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Adoption of Internet Based Systems for Stock Monitoring

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Abstract- This study sought to investigate the use of Internet based systems to monitor the stock of antiretroviral drugs in level4 public hospitals. The said Internet based systems is currently geared towards keeping medical records and resupply decisions. In order to come up with this investigation this study was carried out using the following objectives. First was to investigate how the use of internet based systems can monitor stock levels of antiretroviral drugs. Secondly was to determine how obsolescence of antiretroviral drugs can be controlled using Internet based systems. Thirdly was to examine how Internet based systems can influence record keeping of antiretroviral drugs.

This study made use of inventory control theory and descriptive research design; target population for this study was made up of all the thirteen levels 4 hospitals in Kisii County. A total of thirty nine officers was issued with the questionnaire, but only thirty questionnaires were returned and this is what was used for analysis. Purposive sampling was used as only the procurement managers, stock controllers and the dispensing officer were issued with questionnaires as they have the have first- hand information on antiretroviral drugs in their facilities.

The findings from the data and interpretation of the responses revealed that those hospitals that have adopted Internet based systems have achieved better stock control. Thus they should be adopted to solve stock control challenges such as stock levels, obsolescence and record keeping of antiretroviral drugs in level 4 public hospitals in KisiiCounty.

Index Terms- ADOPTION,INTERNET-BASEDSYSTEMS, MONITORING, STOCK, ANTIRETROVIRAL DRUGS, LEVEL4PUBLICHOSPITALS,KISIICOUNT,YKENYA

I. INTRODUCTION

According to WHO(2011) HIV/AIDS is a global pandemic. This implies that those who are infected are many and therefore their need for antiretroviral drugs is high. The number of people receiving antiretroviral drugs has increased considerably in the recent years and is expected to grow in coming years (Schouten, 2011). A major challenge is to maintain uninterrupted supplies of antiretroviral drugs and prevent stock out. Reliable supply chains are needed to ensure that there no interruptions in treatment.

To ensure that all those patients who need these drug access them considerable energy and money have been spent trying to achieve universal access to treatment for HIV(UNAIDS,2012).This is part of a wider objective to provide universal access (15 million people on treatment) by 2015 as agreed in 2010. In spite of to the efforts that are being mae still many patients has not been able to access these drugs. These because the stock control of antiretroviral drugs is faced by a number of challenges. One is improper stock levels (Vawda& Variawa, 2012) say that lack of adequate supply of antiretroviral medication has been one of the challenges documented. Two is obsolescence according to WHO (2011) in order to be cost effective, accurate forecasting of the necessary quantity of drugs is needed. Over purchasing of antiretroviral drugs can put strain on money and storage space and may lead to wastage of drugs with limited shelf-life.

In Kenya HIV/AIDS has been declared a national disaster since 1999. The number of people receiving the antiretroviral drugs has been on the rise. The Government of Kenya in conjunction with the donors has put considerable efforts to ensure that patients access these drugs. Despite the efforts to ensure adequate supply the major setback lies in poor stock control**.** According to the Kenya Health Information System strategic plan 2009-2014; the use of internet based systems in Kenya healthcare sector is primarily limited to the records keeping and resupply decisions to health facility. However according to the e-health strategic plan 2011-1017 Kenya's healthcare players have not fully embraced the use of internet based systems like their financial counterparts in their service delivery options and reach.

Antiretroviral drugs are expensive, because of this programs and streamlining their pipelines (eliminating levels) and reducing lead times and review periods; thus they can minimize the quantity of buffer stock that needs to be maintained at facility levels and central warehouses. In some cases facilities review their stock status and place orders on monthly basis; they are provided with one month buffer stock. According to WHO (2011) in order to be cost effective, accurate forecasting of the necessary quantity of drugs is needed.

The cycle of providing antiretroviral drugs is information based; therefore poor coordination of the necessary information is the major cause of the unavailability of these drugs to people who need them. Despite many improvements the limited availability of ARVs continues to be reported as a major constraint to scaling up programs

As countries move to rapidly scale up comprehensive HIV/AIDS programs, it is critical that adequate and continuous availability of diagnostics medicines and other pharmaceuticals be ensured at the point of service. Stock outs or irrational use of ARVs can result in treatment interruptions that can quickly lead to treatment failure and the development of drug resistance.

Stock outs continue to be major constraints in HIV and TB programs. The WHO Report on Global HIV/AIDS Responses published in 2011 stipulates that out of the 118 countries reporting information on ARVs stock out, 45 countries (38%)

reported that they experienced one ARV stock out episode at the health facility level in 2010. The AIDS medicines and Diagnostics Services (AMDS) in collaboration with the Global Fund and other AMDS partners organized two capacity building workshops on procurement and supply management to prevent stock outs and over stocks of HIV products.

In Kenya, the use of internet to control stock of antiretroviral drugs through the computerized Logistics Management Information System (LMIS) was originally solely used for resupply decisions at KEMSA and did not consider the information needs of different managers and policy makers. Generally the LMIS monitors stock levels throughout the supply chain, calculates reorder quantities for individual facilities, provides data for estimating future demand in the system and identifies facilities requiring supervision(John2007).

In Kenya HIV/Aids has been declared national disaster in 1999. This was because people infected and/or affected were increasing at an alarming rate. In attempting to prolong the lifespan of the people infected, the Government of Kenya partnered with donors for the supply on the antiretroviral drugs. The stock control of these antiretroviral drugs has faced a number of challenges such improper record keeping, poor stock levels, obsolescence ,irregular access of antiretroviral drugs by patients and rollout of antiretroviral therapy (Vawda & Variawa,2012). In addressing these challenges, the Government of Kenya has adopted the use e-health systems. According to Kenya health sector strategic plan for health information system 2009-2014, Internet based systems are being implemented in health institutions including level 4 hospitals. The study by Fuchao (2011) focused on mobile personal health care systems for patients with diabetes shows that internet based systems are being adopted for monitoring patients. For example use of online patients' medical records. However the adoption of Internet based systems in monitoring the stock of antiretroviral drugs in level 4 hospitals in Kisii County remains untapped, hence the focus of this study. **The objectives used were:**

1. To examine use Internet based systems in monitoring stock levels of antiretroviral drugs in level 4 public health institutions in Kisii County.

2.To determine how obsolescence of antiretroviral drugs can prevented using Internet based systems in level public health institutions in Kisii County

3.To examine how Internet infrastructure influence record keeping of antiretroviral drugs in level 4 public health institutions in Kisii County

The government in conjunction with the donors and Non-Governmental Organizations (NGOs) are doing all they can to ensure the availability of ARVs to people living with HIV/AIDS. This study is focused on ARVs because of the following reasons firstly ARV drugs are particularly high-value items therefore regulatory mechanisms must be secured to avoid misuse or misappropriation. Two ARV treatments are complex to use and monitor. Three ARVs can easily be inappropriately prescribed or misused with little health gain and potentially adverse public health consequences such as development of drug resistance. And four interruption of the drug supply may have serious repercussions for patient care and overall program efficiency. ARV drugs require a good supply chain management because they are costly, generally have short shelf life, require long life use so they should be continuously available and also require strict adherence by the patient so as to minimize development of resistance.

This research was done in Kisii county Kenya.A county system is the new administrative structure according to theKenya's new constitution 2010. Kisii County is number 47 found in South West Kenya. This County 13 level 4 hospitals which are distributed in the 7 constituencies.

II. LITERATURE REVIEW

This chapter discussed the literature related to Internet based systems for monitoring stock control of antiretroviral drugs in the healthcare service delivery. It particularly focusedon analyzing the features of the internet that makes it suitable to monitor the stock levels of antiretroviral drugs. Two examining how internet based systems can help to solve stock control problems of antiretroviral drugs such as improper stock levels, obsolescence and poor record keeping. This study made use of inventory control theory. Under conceptual framework this study has three variables; the independent variable is internet,dependent variable is stock control and the mediating variable.

2 .1. Theoretical Framework

This research made useof Inventory control theory. Horst (2011) argues that regardless of the type of inventory in question inventory requires storage and there is always a cost associated with the storage. This theory is concerned with all actions related to the storing of items and the consequences both positive and negative Levi (2004). The benefits will include the problems that will be avoided by making use of the internet to control stock of antiretroviral drugs such as overstocking, obsolescence, stock-out and record keeping.

One of the most common applications of inventory control theory is in the determination of the optimal quantity of inventory to be held. There are several mathematical models in use that can act as a useful tool in inventory control. These models strive to balance storage costs with order costs; the cost of shortage is also considered. While inventory control theory tend to be short-sighted regarding the non- monetary costs of storage, and it makes assumptions regarding future demand and delivery that could not be known , inventory control theory is still a cost- saving tool, and is still considered part of good business practice in a firm. According toWangechi (2011) internet is a channel with the capability to communicate directly with the relevant audiences regardless of their location as long as they can access the facility. It is a network of networks that consist of millions of private, public, academic, business, and government networks, of local to global scope, that are linked by a broad array of electronic, wireless and optical networking technologies (Wikipedia). Internet will be used as a form sharing the necessary information required by the various channel members in their effort to provide ARVs to people living with HIV/AIDS.

As countries move to rapidly scale-up comprehensive HIV/AIDS programs, it is critical that adequate and continuous availability of diagnostics medicines and other pharmaceuticals be ensured at the point of service. Stock outs or irrational use of ARVs can result in treatment interruptions that can quickly lead

to treatment failure and the development of drug resistance. Despite many improvements the limited availability of the ARVs continues to be reported as a major constraint to scaling up programs. The major challenges being experienced in the stock control of ARVs include improper stock levels, obsolescence and poor record keeping. With the use of the internet these problems can be solved. Approaches/ Tools of internet that can be used to control stock of ARVs include barcoding, electronic data Interchange, Radio Frequency Identification, Vendor/Supplier Managed Inventory, and Enterprise Resource Planning. For the said internet to operate the following aspects are necessary; these are Internet accessibility and infrastructure

Internet access in Kenya is widespread. In all cities and most towns, public internet computers can be found. Only in very rural areas may have to do without. Rates are usually low: typically 1 shilling per minute (CCK, 2012). If Internet is cheaply affordable all over the country it means that antiretroviral drugs supply chain partners can easily exchange the information required among the channel members.

The internet infrastructure is an array of remote hardware and software working to send and receive information to various systems (Wisegeek2013). According to USAID/Kenya (2012) 83% out of the 600,000 Kenyans on antiretroviral treatment are treated in sites that use Antiretroviral Dispensing Tool (ADT). The dispensing tool is valuable resources that allow pharmacy staff to keep track of patient information and records on the antiretroviral drugs being prescribed and dispensed.

The following aspects of Internet based systems will be used for the purpose of this study to show how internet based systems can monitor the stock levels of antiretroviral drugs in healthcare institutions. These are (Lysons 2007) argues that with increasing computerization, plain language description of products and services need to be replaced by codes that are usable in all trade and industry sector worldwide. The EAN's (International Article Numbering System) was established in 1977 and provides a unique and unambiguous numbering system that enables items to be identified anywhere in the world. These numbers are represented by bar codes, a pattern of wide and narrow black bands and alternating white spaces that a computer reads with the aid of an optical scanner or wand.

According to Article Numbering Association (ANA) publication the benefits of bar coding include fast and accurate data capture at every point in the supply chain including goods received, warehousing, dispatch and point of sale, Better more timely management of information, Less stock holding and less waste, Greater responsiveness to trade customers, The ability to automate warehousing, Better control over distribution and storage, Fewer errors in recognition of goods, Improved company to company communications throughout the supply chain and also one standard for use to avoid conflicting demands. According to the benefits of barcoding listed above, this type of internet based system can help solve the challenges of stock control of antiretroviral drugs it can offer timely management information. Barcode scanners can be used to notify stock managers on the stock levels, what quantity to order and when. Barcoding internet systems can enable an institution to have a vendor managed inventory in which stock control is left to the supplier.

Baily *et.al.*,2008) defines stock control as refer to the policies and procedures which systematically determine and regulate which thing are kept in stock and what quantities of them are stocked. Stock control, otherwise known as inventory control, is used to show how much stock you have at any one time, and how you keep truck of it. Efficient stock control allows an organization to have the right amount of stock in the right place at the right time.

Every participant in a supply chain whether manufacturer or vendor prefer to reduce stock and yet maintain customer service so as not to lose customer due to non -availability of goods. Insufficient ARVsat any stock point be it at KEMSA, Central warehouse, regional warehouses or even the authorized health facilities can be very critical in the sense that PLWHS cannot get the medication when they need them. A typical supply chain consists of multiple items and stock points where each stock point has a customer and a supplier operating within the law of demand and supply. The typical decision made at a stock point decides when and how much is to be reordered. The internet can play a very important role in stock control as the system will be able to(i)to record how many of a particular items is in stock (ii)have an order of when new orders of a specified product are due to be delivered(iii)to search for the details of the supplier e.g name, address, phone number(iv)hold minimum and maximum stock levels(can warn them when minimum stock level is reached (v)automatic reordering when minimum stock level reached and (vi)update stock records when deliveries are made

In order for to be able to control stock of antiretroviral drugs it is important for the managers to understand the various stock levels. Riley 2012 classify stock levels into the following

(i) maximum stock: The most stock that the firm is willing or able to hold

(ii) minimum stock: this is the stock below which it is felt to be unsafe for the firm to operate

(iii) Re-order level: the point at which the firm will re-order the stock

(iv) Re-order quantity: This is the number of new items that will be bought in when stock fall to the re-order levels

The primary concern in the management of stock control must be to provide the right condition at the price, price and time. This means that control procedures should
-retain stock appropriate levels
-safeguard stock against loss or misuse
-ensure that stock is duly accounted for.

The lack of coordination causes confusion and stock outs at many antiretroviral treatment clinics, often forcing patients to switch to other regimens- not for medical reasons, but because of supply-chain failures. In addition to interrupting treatment, drug stock outs increase the risk that the virus will become resistant to treatment.(USAID/WHO 2010)

According to Baily *et.al.*,(2008) obsolescence is the state of being which occurs when an object, service or practice is no longer wanted even though it may still be in good working order. Obsolescence frequently occurs because a replacement has become available that has got more advantages than the inconvenience to repurchasing the replacement. Antiretroviral drugs just like any other drugs are not immune to obsolescence this is because the AIDS virus becomes resistant to the drug

forcing the patient to change the regimen. At other times the patient may develop adverse side effects forcing the patient to go for the less toxic regimen. In the two scenarios it means that there will be stock of drugs that are already in a pharmacy but the patients who were supposed to use them cannot due to one reason or the other they changed the regimen.

Antiretroviral are supplied to the health facility based on its requisition. The supply is based on push system. Obsolescence will therefore be inevitable in the sense antiretroviral drugs like any other drug can become obsolete owing to the fact that virus become resistant to the drugs due to overuse. At other times a patient might develop serious side effects forcing the health officer to change the drug for another one. Therefore what happens to these drugs that have already been ordered it is in store but the patient cannot it use it. It ends up becoming obsolete Record keeping is a very important management tool in any organization. Records that are kept by stock controllers show which products and materials are transferred into and out of the storeroom(Baily.et.al 2008). The balance is used to indicate when reordering is needed and can also be used to highlight pilferage and other losses that are not accounted for.One weaknesses of the supply chain evaluation of antiretroviral drugs is in record keeping, including incomplete or inaccurate data on the consumption (GAO) 2013.

In this study there are three moderating variables these are e-health policy, Kenya public procurement Act and the donors that can also contribute to stock control

This Act applies with respect to

(i)Procurement by a public entity (ii) Contract management (iii)Supply chain management, including inventory and distribution ; and (iv)Disposal by a public entity of stores and equipment that are unserviceable, obsolete or surplus

According to Cap 27 of this Act subsection 3 each employee of the public entity and each member of the public entity shall ensure, within the areas of responsibility of the employee or member, that this Act ,the regulations and any directions of the authority are complied with.Subsection4 stipulates that contractors, suppliers and consultants shall comply with the provisions of the Act and regulations. These two subsections will ensure that the managers and the staff that are dispensing ARVs to the patients do not sell the drugs to the private sector or the black market. This will caution against the problem of under stocking as well as overstocking.

The Act also ensures that contracted suppliers supply ARVS according to the country set standards. This will caution the problem of obsolescence in that there is the expected shelf-life that the ARVs should meet when they are being procured.This Act leaves the accounting officers with no other option than complying with it or face legal action.

The World Health Organization (2009) defines e-health as the combined use of electronic communication and information technology in the health sector. In practical terms e-health is the means of ensuring that the right health information is provided to right person at the right place and time in a secure, electronic form to support the delivery of quality and efficient healthcare.
E-health policy stipulates that the medical staff should observe integrity at their work places by ensuring that the limited available health resources are utilized well to deliver effective service to the patient. This policy cautions the staff against selling ARVs to the black market or the private sector hence inconveniencing the patients.

According to Kenya operational Plan Report (2010) the United State is the predominant donor to HIV intervention in Kenya. The United Kingdom Department for International Development (DFID) is the next bilateral donor and the World Bank is the largest multilateral funder. Other development partners active in international cooperation Agency, the German Development Corporation, the Gates Foundation and the Clinton foundation. Improved coordination is covered and does not miss treatment even when there have been interruptions in government supplies. Donors demand higher levels of accountability including special reporting and other documentation (John 2008). This special characteristic influence how they are managed. This could be one of the reasons leading to better stock control of antiretroviral drugs.

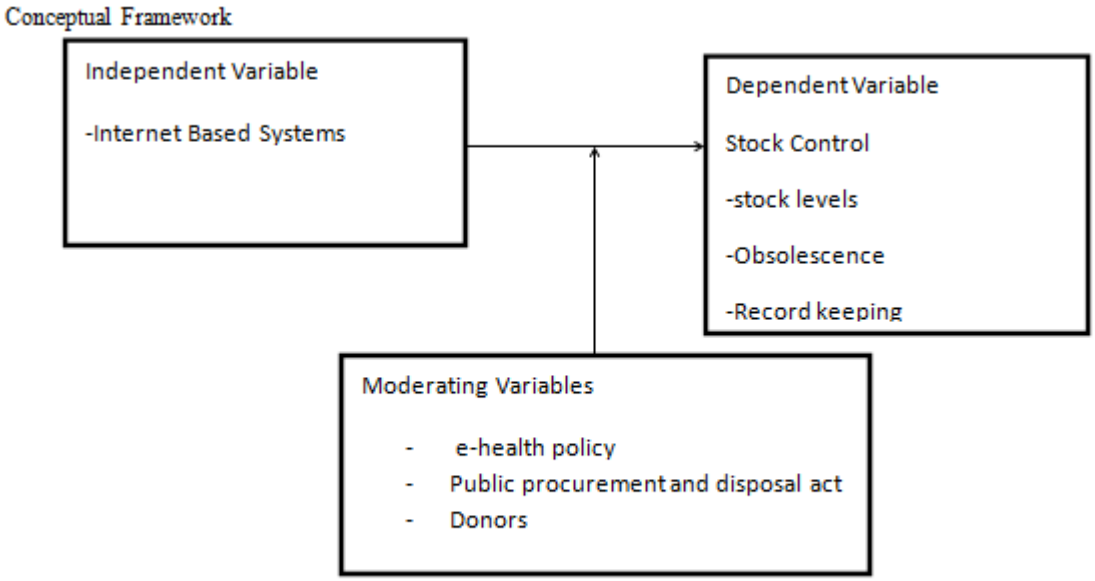

Fig 1 : Conceptual framework 7

III. METHODOLOGY

This chapter presented a detailed description of research methodology. It specifically discussed the research design, target population, sampling procedure, instrumentation, validity of the research instruments, reliability of the research instrument, data collection procedure, ethical consideration and data analysis techniques.

This study was conducted through descriptive research design. The central feature of descriptive research design is the systematic collection of data in standardized form from an identifiable population or representative sample. This research design provided rigorous and replicable procedure for understanding relationships. It determines whether and to what degree a relationship exists between quantifiable variables.

The research design is the most appropriate because a lot of data was collected within a short period of time and at the same point in time(Kothari,2009), information from widely scattered respondents can be obtained, analyzed, patterns extracted from it and comparisons made. It also provided information concerning the degree of relationship between variables being studied. In this section the research concentrated on the issues of target and accessible population, the sample and sampling techniques. The target population of this studyconsisted of all the level 4 health institutions (district and sub-district hospitals) in kisii county Kenya which are thirteen in total. From each hospital three participants will be issued with a questionnaire. These participants are the pharmacy in-charge(procurement officer), the pharmacist(stock controller) and the nurse at the patient support Centre.

This research was based on purposive sampling. In purposive sampling the researcher decided who to include in the sample based on their typicality. This technique was used to collect focused information; it selected typical and useful cases only in order to come with the right analysis. Purposive sampling will also be appropriate for this study because not all health worker officials deal with antiretroviral drugs but only the selected three from each of the level 4 hospitals.

This describes the instruments were used and to collect the data. For this study a questionnaire was used. A questionnairewas appropriate for this study because it captured more varied information for comparison. The questionnaire was geared towards answering the three research objectives and questions. The questionnaire was presented with exactly the same wording and in the same order to all respondents, they were printed and hand delivered to the respondents. This method allowed the respondents to fill the questionnaire at their convenient time and they will be collected after three days.

Analysis is the processes of converting data into meaningful statements. Separation of data into its constituent parts or elements was done to describe the component parts separately and in relation to the whole, Oso and Onen [2005]. Data was edited and coded and presented in form of tables.

IV. RESEARCH FINDINGS

The overall result of from the study is presented in the tables below. Thirty nine questionnaires were given to the respondents. The questionnaire can be found in appendix 1. Five participants did not return the questionnaire. Four questionnaires were not filled and hence they are not used in this analysis.

Section A of the questionnaire required the respondents to answer four questions. The aim of this section was to gather the demographic data about the respondents. The result is as shown in the table below.

Table 4.1 Responses on demographic data

Question	Category	Responses
Sex	Male	20
	Female	10
Age	20-25	0
	26-30	5
	31-35	5
	36-40	7
	41-45	8
Above 45	5	
Level of education	Certificate/Diploma	25
	Bachelors	5
Masters & PHD	0	

Control of Stock Of antiretroviral drugs

Table 4.2Antiretroviral stock control responses

Question	Category	Responses
(i) How is stock control of antiretroviral drugs carried out in your institution?	Manual	24
	Internet-aided	6

(ii) How would you rate you current method of stock control of antiretroviral drugs?

Very Successful	Successful	Don't Know	Unsuccessful	Very Unsuccessful
6	0 0	4	20	

Stock levels of antiretroviral drugs

Table 4.3 Stock levels of antiretroviral drugs responses

Question	Category	Responses
.(i)Do you always maintain the right Stock levelsof antiretroviral drugs in your health institution?	No20 Yes 10	

(ii) How would you rate Internet based systems in monitoring stock levels?

Very successful	Successful	Don't Know	Unsuccessful	Very Unsuccessful
20	10	0	0	0

Obsolescence

Table 4.4obsolescence of antiretroviral drugs responses

Question	Category	Responses
(i) Are there times when antiretroviral drugs expire (obsolescence) in your health institution?	**Yes** No	**21** 9

(ii) How would you rate Internet based systems in Controlling of obsolescence?

Very Successful	Successful	Don't Know	Unsuccessful	Very Unsuccessful
21	6	3	0	0

Record Keeping

Table 4.5 Record keeping of antiretroviral drugs responses

Question	Category	Responses
(i) Are you able to always to keep all the	**Yes**	**8**
records of antiretroviral drugs in your hospital?	No	22
(ii) How would you rate Internet based system		
In influencing record keeping?		
Very Successful	Successful	Don't Know	Unsuccessful	Very Unsuccessful
21	**7**	**2**	**0**	**0**

V. Discussion of Results

Demographic Data

Level of education	Certificate/ diploma		Bachelors		masters &phd		Total	
	F	%	F	%	F	%	F	%
25	83	5	17	0	0	30	100	

Work Period (years)	Below 1 year		1-5		6-10		11-15		Above 15years		Total	
	F	%	F	%	F	%	F	%	F	%	F	%
s	0	0	10	33	6	20	4	14	10	33	30	100

KEY: F= Frequency %= Percentage

Out of the 30 respondents 25are certificate /diploma holders, 5 are degree holders; this was important for this research as it ensured that at least the respondents had knowledge of stock control hence they were able to give appropriate responses for this study.

The thirty respondents had for a period ranging between 1-10 years; this was important for this study as the respondents could easily identify the past and the current challenges facing stock control of antiretroviral drugs.

Stock control of antiretroviral drugs using the current method

Stock control	VS		S		DK		US		VUS		T	
	F	%	F	%	F	%	F	%	F	%	F	%
Success rate	6	20	0	0	0	0	4	13	20	67	30	100

KEY: VS= Very Successful S=Successful DK= Don't Know
US=Unsuccessful VUS= Very Unsuccessful

According to table 4.2 twenty four of the respondents said that stock control of antiretroviral drugs in their hospitals is carried out manually(paper-based) while only six make use of the Internet based systems. In rating the success rate of the current method of stock control the respondents expressed the following views: 6(20%) said that it was very successful,four(13%) said it was very unsuccessful and twenty(67%) said that it was very unsuccessful. The high rate of unsuccessful stock control can be attributed to use of paper based stock control method. Only those hospitals that have adopted Internet based systems are able to successfully control stock of antiretroviral drugs.

Internet based systems and Stock Control of antiretroviral drugs

Stock Control	VS		S		DK		US		VUS		T	
	F	%	F	%	F	%	F	%	F	%	F	%
Stock levels	20	66.6	10	33.3	0	0	0	0	0	0	30	100
Obsolescence	21	70	6	20	3	10	0	0	0	0	30	100
Record Keeping	21	70	7	23.3	2	6.6	0	0	0	0	30	100

KEY: VS= Very Successful S= Successful DK= Don,t Know
US= Unsuccessful VUS= Very Unsuccessful T= Total

a) Stock-levels

According to table 4.3Twenty out of thirty respondents (66.6%) said they were not able to maintain the right stock level which concurs with the study of Vawda &Variawa (2012) which state that improper stock levels is one of the challenges facing stock control of antiretroviral drugs. 10(33.3) of the respondents said that they were able to maintain the right stock levels. This is because they make use of Internet based systems. The respondents ratingon use of Internet based system to monitor the stocklevels they rated it as follows: Twenty (66.6%)expressed the view that internet based systems can be very successful, 10(33.3%)successful. The views expressed by the respondents are in agreement with USAID/Kenya (2013) which argues that hospitals that have adopted Internet based systems have been able to maintain the proper stock levels of antiretroviral drugs. These Internet based systems the pharmacy staff are able to forecast when to order drugs and in what amount; preventing overstocking/ under-stocking and disruption of treatment. This is in contrast to the scenario which was there before the adoption and is the case in those hospitals that have not adopted.Thus Internet based systems can monitor stock levels of antiretroviral drugs.

b) Obsolescence

According to table 4.4twenty one(70%) of the respondents experience obsolescence while nine(30%) said that they did not experience obsolescence in their hospitals of antiretroviral drugs ,they attributed this to the adoption of Internet based systems. If Internet based systems were adopted to control obsolescence of antiretroviral drugs in their hospitals they rated it as follows;twenty one(70%) of the respondents stated that can be very successful, 6(20%) stated it can be successful and 3 (10%) said they did not know. Thus Internet based systems help stock control managers to identify the old stock and the new stock. Internet based systems such as barcode to scan ensures that the product is legitimate and safe. These codes prevent counterfeit pharmaceutical products and even fraudulent unsafe items from getting into customers hands

c)Record keeping

According to table 4.5 eight (26.6%) respondents said that they were able to keep good records since the adoption of Internet based systems ; twenty two(73.3%) said they had poor record keeping in their hospitals ; this is because they still rely on the Daily Activity Register- a thick book- in which they log in dispensing information which make it hard for them to track information and generate records in a timely manner . The respondents rated Internet based systems influence on record keeping as follows:21 (70%) out 30 expressed the view that barcoding can be very successful ,7(23.3%) said it was successful, 2(6.7%) said they don't know. Their rating is in line with USAID (2012) which argues that Internet based systems is a valuable resource that allows pharmacy staff to keep track patient information and records on the antiretroviral drugs prescribed and dispensed. Based on this finding USAID by December 2012 ensured that 83% of the patients in Kenya are treated in sites with these systems for easier and faster record keeping.

VI. CONCLUSION

The first objective of this study was to examine how Internet based systems can monitor stock levels of antiretroviral drugs in level 4 public hospitals in Kisii County. Data analysis and interpretation of questionnaire responses from the67% of the officers from hospitals revealed that stock levels of antiretroviral drugs in level 4hospitalswere not properly maintained. These findings indicate that hospitals that have adopted Internet based systems are able to maintain proper stock levels as opposed to those that have not.

The second objective was to determine how obsolescence of antiretroviral drugs in level 4hospitals in Kisii County can be controlled through Internet based systems. Theanalysis and interpretation of data70% of the responses revealed that hospitals were not able to control obsolescence of antiretroviral drugs. 30% of the responses revealed that they were able to control obsolescence because they had adopted Internet based systems. From the findings it shows that when deciding on the methods of stock control internet accessibility should be taken into consideration. This findings answered research question number two of this study.

The third objective was to examine how Internet based systems can influencethe record keeping of antiretroviral drugs in level 4hospitals in Kisii County. Data analysis and interpretation of the 73% responses revealed that hospitals relied on paper based record keeping which is cumbersome. 90% of the responses agreed that with implementation of Internet based system (infrastructure) proper record keeping can be achieved. Internet infrastructure should be put into consideration when deciding on record keeping systems of stock control. This answers research question number three.

This study analyzed the adoption of internet based systems for monitoring the stock of antiretroviral drugs in level4 public hospitals in Kisii County. It was intended to advise officers from level 4 hospitals Kisii County the reasons as to why they should adopt Internet based systems in order to overcome the challenges facing stock control of antiretroviral drugs. These challenges include improper stock levels, obsolescence and poor record keeping. Despite the increase in use of Internet based systems their potential remains untapped in level 4 hospitals in Kisii County.The study specifically soughtto first examine how Internet-based systems can used to monitor stock levels of antiretroviral drugs in level 4 public hospitals Kisii County. Secondly was to determine how obsolescence of antiretroviral drugs can be controlled by Internet based systems. Thirdly was to examine how Internet based systems can influence record keeping of antiretroviral drugs.

The findingsfrom the responses given by the officers established that there is poor stock control of antiretroviral drugs in level4 hospitals in Kisii County. However, the hospitals that have adopted Internet based systems expressed the views that Internet based systems are very crucial stock control. In view of these findings, the study concludes that the use of Internet based systems can play a very important role in stock control of antiretroviral drugs as a result they can help to control stock levels, obsolescence and record keeping of these drugs.

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