliable and timely health information is the foundation of public health action, it is often unavailable. Consequently, decision-makers cannot identify problems and needs, track progress, evaluate the impact of interventions and make evidence-based decisions on health policy, program design and resource allocation (WHO, 2008). One of the key challenges in the Kenyan health sector (HIS, 2008), identified in the first medium term plan of vision 2030 document, is weak health information systems. Various weaknesses identified in the existing information systems include lack of policy and guidelines, inadequate capacities of health information system, staff, and unskilled personnel handling data, lack of integration, many parallel data collection systems, and poor coordination, amongst others. Overall, the current health information system provides limited information for monitoring health goals and empowering communities and individuals with timely and understandable information on health (HIS, 2008).

Kenyan health care systems are typically made up of a number of relatively independent health programs and services which all maintain own vertical and uncoordinated reporting systems. Additionally, fragmentation of services, locally within hospitals and between primary, secondary and tertiary health care settings, alongside the use of different information systems in different care settings can make it difficult to safely communicate information. This may lead to miscommunication or missing patient information, ultimately compromising patient safety. The problem of HIS fragmentation and integration of health care information system is consequently a priority that needs to be addressed to realize successful patient centred healthcare delivery in the country (African Development Bank, 2013). Proper computerization of health records is a problem that many countries have had to deal with to ensure patient safety and evidence based care. Most developed countries have managed to come up with arguably workable solutions. However their counterparts in third world countries are yet to get there (Mwangi, 2013). The study has not only indicated insufficient adoption of HIS system in the country but also a major disconnect between adoptions in different health care facilities, therefore bringing out the need to find out the use of HIS in two Kenya hospitals.

## **Purpose and Objective of the of the Study**

The purpose of the study was to examine the use of hospital information management systems among healthcare workers in two public and private hospitals in Kenya.

## **Objectives of the Study**

Objectives of the study were to:

- i. Assess the use of the hospital information management systems in two selected public and private hospitals.
- ii. Find out the extent to which the hospital information system provides accurate and relevant information of the patients.
- iii. Establish the perception of the healthcare workers towards the hospital information management systems.
- iv. Find out the challenges faced in the use of the hospital information management systems in the selected hospitals.

- v. Find out possible solutions to improve the use of the hospital information management system in both hospitals.

## **Research Questions**

Study was guided by the following research questions:

1. What is the use of hospital information management systems in both the selected hospitals?
2. To what extent does the hospital information system provide accurate and relevant information of the patient?
3. What is the perception of the healthcare workers towards the system?
4. What are the challenges faced in the use of the hospital information management systems in the two hospitals?
5. What are the possible solutions and recommendations to improve system in the hospitals?

## **Research Methodology**

### **Research Design and Sampling Strategies**

The research design was a comparative study. The study was concerned with examining use of the hospital information management system in two hospitals a public and private. The study was conducted in two selected hospitals private and public hospitals. This provides a cross sectional information of hospitals in public and private institutions. The study target population was 120 healthcare workers drawn from different departments in the two hospitals. The departments are focal points for decision making and include outpatients, inpatient, theatre, radiology, pharmacy laboratory, clinics, stores and administrative. The target population involved health care workers who routinely use the hospital information management systems. The sample size for research was based on healthcare workers using the hospital information management system. From a total population of 193 healthcare workers employed in each hospital using the hospital information management system, 60 respondent's healthcare workers were chosen. Stratified purposive sampling technique was adopted to illustrate the characteristics of particular subgroups of interest in the hospitals. The healthcare workers were stratified into different departments according to their operations. Semi structured questionnaire were self-administered to obtain the primary data. Documentary review of internet information such as Yahoo, Google scholar, HINARI health information data base, scholarly journals and content written on hospital information management system were also applied.

**Table 1: Sample Frequency**

<b>Departments</b>	<b>Private Hospital</b>		<b>Public Hospital</b>	
	<b>Population Size</b>	<b>Sample Size</b>	<b>Population Size</b>	<b>Sample Size</b>
Nursing	24	7	24	7
Doctors	24	7	24	7
Laboratory	20	6	20	6
Dental	15	5	15	5
Pharmacy	15	5	15	5
Physiotherapy	15	5	15	5
Radiology	15	5	15	5
Procurement	15	5	15	5
IT Department	10	3	10	3
Registration/Administration	10	3	10	3
Medical records	10	3	10	3
Human Resources	10	3	10	3
Finance	10	3	10	3
<b>TOTAL</b>	<b>193</b>	<b>60</b>	<b>193</b>	<b>60</b>

## **Literature Review**

### **Health Information Management Systems**

Health information management system is defined as the comprehensive and integrated structure that collects, collates analyses, evaluates, uses, and manages, disseminates, stores all health and health-related data and information (HIS Strategic Plan, 2009-2014). Health systems, like any software, consist of parts which are interrelated, interdependent and work towards a common goal. In general, the system is the combination of health information and management information that collects information on health (morbidity and mortality statistics, service statistics) and on management (human resources, financial, fixed assets and infrastructure, drugs and supplies logistics) and performs comparative analysis with population- based data from various surveys. Health system is the powerful tool for making health care delivery more effective and efficient in hospitals (HIS, 2008). Statistical constituencies of this system are: civil registration process whose vital events include registration of live births, deaths, marriages, divorces, adoptions, recognition and legitimating; Kenya National Bureaus of Statistics (KNBS) as the custodian of all government statistical information maintains the database for all national surveys including national population and housing censuses and population based health statistics derived from national surveys; AfriAfya (African Network for Health Management and Communication), which is consortium of seven Kenya-based health development agencies (HIS, 2008).

### **Hospital Information Systems and Healthcare Workers**

Hospitals are information-intensive organization and pay great attention to information management and processing, which have to be carried out using appropriate information system. Hospital information system and clinical information system are computer- based systems used in hospitals to assist the overall management of the health care facility through information about

diseases and information about patient care (Haux, 2004) in terms of record keeping of patient information, accounting, human resource management, asset management, and stock management and knowledge management. Task of the hospital information system is to support patient care and associated administration by providing: information primarily about patients, that information must be correctly collected, stored, processed and documented. Knowledge, primarily about diseases- such as drug actions and adverse effects-to support diagnosis and therapy; information about the quality of patient care and hospital performance and costs (Haux, 2004).WHO (2010) defines health care workers as “all people primarily engaged in actions with the primary intent of enhancing health”. Often work in hospitals, health care centres and other service delivery points. Community health workers work outside formal health care institutions. Health care practitioners are commonly grouped into a number of professions: Medical includes general practitioners and specialists; nursing includes various professional titles, midwifery includes obstetrics, dentistry and allied workers.

### **Effectiveness of Health Information Systems**

Information systems in healthcare allow the capture and dissemination of information to decision makers for better coordination of healthcare at both the individual and population levels (Fichman et. al 2011). The study indicates that data mining and decision support capabilities can identify potential adverse events for an individual patient whilst also contributing to the population’s health by providing insights into the causes of disease complications. Gonzalez- Molero et.al (2012) in the study of the implementation of a telemedicine approach in subjects with type I diabetes equipped with an insulin pump and real-time blood sugar monitoring. In this prospective one-year study, the investigators followed 15 subjects and noted that the telemedicine care improved multiple outcomes of health care including the variability in blood sugar control, and long-term measure of good sugar control (HbA1c). Such programs offer great potential to improve patient access to health care. Reduce travel time, cost for patients and reduce the burden on an already stretched health system. These are all good outcomes from a healthcare management perspective. The large pool of the potential benefits of information systems in healthcare is contained in the work of (Li et al 2012). In the study the authors undertook a cost benefit analysis in relation to the implementation of an electronic medical record (EMR) system for a six-year period, and found out the net benefit to be in the range of half million dollars (US). Shekelleet. al (2006) undertook large piece of research involving systematic review of the evidence around the cost and benefits of health information technology (HIT) projects. Many of which involved electronic health records. The study concluded that health information technology has the potential to enable dramatic transformation in the delivery of health care, making it safer, more effective, and more efficient.

### **DeLone and Mclean Information System Success Model**

DeLone and McLean (2003) model has been found to be a useful framework for organizing information system success measurements. The model has been widely used by information system researchers for understanding and measuring dimensions of information system success, each of the variables describing success of an information system was consistent with one or more of the six major success dimensions of the updated model. The dimensions of success include: system, quality, and the desirable characteristics of an information system. Information

quality- desirable characteristics of the system outputs; that is, management reports and web page. Service quality– the quality of the support that system users receive from the information system department and information technology support personnel. System use– the degree and manner in which staff and customers utilize the capabilities of information. User satisfaction – users’ level of satisfaction with reports, Web sites, and support services. Net benefits– the extent to which IS are contributing to the success of individuals, groups, organizations, industries, and nations. For example: improved decision-making, improved productivity, increased sales. The practical application of the DeLone & McLean model is naturally dependent on the organizational context.

### **Organization Culture and RHIS Performance**

Studies in organizational culture (Mead, 2006 & Triandis, 2006) help understanding how values are generated, sustained and amenable to change. Organizational culture is a body of solutions to problems that have worked consistently (Shein, 2003) and new members are taught the correct way to perceive, think and feel in relation to those problems. The effectiveness of organizational culture in improving performance is well established (Glaser, et.al 1987; Taylor, 2005). Routine health information system management (Odhiambo-Otieno, 2005) is crucial for RHIS performance measured through availability of the RHIS vision statement. Establishment and maintenance of RHIS support services such as planning, training, supervision, human resources, logistics and finance. In identifying levels of support services, it is possible to develop priorities for actions. Information technology remains the engine for information system development as computers operates and communicate faster (Rotich et. al 2003; Kamadjeu et. al 2005; Odhiambo-Otieno, 2005).

Fundamentally, routine health information systems users must have good knowledge and information technology skills to effectively use and sustain the system. In low technology settings, well-designed, paper-based RHIS can still achieve acceptable levels of performance. If indicators are irrelevant, data collection forms are complex to fill, and if computer software is not user-friendly, it will affect the confidence level and motivation of RHIS implementers. When software does not process data properly in a timely manner, and resulting analyses do not provide meaningful conclusions for decision-making, it will affect the use of information (Rotich et. al 2003; Kamadjeu 2005: 180; Odhiambo-Otieno 2005). Measuring the impact of RHIS on health system performance is still unexplored. RHIS focuses mostly on the service delivery and resource management functions of the health system. Based on the proximity (Ajzen, 2005) of RHIS and health system performance, the proposed operational definition of health system performance is to ‘maintain or improve service coverage and make necessary adjustments or improvements in financial and human resources in relation to services provided.’

### **Relevance of Hospital information System**

Due to extensive changes in medical technology and increased expectation of patients in the twenty-first century hospitals that lack hospital information Systems will not be able to compete with other hospitals. The most important necessity and reason for hospitals information systems automation are inefficiency manual procedures (Meinert & Peterson2009). Hospital information systems help to improve operational efficiency, care quality and more informed decision making.



According to Ghosh (2010), hospital information systems give comfortable and quick access to patient data.

### **Technology and Efficiency**

Technology as the sub-factors hardware, software and connectivity, the hardware needed should be identified before the introduction of the system. This means that at the start of the project an assessment should be made about the hardware already available and the hardware needed for full introduction of the system. One of the major concerns with IS, is the fact that users often claim that they are not user friendly and lack intuitive data input. The way in which data is put into a system reflects the individual's practice style. The interface design and structure of the data need therefore to conform to each other. The other issue is that it depends on the technology being used. Flexibility and adaptability is also a challenge when introducing such a system. Looking for the right terminology for input is also a concern (Kuhn et. al 2001). Software content issues include the lack of local content creation, the language used and the relevance of content to the local situation. Appropriate language is frequently neglected in ICT programmes and little content is available in local languages for health programmes (Chetley, 2006). Another concern of any health organization in the integration of health information systems is the fact that healthcare institutions need timely patient information from various sources at the point of- care. This means buying a fully functional system fulfilling all their needs from one vendor. This suggests working with standards for better data integration (Kuhn et. al 2001).

With connectivity one has to deal with things like the lack of an enabling telecom policy and regulatory environment; access to electricity, solar power options, back-ups, insufficient infrastructure, connectivity access and high costs. The better these things are functioning the greater the chance for successful implementation. The actual integration of isolated systems is an important issue for the success of an information system. The use of simpler systems fitted better with the clinical work processes should also add to better solutions. Service and maintenance not only of the hardware but of all technology being used should also be considered when introducing the system. The availability of a good backup for failing hardware and software should also be considered when implementing an HIS. There should also be a combination of old and new ICT in creative and innovative ways, no single technology will be suitable for all situations (Chan & Kaufman 2010).

### **Financial Resources**

Generally, there is little investment in ICT for health in most developing countries. The picture is one of fragmentation, with many different varieties of ICT being acquired from different donors. Invariably, there is no national health information and information technology infrastructure to underpin the delivery of health care. It is very important to make a realistic financial plan for all the costs in the system before the introduction of the health information management system (Gladwin et al., 2003). Sustainability is very important when considering the introduction of the health information management system in the organization, especially in local hospitals in developing countries. Being able to continue supporting the system financially on the long run is the important issue to consider. Plans for sustainability should be clearly expressed ensuring that capital investments and costs are identified up front as well as ICT, capacity and infrastructure

requirements. Monitoring and evaluation is also part of the sustainability failure to adopt a particular IM strategy may signal inappropriateness. Encouraging partnerships between stakeholders on local, national, regional and international level sustainability can grow (Gladwin et al., 2003).

### **Health Information Management Systems in Developed Countries**

One notable observation in Europe is that each country has its own distinctive approach in the journey towards enabling technologies in healthcare. France is developing the concept of *digital hospitals* via telemedicine technologies (Currie and Finnegan 2009). Germany is working on an electronic health card (EHC) that allows the physicians to check the administrative data of the patient and write prescriptions on the system. This system will also have voluntary medical functions like the emergency data record and later the electronic patient record that can be checked anywhere using appropriate card readers (Sunyaev et. al2009).Denmark leads the way in European ehealth and patient-controlled health records (Cruickshack et.al2012) boasts a universal electronic health record system and of national patient health record (PHR) service available to any Danish citizen that allows the control to accesses and use medical information. Launched in 2003, the country's government-run patient health record portal is *Sundhed.dk*, the website where, citizens view treatments and diagnoses from the hospital patient record, book appointments with the general practitioner, renew prescription drugs, monitor own drug compliance, survey shortest waiting lists for operations and quality ratings of hospitals, register as organ donor, and get access to local disease management systems in out-patient clinics (Makori, Musoke and Gilbert 2013).Information system development until recently relied mainly on technical approaches, from assessing information needs to developing data analysis and presentation tools, and using information communication and technology, with little recognition of the effects of contextual issues. Information system is described as the set of related elements without any consensus on defining and measuring the systems' performance. Attention is given neither to how people react to and use information systems for problem solving or self-regulating performance (behavioural factors), nor organizational processes for creating enabling environment for using and sustaining routine health information system. When attention is given to these factors, there is need to put them in a coherent framework to understand the effects on RHIS processes and not follow their performance only

### **Health Information Management Systems in Developing Countries**

Health system strengthening is a global priority and one of the core components is the need to improve health information systems. World Health Organization describes these components as integrated efforts to collect, process, report and use health information and knowledge to influence policy making, program action and research (Global Health Action, 2014). Most health information systems in developing countries, in practice are complex and fragmented (AbouZahr and Boerma 2005). This is caused by the way systems have been developed and evolved over time, in piecemeal fashion, in response to donor pressure or requirements of disease specific initiatives (HMN, 2008).

Developing countries are now waking up to the realization that there is need to embrace information and communication technologies to deal with the problem of access, quality and costs of healthcare. Adoption of ICT in health sector across developing countries accelerates knowledge diffusion and increase access to health information (Ojo et al., 2007) Videoconferencing tools have been deployed in Tunisia for tele-diagnosing while in Botswana there is extensive e-learning for AIDS programs by community health workers. In Rwanda, efforts are on-going to connect the district hospitals with referral hospitals for the transfer of medical information. This is going to be very important especially in the area of teleradiology (Makori, Musoke and Gilbert 2013). The problems that exist in the health sectors of many developing countries such as high mortality and morbidity rates, high population, and lack of enough medical staff can be addressed by telemedicine adoption (Orlando, 2007).

Hospital information systems have enabled faster processing, storage and transfer of medical information between service providers in developing countries. A health information system prominently featuring in developing countries' e-health landscape is the one shared by Southern African countries including Botswana, South Africa, Mozambique, Tanzania, Ethiopia and Malawi. In Ghana, adoption of electronic health information technology, (EHIT) has become the integral part of the national health care delivery system. Reliance on EHIT seems poised to grow in the years to come due to the myriad of advantages derived from the capture, storage, retrieval and analysis of large volumes of protected health data, and from multiple sources, which is spread over a long period of time. (Alkins and Binka 2011).

There exists evidence to show that electronic medical records are gaining ground in the health sector in developing countries. For instance, the OpenMRS developed by the Regienstrief Institute and Partners in Health, provides a user-friendly interface for electronically storing medical data and has been very successful in Kenya. The Mosoroit Medical Record System (MMRS), which was implemented at a primary care rural health center in Kenya, provides patient registration and patient visit records management with capability to handle information of over 60,000 patients (Soodet. Al 2008). Other electronic medical records that have succeeded in developing countries include the Lilongwe HIS used for wide range of clinical problems in pediatric department of the Central Hospital in Malawi; Partners in Health (PIH)-HIS, Peru; HIV-HIS system, Haiti; Careware, Uganda; PEPFAR project, Tanzania; National HIS, project Zambia (Soodet al, 2008). These electronic medical records require addressing of confidentiality, privacy and security issues for maximum acceptability by clinicians. The clinicians must also understand the benefits and how systems will impact on routines and business processes in hospitals, a challenge that can be overcome by including ICT in the curriculum of medical courses offered in developing countries, this is why the study seeks to establish the health information systems use among the healthcare workers.

### **Healthcare Workers Training and Efficiency**

In Kenya, use of computers in hospitals has not been a widespread practice. Computerization of hospital services has been embraced in private hospitals more than the government hospitals. According to Huryk, (2010) several factors have been found to shape the attitudes of health care workers towards the use of computers. Age, educational level, years of experience and experience with computers has frequently been described as factors influencing attitudes towards

computerization. In a study by Kivuti-Bitok, (2014) conducted in Kenyatta National hospital and Aga Khan University Hospital (AKUH) age of nurses showed a statistically significant association with the attitude towards computerization. Within KNH nurses aged less than 40 years had higher attitude towards computerization than those groups above 40 years. In AKUH nurses aged 40 years and above had the lowest attitude.

ICT training among clinicians is cited as the key determinant of electronic health (Ochieng and Hosoi2005. Marques et al, 2011). ICT skills are required to foster positive attitudes about electronic medical records which translate to greater adoption of electronic medical records. Therefore developed countries in an effort to raise ICT skills amongst clinicians have incorporated ICT training in health courses offered at various academic levels.Soodet.al (2008) notes that, developed countries are using cutting edge technologies like 3D simulations, virtual reality and robotics to train clinicians and that ICT is included in the curriculum of medical courses. Availability of ICT skills amongst clinicians is likely to lead to the acceptance and actual use of e-health in primary healthcare. This is because clinicians with ICT skills are able to appreciate the possible benefits of ICT in execution and improvement of the various processes they are engaged in. Training is also an important part of capacity development. If the intended training approach is not undertaken there will be lack of understanding of changes needed to accompany the innovation. Health management information system data collection, processing and information use assumes certain level of general education and specialist training amongst health workers, which is often not available, especially in smaller health units in developing countries. Too few health management information system training for health unit personnel to grasp new skills such as data processing, compiling graphs and statistics then leads to unsuccessful skills and lack of the right capacity. This is why workers' skills should always be aligned with the health information management system, (Chetley, 2006).

### **Human Capacity and Training**

Impact of human capacity and training, as any technology will be insufficient if people do not understand how to put it into effective use (Bridges, 2010). Lack of trained human resources for health is a major problem in health care systems in most developing countries (Chetley, 2006). The limited human resources and capacity available, both in terms of technical skills in how to use ICT, as well as high-level technical support skills to ensure setup and maintenance, have resulted in high reliance on external resources and experts. Such a reliance on external capacity drives ICT costs upwards, and also produces significant retention problems and lack of locally-qualified personnel. In particular, however, it is not only the recipient country that needs capacity development and training in the use of ICT. As demonstrated in Vanuatu (Khazei et. al 2005), international eHealth consultants must know what local resources are available and have an understanding of the conditions of the country they are providing information to (for example, standard treatment protocols and availability of various drugs and diagnostics). Overall, while technology can provide a link to information and knowledge, the critical factor in all ICT initiatives is human resources and capacity for effectiveness in its use (Keke, 2007).

## Health Information Systems Challenges

Given the high failure rate and the very visible and often politically embarrassing failure of many health ICT projects, there has been substantial academic and industry research on the factors that cause such systems to fail. Health systems are significantly different from other information system environments, due to complexity, lack of one single 'owner', and 'hyper turbulent' and 'information sensitive' nature (Al-Ahmad et.al 2009). Lack of senior management support is often cited as number one cause of project failures in ICT, and this is particularly the case in health ICT projects. In the 10 years since Dorsey (2000) published the report stating that almost every study to-date had identified top management support as the key factor in project success, it would appear that very little has changed.

Any worthwhile project causes disruption within the organization and challenges existing interests and practices. If senior management are not committed to the project and willing to undergo the difficulties involved in overcoming the internal and external barriers then the project is almost certain to fail. Lack of engagement of clinicians and other end-users remains the critical factor in the ultimate success or failure of the ICT project. In research on lessons learned from telehealth projects, Elder & Clarke, (2007) remark that, the fundamental issue pervading the continued failure of ICT projects in health is the lack of focus on the end-user. The internal dynamics of clinical organizations are quite different from those of other businesses. In the bank, for example, management can enforce the introduction of new systems even if the end-users are opposed. In a clinical setting, doctors who have not been engaged in the introduction of new technology, who feel the systems waste the time or affect patient safety, can refuse to use the technology and often have the organizational power, even if informal, to have their wishes implemented.

The introduction of new ICT systems usually requires the introduction of new ways of working, new staff skills, new roles and may require organizational restructure. In general, people are resistant to such changes especially if issues of being threatened by the system remain unsolved. Health information systems not only deal with complex clinical information technologies, medical science, research and practices (Al-Ahmad et. al 2009), but are often fragmented, disorganized and do not operate or progress as a coherent whole (HMN, 2008). Frequently, technology companies coming into the health domain underestimate its complexity and proceed on the assumption that if something has worked in another domain then it should be possible to achieve the same in health. The under-investment in human resource capacity-building is a critical factor in the continued failure of ICT projects in health. As discussed by the UN agency on ICT for development (UNAPCICT, 2010), many proponents of ICT mistakenly assume that such projects are only about hardware, networking, software and applications; however a substantial amount of human activity is required when dealing with ICT. Challenges with equipment, infrastructure and connectivity, no online consultations are ever made, and despite the considerable investment made to the project, no direct benefits to the health of the rural population were observed.

One of the most common causes of ICT failure is the temptation to leapfrog certain aspects of the development path, in an attempt to decrease the gap between developed and developing countries (Avgerou, 2008). Technology offers attractive means to bypass some processes in the

accumulation of human or system capabilities, Technology rarely stands independently; rather, it is embedded in a system of complementary technologies and capabilities and requires three key elements for success, people, process, and technology (Cleverley, 2009, and UNAPCICT, 2010). If ICT is to be used to provide information at the right time and when required, key elements must be understood including what to collect, where to collect, whom to report to, and how the information will be used and by whom (Sinha, 2010). Technology needs to be appropriate to the capacity and maturity of the health system, this includes human and technological maturity, 'if you automate a mess, you'll get an automated mess' (USEPA, 2012).

## **Health Information Security Issues**

In spite of many attempts in providing security in health information system, data security breaches in health care organizations have continued to increase and number of threats in this area has increased dramatically (Brady, 2011). Studies show that between 2006 and 2007 in hospitals alone, more than 1.5 million names were exposed to data breaches (HIMSS Analytics, 2008). In addition, the results of 2010 healthcare information and management systems society security survey suggests that the reports of more than 110 healthcare organizations have shown the loss of sensitive protected health information. Personal identifying information affected over 5,306,000 individuals since January 2008 and damages from patient information lost top \$6 billion per year in 2010 (Sedlack and Tejay 2011). The report showed they were received as theft (stolen laptops, computers, or media), loss or negligence by employees or third parties, malicious insiders, system hacks, web exposure, and virus attacks (HIMSS Analytics, 2010). Some researchers categorized risks to hospitals information as the internal or external threats and found that employees' ignorance, curiosity, recklessness, inadequate behavior, using someone else's password and giving the password to other employees are some of the internal threats to health information system.

Viruses and spyware attacks, hackers and intruders are placed as external threat to information system (Samy et al, 2011). Most organizations however, tend to focus on the vulnerabilities to external threats and have used technical solutions to improve the security of their information system (Parks *et al*, 2011). Most internal security breaches in health information systems continue to occur by legitimate users. People's behavior is a major source of threats to the various information systems so; security cannot be achieved only through technological tools (Herath and Rao, 2009). According to Sood et al, (2008), information security is more of human problem than a technical problem. In this kind of scenario non-technological aspects of information security such as education and awareness must be considered together with technical aspects. Bakhtiyari, Shahri & Ismail (2012) identified more than 70 threats to health information system and have proved that threats caused by human in the role of users' technology play a big proportion in many threats to the system. (Asai and Fernando, (2011) prove that, human factors are the cause of 80% of privacy breach incidents, and (Eminağaoğlu et al 2009) also confirm that human errors have a large proportion in privacy breaches in the United States. In addition, published academic of Global Security Survey by Deloitte (2007), found that 91% of participants are concerned about the employees' security weaknesses, and that human factors known as the main reason of the information security failures by 79% of participants (Padayachee, 2012). Moreover, most people do not feel hurt nor see any threat (Asai and Fernando, 2011). As a result,

health information systems users need to be informed and educated about the risk perception biases and understand the magnitude or implications of potential security breaches.

## **Data Analysis and Presentation**

### **Use of Hospital Information Management System**

The first objective of the study was to find out the use of hospital information management system in both selected private and public hospitals. The researcher sought to find out functionality of the system in accessing more services, respondents in the private hospital strongly agreed the system has provided more functionality for accessing services at (89%) and the public hospital respondents agreed on the same though not as strongly at (53.7%). The results show in private hospital the system is well integrated and most services can be accessed via the system. Respondents in public hospital indicated some areas are not yet connected to the system meaning the system is not well integrated. On use and access to in and out patient information, respondents in the private hospital strongly agreed (74.08%) the system enables more access to patient information and in the public hospital agreed at (26.83%). The private hospital has more access and use of both in and out patient information. In finding out Improvement of quality service respondents in the private hospital agreed at (66.6%) and public hospital (53.66%) agreed the system has improved the quality of service in the hospitals. This implies both hospitals are in agreement the system has improved the management of the hospital and help in giving patient better and improved service. In disease notification function, results show (50%) private hospital respondent indicated the system provide disease notification and public hospital (41%) agreed to the same. Provision of Epidemiology data both hospitals had similar results (44%) agreed to system providing this kind of data. On the system managing financial imperatives private hospital respondents agreed at (85.36%) and public hospital respondents agreed at (77.77%). Improvement on patient information security, respondents in private agreed strongly (75.93%) the system manages the patient information security and public hospital (56.66%).

### **HMIS Provision of Accurate and Relevant patient Information**

The second objective of the study was to establish the extent to which the hospital information management system provides accurate and relevant patient information. The study findings revealed that respondents in the private hospital agreed strongly (70.37%) the system in use provides accurate and relevant patient information and Public Hospital (26.83%) were of the same opinion. The results imply Private hospital system provides accurate and relevant patient's information for users. Majority respondents (60.98%) in Public hospital were neutral on this aspect of the system. The study has established the system in use in the public hospital is not fully integrated some sections are yet to be automated and this could be hampering the provision of accurate and relevant patient information.

**Table 2: Provides Accurate and Relevant Information**

	Private Hospital		Public Hospital	
	Frequency	Percent	Frequency	Percent
Strongly Disagree				
Disagree	1	1.85	5	12.2
Neutral	8	14.81	25	60.98
Agree	27	50	6	14.63
Strongly Agree	18	33.33	5	12.2
<b>TOTAL</b>	<b>54</b>	<b>100</b>	<b>41</b>	<b>100</b>

### Perception of the Healthcare Workers Towards the System

The third objective was to establish the perceptions of healthcare workers towards the system. In both hospitals half of the respondents' agreed the system is easy to use, private hospital (51%) and Public hospital (54%). Majority of the respondent's in the private (72%) and public (63%) indicated they are competent on the use of the system .Other almost similar percentages in both hospitals believe the system provides meaningful patients information, Private hospital respondent (52%) and Public hospital respondents (59%). A number of respondents in both hospitals strongly agreed the system is slow and keeps going on and off implying users keep experiencing problems from time to time. In both hospitals respondents expressed the need for more training to be able to utilize the system better.

**Table 3: Healthcare Workers Training Perceptions**

Statement	Private Hospital		Public Hospital	
	Mean	Standard Deviation	Mean	Standard Deviation
Competent on system use	3.67	0.88	2.95	1.047
System is easy to use	3.7	1.06	2.82	0.771
Encounter problem when using the system	3.32	1.17	3.75	0.969
Training was conducted on how to use the system	3.94	0.93	2.59	1.117
Need for more training to adequately use the system	3.85	1.26	4.39	0.77

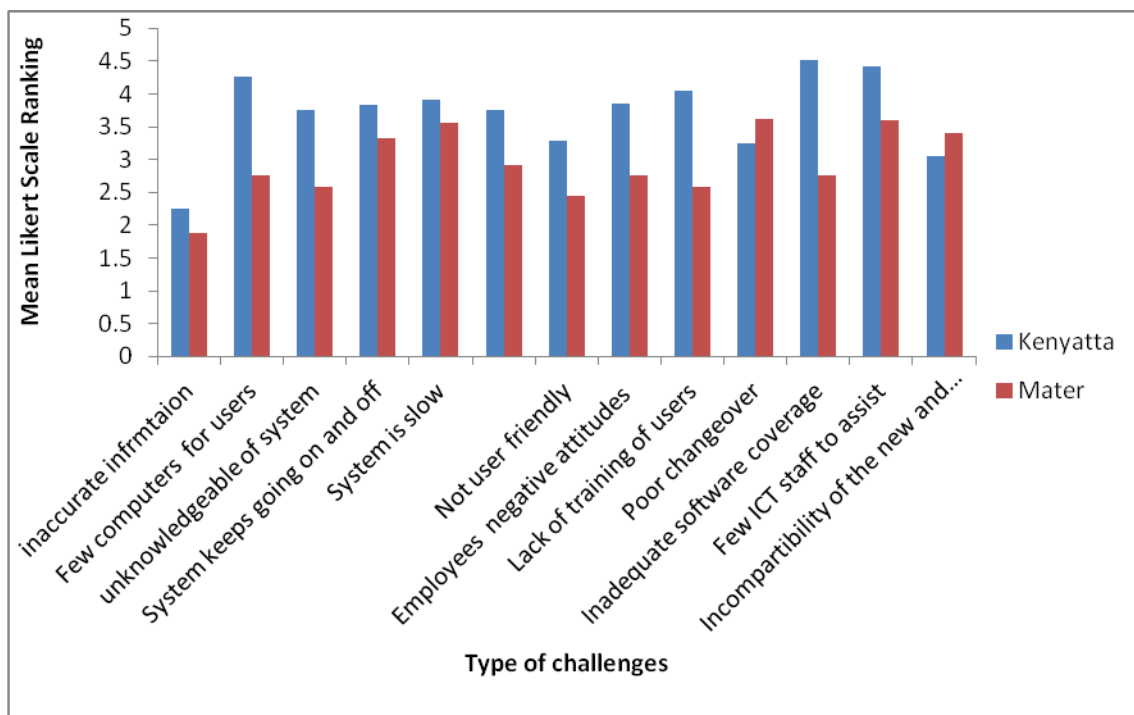
### Challenges in the Use of Hospital Information Management System

The fourth objective of this study was to establish challenges healthcare workers in both hospitals encounter in the use of hospital information management system. The study established that the main challenges encountered in the private hospital as system being slow, poor changeover between the new and old system, Few ICT staff to assist when needed, system keeps



going on and off, and incapability between the old and new system. In the public hospital main challenge were, few ICT staff to assist when needed, few computers for use, inadequate software coverage, systems is slow and lack of training of users, system not yet implemented in some areas. Other challenges common in both hospitals were found were system providing inaccurate information, respondents not knowledgeable with the system, System not user friendly, and employees having negative attitude towards the system. Respondents 'recommendations on improving the system, most respondents in the public hospital want complete overhauls of the system. In private hospital more respondents would want development of electronic resource planning system for the hospital and development of specific tools to the current structure, more training on the use of the system is recommended by respondents in both hospitals.

**Figure 1: Challenges Faced Using Hospital Information Management System**



## Conclusion

- Well-integrated hospital information management system is able to manage effectively all the information and data needs of any hospital and in return provide quality service to the patients. Financial imperatives are well managed with this kind of system and can greatly curb financial malpractices.
- Hospital information management system is able to provide timely, accurate and relevant data whether on the patient, disease notification or epidemiological data very easily.
- Security on patient information can well be managed effectively with the help of the hospital information management system.

- Training of healthcare workers is required from the time of implementation to enable the effective utilization of the system, without which the system will not achieve the intended purpose.

### **Recommendations**

Public hospital needs review of the software in use currently and should strive to have a more integrated system covering the whole hospital for effective and efficient management of the hospital resources. There is need for more ICT staff in both hospitals. This would translate to quicker and improved response for staff whenever assistance with the system is required. Both hospitals require more computers for effective utilization of the system and improved quality of service. There is need for continuous training of healthcare workers and other staff members in order to provide relevant and accurate data and information for strategic planning and decision making.

## REFERENCES

- Abraham, C. & Junglas, I. (2011). From cacophony to harmony: A case study about the IS implementation process as an opportunity for organizational transformation at Sentara Healthcare, *Journal of Strategic Information Systems*, 20(2).
- AbouZahr, C. & Boerma, T. (2005). Health information systems: the foundations of public health. *Bulletin of the World Health Organization*.
- African Development Bank,(2013) Health in Africa over the next 50years.
- Asai, T. and Fernando, S. (2011). Human-Related Problems in Information Security in. Thai Cross-Cultural Environments. Contemporary Management Research.
- Avgerou, C.(2008) Information Systems in Developing countries: Critical Review.
- BakhtiyariShahri, A. and Z. Ismail, (2012b). A Tree Model for Identification of Threats as the First Stage of Risk Assessment in HIS. *Journal of Information Security*.
- Chetley A (2006). Improving health, connecting people: The role of ICTs in the health sector of developing countries. A framework paper. *InfoDev*, Washington, DC
- Cruicksack, J., Carl, P., and Jon, P. (2012). Personal Health Records: Putting Patients in control.
- DeLone, McLean, E.R.(2003) Information Systems Success: The Quest for the Independent Variables, *Information Systems Research*
- Finchman, G. et al (2011). Editorial Overview - The role of IS in Healthcare. *Information Systems Research*.
- Gladwin, J., Dixon, R., Wilson, T., (2000), Using external training materials to strengthen health information management in East Africa, *Information Research*, Vol.5:p.12
- Ghosh.N (2010).Benefits of Hospital Information System.
- Haux,R, Alfred, W. (2004) *Strategic Information Management in Hospitals*: New York: Springer.
- Health Information System (2008), Republic of Kenya, Ministry of Health, Health sector; Health information system policy
- Health Information System Strategic Plan (2009-2014); Republic of Kenya; Health Sector Strategic Plan for Health Information System.
- Herath, T. and H. Rao, (2009). Encouraging Information Security Behaviors in Organizations: Role of Penalties, Pressures and Perceived Effectiveness. *Decision Support Systems*.
- Himss Analytics, (2010). The 2010 HIMSS Analytics Report: Security of Patient Data Technical Report.
- HMN–Health Metrics Network 2008; Republic of Kenya; health sector; report for assessment of health information system.
- HMN.The Health Metrics Network Framework 2nd Edition. 2008.
- Huryk, L. (2010): Factors influencing nurses’ attitudes towards healthcare Information technology. *J Nursing Manag* 2010.
- Kamadjeu R.M, Tapang E.M., and Moluh R.N. (2005). Designing and implementing an electronic health record system in primary care practice in sub-Saharan Africa: a case study from Cameroon. *Inform Prim Care* 13.
- Keke K. (2007). APT Telecommunity Telemedicine Initiative, Opening address at the *21st Pacific Science Congress in Okinawa*, Japan, P.14 June 2007, Pacific Science Association, Honolulu.
- Khazei A, Jarvis-Selinger S, Ho K and Lee A. (2005). An assessment of the telehealth needs and healthcare priorities of Tanna Island: A remote, under-serviced and vulnerable population. *Journal of Telemedicine and Telecare*.

Kivuti-Bitok, 2014, Attitudes of nursing staff towards computerization: a case of two hospitals in Nairobi, Kenya.

Kolodner, R. M., S. P. Cohn, C. P. Friedman. (2008). Health information technology: Strategic initiatives, real progress.

Kuhn, K. A., Giuse, D. A., (2001). From Hospital Information Systems to Health Information Systems Problems, Challenges, Perspectives. Institute of Medical Informatics.

Makori, A.C., Musoke. M., and Gilbert, M. (2013). User issues on the adoption of health informatics systems in level 5 hospitals in Nyanza, Kenya. *Interdisciplinary Journal of Contemporary Research in Business*; 5

Mead R. (2006). International management: cross-cultural dimensions. Cambridge, MA: Blackwell Publishers.

Meinert, DB. & Peterson, D. (2009), Perceived importance of EMR functions and physician characteristics, "Journal of System and Information Technology.

Ochieng, O.G., & Hosoi, R. (2005). Factors influencing diffusion of electronic medical records: a case study in three healthcare institutions in Japan, *Health Information Management*, 34 (4), 120

OECD (2013). Key ICT Indicators.

Odhiambo-Otieno G.W. 2005. Evaluation criteria for district health management information systems: lessons from the Ministry of Health, Kenya. *International Journal of Medical Informatics*.

Piontek, F., R. Kohli, P. Conlon, J. J. Ellis, J. Jablonski, N. Kini. (2010). Effects of an adverse-drug-event alert system on cost and quality outcomes in community hospitals. *American J. Health-System*.

Pollak, V. E, Lorch, J. A, (2007), "Effect of electronic patient record use on mortality in End Stage Renal Disease, a model chronic disease: retrospective analysis of 9 years of prospectively collected data.

Rotich J.K, Hannan T.J, Smith F.E et al. 2003. Installing and implementing a computer-based patient record system in sub-Saharan Africa: the Mosoriot Medical Record System. *Journal of the American Medical Informatics*.

Samy, G.N., R. Ahmad, and Z. Ismail, (2011) Health Information Security Guidelines for Healthcare Information Systems. In: ISHIMR 2011.

Sinha, R. (2010), Impact of Health Information Technology in Public Health. Sri Lanka *Journal of Bio- Medical Informatics*.

Sood, S. P., Nwabueze, S. N., Mbarika, V. W., Prakash, N., Chatterjee, S., Ray P., Mishra (2008). Electronic Medical Records: A Review Comparing the Challenges in Developed and Developing Countries. *Proceedings of the 41st Hawaii International Conference on System Sciences*.

Sunyaev, A., Göttinger, S., Mauro, C., Leimeister, J. M., Krcmar, H. (2009): Analysis of the Applications of the Electronic Health Card in Germany. *Business Services: Konzepte, Technologien, Anwendungen, Band II*.

Swanson, R.C., Bongiovanni, A., Bradley, E., Murugan, V., Sundewall, J., Betigeri, A., Nyongator, F., Cattaneo, A., Harless, B., Ostrovsky, A., & Labont, R. (2010). Toward a Consensus on Guiding Principles for Health Systems Strengthening.

World Health Organization (2010). Monitoring and evaluation of health system strengthening.

World Health Organization 2008: Framework and standards for country health information systems, 2nd edition. Geneva: World Health Organization.