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HEALTH INFORMATION SYSTEMS USAGE AND DISEASE SURVEILLANCE: A CASE STUDY OF MUHIMA DISTRICT HOSPITAL, KIGALI, RWANDA

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ABSTRACT

The usage of Health Information Systems (HIS) helps in disease surveillance program as it enables collecting data from multiples sources in real time and indicates the potential of disease outbreak in certain location. The purpose of the study was inspired by the arising issues of Health Information Systems icons were inactive and it is also not known whether the hospital staff is comfortable in using the health information system to perform their duties or whether there are various challenges experienced in the process of using the HIS in disease surveillance. The study aimed at examining effect of Health Information Systems usage on surveillance of diseases in Muhima District Hospital, Kigali, Rwanda. Specific objectives of this study are respectively: To assess health information systems usage at Muhima District Hospital, Kigali, Rwanda, to examine how disease surveillance is carried out using health information systems at Muhima District Hospital, Kigali, Rwanda and to determine the relationship between the usage of health information systems and disease surveillance in Muhima District Hospital, Kigali, Rwanda. The study would be a knowledge reference for further study, to improve on Health information systems and design more strategies for better planning. The research design is a case study. The target population is 232 healthcare staff of Muhima District Hospital. Using stratified and purposive sampling techniques, a sample size of 148 respondents was made. The pilot study was carried out at Kibagabaga District Hospital which had similar health information systems usage for testing the reliability of the questionnaire. Data were collected by means of questionnaires and interviews. Statistical

Package for Social Sciences (SPSS) vesrsion 20.0 was used as the data analysis tool. Findings revealed that GIS usage was agreed on by healthcare staff with the weighted means of 3.720 and the standard deviation of 0.499. Respondents' opinions were agreeing on use of analytic tools, medical data entry application and reporting tools at Muhima District Hospital with the weighted means of 3.993, 4.058 and 3.919 respectively and with 0.257, 0.398, and 0.470 their respective standard deviations showed that respondents agreed on the respective issues concerned. ICT Officer and Director General confirmed the results through interviews. There is a usage of manual systems in collecting data, few number of computers equipped with health information systems software and lack of training of new programs in ICT. Additionally, findings revealed r=0.797 multiple correlation coefficient which shows that there was a fair positive correlation between Health information systems usage and disease surveillance. The study also found that coefficient of determination r^2=0.6352, meaning that 63.52% of total variation in disease surveillance could be explained by stochastic multiple regression equation model developed, whereas the remaining total variation of 36.48% was attributed to factors beyond the control of the study. Recommendations of the study are to recruit staff with computer skills as an added advantage, strengthening user awareness on Health Information Systems usage policy, decrease manual systems usage by improving Health Information Systems usage, and conducting studies before implementation of information Systems project.

KEYTERMS: *Health Information systems, Information System, Information System Usage, Disease Surveillance Program, Management Information System (MIS), Usage.*

INTRODUCTION

This chapter describes the background of the study, the problem statement and research objectives as well.

Newly emerging and re-emerging infectious diseases and its consequences are in the spotlight. Since 1995, the World Health Organiation (WHO) Secretariat has given it high priority and is responding with determination towards infectious diseases (World Health Information, 1995). Prevention and control of communicable diseases depends on effective response systems which could be run successfully with helpful disease surveillance activities. In all countries, surveillance activities on communicable diseases are operated via functional surveillance systems which provide necessary information (WHO, 2000).

Information technologies in the healthcare sector are currently centrally involved in virtually all healthcare activities, from obtaining and recording information about patients, communicating with healthcare professionals and accessing medical literature, selecting diagnostic procedures, interpreting laboratory results and collecting clinical research data (Georgiou, 2001).

Chaudhry et *al*. (2006) stated that health information technologies, such as Electronic Health records (EHR), computerzed provider order entry, clinical decision support, electronic prescribing, telehealth, and other technologies that enable health information exchange have been promted and are being widely used in clinical context.

Kuhn and Giuse (2001) argued that the Web has become a popular channel to deliver information products or services, including those in healthcare industry. The use of web browsers for clinical workstations has increase significantly, as browsers offer a simple and intuitive user interface.

The state of information technology in developed countries is considered as the top in the world and is regarded as an international model. Germany, in 1993 became the first country to begin investing in Health information Technology (HIT), complete a national network, including " smart card" technology 2006 (Gerard et *al*., 2006).

In the U.S.A, the American and Recover and Reinvestment Act of 2009 included $ 19 billion dollars to encourage use of electronic medical records in hospitals and doctors' offices (Dener, 2009). Canada have implemented Health Information System and establish e-health Ontario in 2009 with three targeted strategies to improve; diabetes management, medication management and wait times. One of the examples of the service offered is e-Prescribing under the medication management. It authorizes and transmits prescriptions from physicians and other prescribers to pharmacists and other dispensers (e-Health Ontario, 2009).

Taylor and Lee's (2005) study on occupational therapists' use of information communication technology (ICT) in Western Australia revealed that e-mail and the personal comuter were the most frequently used ICT enabled services.

Developing countries have often been challenged to improve their Health Information Systems though the use of Information Technology (IT) in order to ugrade the health status of their people (Braa & Blobel, 2003). However, different countries have different political and

budgetary issues and situations which affect the development of their healthcare provision based on cureent technologies (Lun, 1999). Acknowledging the key role that information technologies can play in development and public health management, the Asian Development Bank (ADB) established the Health Sector Reform Project (HSRP) in 2005, with the aim of creating various reform initiatives, including those relating to Health Management Information Systems (HMIS) in different countries of Asia (Sundeep et *al*., 2010).

The Lao Pediatric Residency began in 1997 to train doctors in IT and lately, some Laotian graduates have used the internet regularly to research about pediatric cases and develop differential diagnoses, evaluations and treatments (Srour, 2007).

In Vietnam, there is a strong trend towards the application of IT and communications to develop hospital information management, especially for electronic medical records management and remote medical services to patients (Lieu & Dung, 2008).

In Thailand, a number of large hospitals have invested their IT budget into management and services to provide better healthcare quality. However, the majority of hospitals in Thailand, especially those in remote communities, still lack IT funds for such software development and deployment (Linux Med News, 2006).

ICT came into existence in most of the African countries through research institutions, educational institutions, or international organizations like the World Bank, United Nations Development Programme (UNDP), WHO, etc. (UNDP, 2000). The Health Information System Project was established in South Africa in 1994 and is the official health information system in the country (Braa & Hedberg, 2002). Its relative success in South Africa has led to the adoption of the software and ideas on health management to countries such as Mozambique and Malawi (Braa et *al*., 2004).

While ICT capabilities (computers, mobiles phones, Internet) were available in Nigerian teaching hospitals, mobiles phones were spreading fast (Idowu & Ogunbodede, 2003).

In Uganda, a health information system was designed in 1985 to capture and analyze morbidity data for selected communicable and non- communicable diseases, and other services like immunization and family planning (Kintu, 2005).

In Rwanda, communicable diseases constitute 90 percent of all reported medical consultations in health centres. Malaria, respiratory tract infections, diarrheal diseases, parasitic infections, and zoonoses are predominant. The country has often faced epidemics, including emerging and re-emerging infectious diseases such as influena A, cholera, epidemic typhus, and menengitis (Ministry of Health, 2012).

Rwanda adopted Integrated Disease Surveillance and Response (IDSR) strategy as proposed and adopted by the WHO Africa Region Assembly in 1998 to strengthen disease surveillance in member countries using an integrated approach aimed at defining roles and responsibilities and integration of surveillance functions at all levels (Rwanda biomedical center, 2017).

Health information techonology is a quickly growing industry with many committed stakeholders, including the Government of Rwanda, several non-governmental organizations, and private sector partners. Particularly in the area of electronic health records and national reporting system. Rwanda is a pioneer in national initiatives to integrate technology into its expanding healthcare system (Frasier, 2008).

Prior to 2008, the Rwanda HMIS existed almost entirely in paper form. Rwanda began using electronic HMIS in 2008 to capture facility healthcare data. Indicators collected include service uptake data for key programs and general health systems data. Patient-level data are recorded in paper-based registers by care providers. Data are aggregated at the facility-level and monthly reports are submitted to the district team. Prior to 2012, reports were then forwarded to the central Ministry of Health office and imported into an electronic system. Since 2012, Ministry of Health of Rwanda introduced a web-based system “District Health Information System (DHIS2)” allowing data entry to be done at the facility. This system allows data to be stored centrally, and the facility to maintain and view their data from a local database (Nisingizwe M.P. et *al*., 2014).

In 2009 and 2010 the Rwanda Ministry of Health and its partners from the Government of Rwanda as well as the United States of America (USA) Centers for Disease Control and Prevention, the African Field Epidemiology Network, and other partners embarked on a series of activities to develop a public health workforce that would be trained to operate disease surveillance and response systems at the national and district levels (Ntahobakurira et *al*., 2011).

In Rwanda, priority epidemic prone diseases are classified into three categories namely potential epidemic; diseases in elimination/eradication stage and diseases of public threats importance. Thus, there are 23 diseases under the national surveillance system reported and reporting is done using HIS which include a web based electronic reporting tool (Ministry of health, 2012).

Muhima District Hospital is located in Nyarugenge District of Kigali City. It was built in 1988 where it served as a health center, and in 2001, it becomes a hospital. Muhima hospital was elevated by the City of Kigali in April 2004 to become a district hospital (Muhima District Hospital, 2014).

With the enactment law N° 91 *bis*/2013 of 22/01/2014 on the establishment and organization of the University Teaching Hospital, Muhima District Hospital becomes a specialized center for maternal and Child care under *Centre Hospitalier Universitaire de Kigali* (CHUK) (Government of Rwanda, 2014). Appendix I illustrates the organizational structure of Muhima District Hospital.

1.2 Problem Statement

In different parts of the world, many studies have been conducted on the application of health information technology. For example in the United States of America, Lippincott and Wilkins (2015) reported that physicians who use health information technology systems are only slightly more likely to receive the patient information they need to provide coordinated care. In Germany, Ammenwerth et *al.* (2003) showed that information technology is emerging in health care.

In Rwanda, Abizeyimana (2012) stated that cloud virtual server technology has a great impact in Rwandan district hospitals management because it reduces the IT infrastructure costs. Mugisha et *al.* (2013) stated that the government of Rwanda has developed and deployed a Health Information System at District Hospitals in 2011.This technology has become one of the good tools of disease surveillance.

However, there are arising issues of concern related to reasons why some icons of Health Information System (HIS) were inactive despite the amount of millions of dollars spent on the coding and debugging of that system. It is also not known whether the hospital staff is comfortable in using the health information system to perform their duties or whether there

are various challenges experienced in the process of using the HIS in disease surveillance. Currently, there is a scarcity of published materials on the assessment of the effect of health information system usage on disease surveillance in Muhima District Hospital. Therefore this research will assess the effects of health information systems usage on disease surveillance in Rwanda, by considering the case of Muhima District Hospital, Kigali, Rwanda.

1.3 Objectives of the Study

The study has both general and specific objectives.

The general objective of this study was to assess how the usage of health information systems affects disease surveillance with respect to Muhima District Hospital.

Specific objectives were as follows:

- To assess health information systems usage at Muhima District Hospital, Kigali, Rwanda.
- To examine how disease surveillance is carried out using health information systems at Muhima District Hospital, Kigali, Rwanda.
- To determine the relationship between the usage of health information systems and disease surveillance in Muhima District Hospital, Kigali, Rwanda.

2. REVIEW OF RELATED LITERATURE

This study was based on Technology Acceptance Model (TAM) of Davis, TAM2 and UTAUT. Understanding the way in which people react to the emergence of new technologies is of great relevance to the field of Health Informatics. For one reason, low acceptance of Health Information Technology applications, would result into delays or even failure to successfully implement HIT systems, and to achieve relevant organizational goals, such as effective data patient management and storage (Holden and Karsh, 2010).

So far, research in the acceptance of various forms of Information Technology applications, such as Web, internet, mobile phone use applications, and different kinds of software, has identified a number of key psychological variables that predict usage intentions. Specifically, perceived utility, perceived ease of use, and the attitudes towards the Information Technology applications in questions have been found to be the strongest predicators of usage intentions (Venkatesh and Davis, 2000).

The tripartite of perceived utility, perceived ease of use, and attitudes has been well summarized in the technology acceptance model (TAM), which was originally developed by

Davis to assess International Business Machine employees' acceptance of new software (Venkatesh and Davis, 2000).

Venkatesh and Davis (2000), reconsidered the structure of the original TAM and used empirical findings to judge the importance of the models' traditional constructs. In their revised model, known as TAM2, they excluded attitudes, but retained perceived usefulness and ease of use, as these two variables were consistently found to be strong drivers of intentions to use technology. Furthermore, the TAM2 approach added measures of subjective norms to capture social influences (see figure 2.4). The roles of perceived ease of use, job relevance, and social norms seems important, thus showing the TAM2 is perhaps more appropriate for use in healthcare settings than the original TAM. They also argued that job relevance is another important variable to be included in the TAM2. This construct reflects people's beliefs about the applicability of the target IT applications to ones job or daily routines at work. Other constructs related to output quality and results demonstrability of IT applications, were also added in TAM2 based on the idea that those influences, along with social norms and job relevance, would predict perceived usefulness and ease of use.

Therefore, compared to the original TAM approach, the TAM2 expanded considerably the range of indirect effects of distal predictors (e.g., social norms, relevance) on usage intentions, while emphasizing the central role of perceived usefulness and ease of use.

According to Venkatesh et *al.*, (2003), the Unified Theory of Acceptance and Use of Technology (UTAUT) was developed from eight theories, which include the Theory of Reasoned Action, Technology Acceptance Model, Motivational Model, Theory of Planned Behavior, Combined Technology Acceptance Model / Theory of Planned Behavior, Model of Personal Computer Utilization, Innovation Diffusion Theory and Social Cognitive Theory. Figure 2.6 illustrates that the UTAUT proposes four main determinants of behavioural intention regarding people using information technology which are Performance Expectancy, Effort Expectancy, Social Influence, and Facilitating Conditions. In addition, the UTAUT model found four moderators which affect the determinants: gender, age, experience and voluntariness of use from the perspective of social psychology. Performance Expectancy is defined as the performance of information technology for the user. Effort expectancy is defined as the degree of ease associated with use of the system. Social influence is defined as the degree to which an individual perceives the importance that others give to whether he or she should use the new system. Social influence is considered to be system or application-

specific, whereas subjective norm relates to non-system-specific factors. Facilitation Conditions are defined as the degree to which an individual believes that an organization and/or technical infrastructure exist to support their use of the system.

2.1 Health Information System and Disease Surveillance

The health information industry has been around officially since 1928 when the American College Of Surgeons (ACOS) sought to increase and improve the standards of records that were created in the clinical setting that is during the diagnosis and treatment of healthcare patients. The 1980s was the start of using computer software and the 1990s was the golden period for development of IT in hospitals which included laboratory, radiology and pharmacy (Baniode and Motasem, 2014).

According to Rajesh (2010), the implementation of HIT is increasing in healthcare settings. Initially, they were used mostly for administrative and financial purposes, but in today's ambitious and challenging healthcare scenario the healthcare providers completely depend on HIT for timely and instant access to health information. At any given point of time during patient encounter or afterwards, HIT allows the provider to collect, store, retrieve and transfer information in and across healthcare settings. The health sector has always relied on technologies. HIT contribution in public health is countless in terms of providing elective, emergency, and long-term clinical care; educating community; improving nutrition and hygiene; and providing more sanitary living conditions. These in turn ultimately involve massive social and economic changes, as many health challenges go well beyond the health sector.

Today, with the advent of the Internet, high speed computers, voice recognition, wireless and mobile technology healthcare professionals have many more tools available at their disposal. Thus, technology has the potential to help with clinicians need to be more efficient, migrate away from paper based records, reduce medication errors, and have educational and patient related information at their fingertips (Hoyt, Sutton and Yoshihashi, 2009).

According to Nkuchia et *al.* (2013), to monitoring contacts of persons with serious communicable disease to detect early symptoms, the term surveillance was restricted in public health so that prompt isolation could be instituted. Effective disease control measures could be initiated when a primary goal surveillance was to define the magnitude and severity of the outbreak in humans and animals. Confronting the need for information that is faster,

more granular and increasingly complex, a huge growth area for innovation in surveillance relates to the technologic processes required to share public health information. Technology has the potential to transform infectious disease surveillance and advances in information technology are inducing paradigm shifts in public health practice. Implementing of internet based in certain area has dramatically improved timeliness and completeness of reporting because notifications are conveyed to a central database where they can be analyzed.

Health Information Systems (HIS) refer to any system that captures, stores, manages or transmits information related to the health of individuals or the activities of organizations that work within the health sector. This definition incorporates things such as district level routine information systems, disease surveillance systems, and also includes laboratory information systems, hospital patient administration systems and human resource management information systems. A well-functioning Health Information Systems is an integrated effort to collect, process, report and use health information and knowledge to influence policy and decision-making, program action, individual and public health outcomes, and research (Nicola & Shivnay, 2012). The Health Metric Network, in their Framework and Standards for country Health Information Systems, has defined Health Information Systems as consisting of six components (refer to figure 2.1).

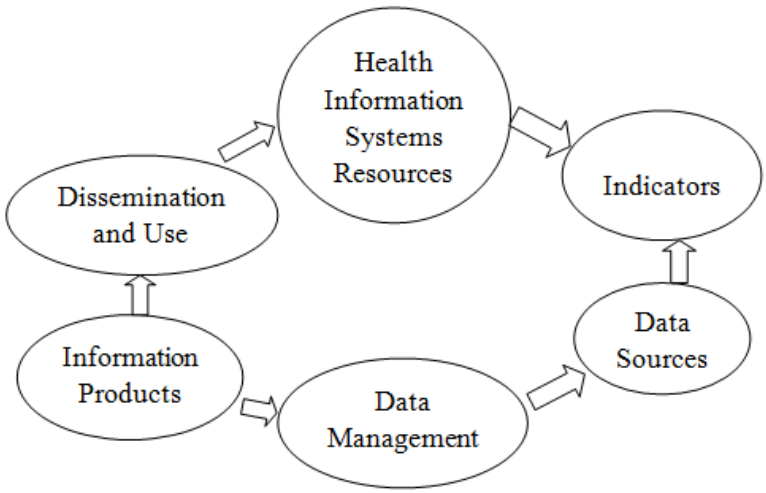

Figure 2.1: Six components of HIS Source: (Nicola & Shivnay, 2012)

a) Health Information Systems Resources: These include the legislative, regulatory, and planning frameworks required for a fully functioning Health Information Systems, and the resources that are required for such a system to be functional. Such resource involve

personnel, financing, logistics support, Information Communication and Technology, and coordinating mechanisms within and between the six components (Nicola & Shivnay, 2012).

b) Indicators: A core set of indicators and related targets is the basis for a health information system plan and strategy. Indicators need to encompass determinants of health; health system inputs, outputs and outcomes; and health status (Nicola & Shivnay, 2012).

c) Data Sources: These can be divided into two main categories including population-based approaches (censuses, civil registration and population surveys) and institution-based data (individual records, services records and resource records). A number of data-collection approaches and sources do not fit into either of the above main categories but can provide important information that may not be available elsewhere. These include also occasional health surveys, research, and information produced by community-based organizations (Nicola & Shivnay, 2012).

d) Data Management: This covers all aspects of data handling from collection, storage, quality assurance, and flow, to processing, compilation and analysis (Nicola & Shivnay, 2012).

e) Information Products: Data must be transformed into information that will become the basis for evidence and knowledge to shape health action (Nicola & Shivnay, 2012).

f) Dissemination and Use: The value of health information is enhanced by making it readily accessible to decision-makers and by providing incentives for, or otherwise facilitating, information use (Nicola & Shivnay, 2012).

2.2 Conceptual Framework

The conceptual framework expresses the rationale behind the study. It reveals and tries to show the relationship between Health Information Systems Usage and disease surveillance at Muhima District Hospital, Kigali, Rwanda as shown in Figure 2.2.

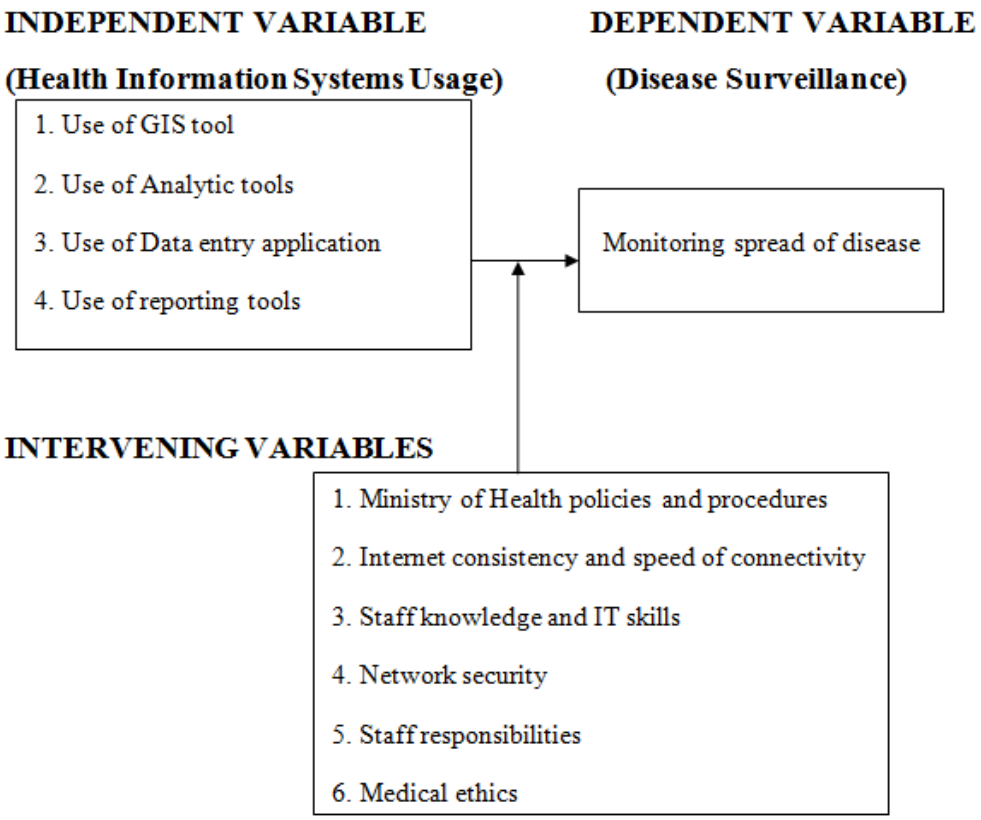

Figure 2.2: Conceptual Framework Source: (Preliminary interpretation)

3. Research Methodology

Methodological approach, the techniques and instruments used in conducting the research. The research methodology various methods were used in research design, design, target population, sample size, sampling technique, data collection methods, data collection instruments, administration of data collection instruments and data analysis procedures.

3.1 Research Design

A descriptive case study research design was chosen because it allows field research which will give deeper description and analysis of the study problem in the chosen study location. It helped to go beyond the quantitative statistical result and understand the behavioral conditions through the employees' perspective; explain both the process and outcome of a phenomenon through complete observation, reconstruction and analysis of the cases It helped to get a picture of health information systems usage and disease surveillance within Muhima District Hospital.

3.2 Target Population

The participant was taken from 11 clinical departments of Muhima District Hospital employees for the year 2017. The study population comprised 19 doctors, 117 nurses and midwives, 94 other medical practitioners (allied health workers) in the same institution, 1 Medical director and 1 ICT officer. The respondents were 230 healthcare staff, excluding Director General and ICT Officer.

3.3 Sample Design and Sampling Techniques

Sample design involved sample size determination from target population, stratified random sampling and purposive sampling techniques were used as the method of selecting sampling units from sampling population.

The sample size of this research was generated by applying Yamane's simplified formula, as cited by Israel (Israel, 2013) where the level of confidence is 95% and sampling error is 5%.

$\boldsymbol{n}=\frac{N}{1+Ne^2}$ where,

N: Sample size, N: Total population, e: Sampling error of 5% (Yamane, 1967).

With N= 230 Persons, e = 0.05, we obtained following calculation:

$n = \frac{N}{1+N(e^2)} = \frac{230}{1+230(0.05)^2}$ = 146.03≈ 146 Number of respondents.

The sample of 146 respondents was drawn from the target population.

The sample size of 146 respondents was drawn from a target population of 230 staff within Muhima District Hospital. Stratification was used to group proportionally the population into three strata, including Muhima District Hospital Medical Doctors, medical practitioners (allied health workers) and Muhima District Hospital nurses. Strata proportions were simply being calculated as it follows:

Cohen (2003) stated that a strata proportion will be calculated using this formula:

$p = \frac{N1}{N} \times n$ Where, p= strata proportion, N1= Population of strata,

N= Total population, n= sample size.

Strata 1 (Muhima District Hospital Medical Doctors) = 146(19/230) = 12.06≈12

Strata 2 (Muhima District Hospital Nurses) =146(117/230) = 61.57≈ 62

Strata 3 (Muhima District Hospital Medical Practitioners) =146(94/230) =72.36≈ 72

In addition Purposive sampling was considered because of responsibility of the respondents (Director General and ICT Officer). All the targeted respondents interact daily basis with the health information systems in Muhima District Hospital

3.4 Data Collection and Analysis

Data collection employed mixed methods. According to the objectives of the study, structured questionnaires were administered to healthcare staff and interview guide were used to conduct interviews with Director General and ICT Officer in their own offices. Questionnaires were considered because they are less costly, use less time, require less administration effort that is inherent in instruments like interviews and useful in obtaining objective data (Marshall & Rossman, 2006). Structured questions were formulated according the objectives of the study. Furthermore, questionnaires included standardized answers that make it simple to compile data. Among the closed ended questions, the use of Likert scales was employed. Likert scale of 5 to 1 was used. 5 = Strongly Agree, 4 = Agree, 3 = Neutral, 2 = Disagree and 1 = Strongly Disagree.

Quantitative analysis method has been used including frequencies, percentages, weighted means, standard deviation, and multiple regressions to describe the relationships between variables. Statistical Package for Social Sciences (SPSS) version 16.0 was used as a tool for quantitative analysis while interview guides and open-ended questions have been analyzed qualitatively using content analysis.

3. RESEARCH FINDINGS AND DISCUSSION

Questionnaires were distributed within Muhima District Hospital. Data were collected during working hours and based on the usage of health information system to affect the land management. Furthermore, the interviews guides were administrated to the Director General of Muhima District Hospital and ICT officer.

Interviews guides were used to understand further information on information system usage, tasks which were achieved using health information system and disease surveillance. Questions involving Likert Scale were analyzed by calculating weighted means where the

weights were as follows: 5= Strongly Agree; 4=Agree; 3=Not sure; 2= Disagree; 1= Strongly Disagree.

$$\text{Weighted mean} = \frac{\sum(weights * observered\ frequences)}{\sum observed\ frequencies}$$

Table 4.1: Assessing health information systems usage at Muhima District Hospital, Kigali, Rwanda.

	N	Strongly Agree 5	Agree 4	Not Sure 3	Disagree 2	Strongly Disagree 1	Weighted Mean	Std.
Use of GIS	137	3 (2.19%)	92 (67.15%)	42 (30.66%)	0 (0%)	0 (0%)	3.720	0.499
Use of Analytic tools	137	4 (2.92%)	128 (93.43%)	5 (3.65%)	0 (0%)	0 (0%)	3.993	0.257
Use of Medical Data Entry application	137	15 (10.95%)	115 (83.94%)	7 (5.11%)	0 (0%)	0 (0%)	4.058	0.398
Use of Reporting tools	137	10 (7.30%)	106 (77.37%)	21 (15.33%)	0 (0%)	0 (0%)	3.919	0.470

Source: Field data

(SD<0.5 or close to zero -Respondents responses crowded around the weighted mean),

(SD >0.5 or high -Respondents responses dispersed on the issues concerned).

Use of GIS

From Table 4.7, Out of 137respondents, 3 (2.19%) strongly agreed, 92 (67.15%) agreed, and 42 (30.66%) were not sure on the use of GIS at Muhima District Hospital. The weighted mean of 3.72 and the standard deviation of 0.499 shows that respondents' responses were crowded around the weighted mean or the respective issues concerned. This indicated that majority of healthcare staff are aware of GIS usage and some healthcare staff of Muhima District Hospital does not explore all icons of HIS especially the icon of GIS.

Use of Analytic tools

From Table 4.7, Out of 138 respondents, 4 (2.92%) strongly agreed, 128 (93.43%) agreed, and 5 (3.65%) were not sure on the use of Analytical tools at Muhima District Hospital. The weighted mean of 3.99 and the standard deviation of 0.257 shows that respondents' responses were crowded around the respective issues concerned.

This indicated that some healthcare staff of Muhima District Hospital does not use all icons of HIS especially analytical tools.

Use of Medical Data Entry application

From Table 4.7, Out of 138 respondents, 15 (10.95%) strongly agreed, 115 (83.94%) agreed, and 7 (5.11%) were not sure on the use of Medical Data Entry application at Muhima District Hospital. The weighted mean of 4.058 and the standard deviation of 0.398 shows that respondents' responses were crowded around the respective issues concerned.

Use of Reporting tools

Table 4.7 revealed that Out of 138 respondents, 10 (7.30%) strongly agreed, 106 (77.37%) agreed, and 21 (15.33%) were not sure on the use of reporting tool at Muhima District Hospital. The weighted mean of 3.919 and the standard deviation of 0.470 shows that respondents' responses were crowded on the respective issues concerned.

Table 4.1: Examining how disease surveillance is carried out using health information systems at Muhima District Hospital, Kigali, Rwanda.

	N	Strongly Agree 5	Agree 4	Not Sure 3	Disagree 2	Strongly Disagree 1	Weighted Mean	Std.
Identify and report priority diseases	137	22 (16.06%)	108 (78.83%)	7 (5.11%)	0 (0%)	0 (0%)	4.109	0.448
Data examination to alert and prompt action	137	46 (33.58%)	91 (66.42%)	0 (0%)	0 (0%)	0 (0%)	4.336	0.474
Confirming suspected outbreaks	137	25 (18.25%)	112 (81.75%)	0 (0%)	0 (0%)	0 (0%)	4.182	0.388
Analyzing and interpreting data in outbreak and routine disease monitoring	137	65 (47.45%)	72 (52.55%)	0 (0%)	0 (0%)	0 (0%)	4.474	0.501
Information analysis to implement appropriate response	137	15 (10.95%)	110 (80.29%)	12 (8.76%)	0 (0%)	0 (0%)	4.022	0.445
Provide feedback across health information systems	137	71 (51.82%)	66 (48.18%)	0 (0%)	0 (0%)	0 (0%)	4.518	0.501
Evaluating and improving performance of disease surveillance and response systems	137	21 (15.33%)	101 (73.72%)	15 (10.95%)	0 (0%)	0 (0%)	4.044	0.513

Source: Field data

(SD<0.5 or close to zero -Respondents responses crowded around the weighted mean),

(SD >0.5 or high -Respondents responses dispersed on the issues concerned).

Identify and report priority diseases

Table 4.8revealed that the majority of respondents agreed on identifying and reporting priority diseases with a weighted mean of 4.109. Out of 137 respondents, 22 (16.6%) strongly agreed, 108 (78.83%) agreed, and 7(5.11%) were not sure. The standard deviation 0.448 shows that respondents' responses were crowded around the respective issues concerned.

Data examination to alert and prompt action

Table 4.8 revealed that the majority of respondents agreed on data examination to alert and prompt action with a mean of 4.336. Out of 137 respondents, 46 (33.58%) strongly agreed, and 91(66.42%) agreed. The standard deviation 0.474 shows that respondents' responses crowded on the issues concerned.

Confirming suspected outbreaks

Table 4.8 revealed that the weighted mean is 4.182. Out of 137 respondents, 25 (18.25%) strongly agreed, and 112 (81.75%) agreed. The standard deviation 0.388 shows that respondents' responses crowded on the issues concerned.

Analyzing and interpreting data in outbreak and routine disease monitoring

Table 4.8revealed that the majority of respondents agreed on Analyzing and interpreting data in outbreak and routine disease monitoring with a weighted mean of 4.474. Out of 137 respondents, 65 (47.45%) strongly agreed and 72(52.55%) agreed. The standard deviation 0.501 shows that respondents' responses were dispersed on the issue concerned.

Information analysis to implement appropriate response

Table 4.8revealed that the majority of respondents agreed on information analysis to implement appropriate response with a weighted mean of 4.022. Out of 137 respondents, 15 (10.95%) strongly agreed, 110(80.29%) agreed and 12 (8.76%) were not sure. The standard deviation 0.445 shows that respondents' responses were crowded around the respective issues concerned.

Providing feedback across health information systems

Table 4.8 revealed that the majority of respondents agreed on information analysis to implement appropriate response with a weighted mean of 4.518. Out of 137 respondents, 71

(51.82%) strongly agreed and 66(48.18%) agreed. The standard deviation of 0.501 shows that respondents' responses were dispersed on the issue concerned.

Evaluating and improving performance of disease surveillance and response systems

Table 4.8 revealed that the majority of respondents agreed on evaluating and improving performance of disease surveillance and response systems with a weighted mean of 4.044. Out of 137 respondents, 21(15.33%) agreed, 101(73.72%) agreed and 15 (10.95%) were not sure. The standard deviation of 0.513 shows that respondents' responses were dispersed around the issue concerned.

4.2.2 Effect between Health information systems usage and disease surveillance.

Statistical Package for Social Sciences (SPSS) version 20.0 and the multiple regression analysis model was used to analyze the relationship between health information system usage and monitoring spread of disease at Muhima District Hospital, Kigali, Rwanda.

$Y = a + b_1 X_1 + b_2 X_2 + \ldots\ldots\ldots\ldots\ldots\ldots + b_k X_k + \varepsilon$

Where: X_k is the Independent variable,a and b_k Coefficients, ε is the error term, and Y the Dependent variable.

Assume that Y: Monitoring spread of disease (disease surveillance),

X_1: use of GIS tool X_2: Use of Analytical tools, X_3: Use of medical data entry application and X_4: Use of reporting tools.

Table 4.2: Multiple Regression Analysis Model.

Model	B	Std. Error	Beta	T	Sig.
(Constant)	3.509	.312		11.246	.000
Use of GIS tools	.272	.083	.271	3.265	.001
Use of Analytic tools	.028	.168	.015	.169	.024
Use of medical data entry application	.211	.125	.168	1.694	.093
Use of reporting tools	.233	.133	.218	1.744	.083

From result of table 4.5, the regression model to support the research objective was developed.

$Y = a + b_1 X_1 + b_2 X_2 + \ldots\ldots\ldots\ldots\ldots\ldots + b_k X_k + \varepsilon$

$Y = 3.509 + 0.272\ X_1 + 0.028\ X_2 + 0.211\ X_3 + 0.233\ X_4 + 0.312$where a=3.509 and

ε= 0.312

Y = 3.509 + 0.272 use of GIS tool + 0.028 use of Analytic tool + 0.211 use of medical data entry application + 0.233 use of reporting tools + 0.378.

5. Summary of findings

Findings shows that the majority of respondents agreed and with same understanding on the issue concerned. Health Information Systems usage supports the healthcare providers in real time access of patient's information. Disease surveillance use health information systems in daily activities and Health Information Systems Usage help health staff to easily perform their duties. Muhima District Hospital' staff use health information systems in disease surveillance but faced some challenges.

The finding on use of GIS showed that the weighted mean is 3.720, on use of analytic tools and medical data entry application the weighted mean is 3.993 and 4.058 respectively, for reporting tools, the weighted mean is 3.919 shown that, respondents agreed on usage of Health Information systems at a high level within Muhima District Hospital, Kigali, Rwanda.

From Table 4.7, findings on examination of how disease surveillance is carried out using health information systems. Respondents' responses generally agreed on the use of health information systems in disease surveillance. Responses on priority disease identification and report with the weighted mean of 4.109. On the item of data examination to alert and prompt action with the weighted mean of 4.336. Regarding confirming suspected outbreaks, with the weighted mean of 4.182. On analyzing and interpreting data in outbreak and routine disease monitoring the weighted mean is 4.474. The level on information analysis to implement appropriate response with the weighted means of 4.022, provide feedback across health information systems with the weighted mean of 4.518, evaluating and improving performance of disease surveillance and response system with the weighted mean of 4.044.

The findings were also emphasized on R-squared = 63.52%. This reveals that Health Information Systems have positive effect on disease surveillance. From this, 36.48 % reveal that there are other factors behind independent variables of research, which affect disease surveillance.

6. CONCLUSION

From this study, with main objective: to assess the relationship between Health Information System usage and disease surveillance within Muhima District Hospital of Kigali, Rwanda. The relationship was measured using both coefficient of correlation and R-squared values. The results shown that there were high correlations between the independent variable (Health Information systems usage) and dependent variable (disease surveillance) and the level of

usage was very high The value of R-square were good, to highlight the effectiveness of health information system usage on diseases surveillance.

7. RECOMMENDATIONS

Recommendations derived from findings are addressed to Muhima District Hospital; to use health information systems on high level because they contribute more in disease surveillance. Basic computer knowledge for new staff recruitment should be taken as a condition.

To decentralize the electronic data recording systems in health centers and community level to improve data entry performance by strongly involving ICT Team. This has to go with the increasing of internet connectivity in diverse corners of the district.

The user should be trained in health information systems usage; this has to go with the improvement of policy and awareness of Information technology to all health and being updated to new version.

8. Areas for further Research

For this study, the factors that used to assess effectiveness of health information systems on disease surveillance represented 63.52%, i.e., there were other factors that represent 36.48 %. Further research should assess other factors that affect disease surveillance. Those factors should be included in the regression model(s) for future studies, in addition to the factors identified in this research. Similar studies need to be carried out in other districts hospital of Rwanda in order to have a broad-based view of the situation concerning health information system usage and disease surveillance in Rwanda.

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