

**EFFECT OF HEALTH MANAGEMENT INFORMATION SYSTEM ON
OPERATIONAL PERFORMANCE OF PRIVATE HOSPITALS IN KENYA
A CASE OF MURANG'A COUNTY**

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Abstract

This study was aimed at studying the effect of health management information system on operational performance of private hospitals in Kenya, a case of Murang'a County. This study adopted a descriptive survey research design. The study focused on 248 employees as it's the target population and used a sample of 75 respondents of whom questionnaires were distributed to in a bid to obtain the required data. Data collected from the questionnaires was coded by a code book prepared for this study then the data was keyed into a computer and was analyzed using statistical package for social sciences. A multiple linear regression model was adopted to test the relationship between variables. Analysis of Variance (ANOVA) was employed to test the hypothesis that there is no significant effect of health management information system on operational performance of private hospitals in Kenya. The study concluded that health management information systems has a strong effect on the operational performance of private hospitals in Kenya and therefore the study rejected the null hypothesis. The study recommended that hospitals should enhance proper drug inventory systems, obtain a feature in their drug inventory system that alerts the users if the inventory levels are below or above some desired levels and must review regularly the inventory buying practices according to seasons. It also recommends that hospitals should also adopt cloud computing which provides for hospitals to manage computing resources and records online and undertake automated data management initiative in a bid to enhance operational performance

Keywords: operational performance, Health Management Information System, electronic billing

I. INTRODUCTION

Using Health management information system is a critical tool in making health-related decisions. New information technologies show great promise in providing ways to develop and deliver changes in health behaviors across the health sector. The

behavioral and information changes in consumers, patients, providers, and organizations are being noticed at individual, community, and organizational levels due to innovations in health information systems, such as personal health records, electronic medical records and electronic

health records. The noted information changes include improved quality patient care; easy, accurate, and quick information retrieval; rapid information sharing; quick decision making; reduced medical errors due to electronic alerts; increased storage of data and records electronically; and improved information screening and reporting (Kumar, 2011).

The rapid introduction of health management Information Systems in all aspects of society has left little time to consider the impacts or develop policies to take maximum advantage of these systems. Most organizations, including hospitals either use or are planning to implement HMIS in some capacity so as to remain competitively active both in the society and even performance wise. The progressive growth of HMIS has led hospital administrators to recognize IT as a powerful tool to enhance their organization's productivity. Many hospitals around the world are in the process of moving away from paper-based health information and implementing electronic health information to support patient care (James *et al.*, 1996).

The unimproved larger volume and variety of health management information has caused problems in the delivery of patient care when using traditional information systems. For example, paper-based medical records are easily misplaced and can cause serious problems, such as the need for repeated diagnostic tests, delays in the planning of care, legal complications, and delayed patient discharges. Hence, hospitals have resorted to use Hospital Management Information System (HMIS) to facilitate and improve the process of patient care via the generation of electronic health records (Ting-Ting, 2004).

HMIS implementation is therefore an essential tool in meeting increasing healthcare demands and the associated diagnostic, treatment and administrative system burdens; to support better patient care planning, and clinical or administrative decision making. The real-time access, exchange and receipt of clinical data provided by HMIS have improved

clinical documentation, reduced the duplication of care services, and supported better decision making related to patient care (Tiina, *et al.*, 2009).

History of health information system in Kenya

Kenya has a long history of health sector reform. In 1972 the Ministry of Health, the world health organization, Central Bureau of Statistics and the Attorney General Chambers formed a committee to design a health information system for Kenya. In 1984, the Ministry of Health established health information systems offices in each district, thereby decentralizing its reporting activities and making the districts responsible for processing health data from all health facilities. With Kenya's National Health Sector Strategic Plan (1999 – 2004), the ministry laid out strategies to improve coordination with the private sector and NGOs and recognized the need for integrated health information systems (Republic of Kenya, 2008). The private sector and NGOs play a large role in delivering health care in Kenya, but this role is decreasing with the investment of government funds in the construction of health facilities. The ministry's HMIS report from 2006 stated that 59% of health care delivery was by the private sector, and NGOs (Republic of Kenya, 2008). By the end of 2007 the numbers reversed: the government managed 58%. Hospitals, which make up just 7% of all health facilities, employ the majority of health workers and care for the majority of patients.

Other health facilities included health centers, dispensaries and specialized clinics for physicians, dentists, and other health practitioners. More investment is needed in health infrastructure to address the urban-rural divide and regional variability as well as the shortage of health workers. In 2000, there was only one doctor for 10,150 people and in 2007 the situation worsened, with the ratio declining to one doctor per 16,000 people. The goal of HIS stated in the Annual Health Sector Status Report for 2005-2007 is to generate and use health information for policy formulation, management, planning, budgeting,

implementation, monitoring and evaluation of health services and program interventions in the health sector. However, Kenya’s HMIS is not delivering on this goal. The information systems at the central (ministry) level are stand-alone and therefore focused on a specific vertical function. The provincial and district level systems, which provide data to centrally managed health service units and hospitals at their respective levels, are also fragmented. Kenya’s HMIS systems have historically supported epidemiological data, explaining the lack of other subsystems of a comprehensive HMIS, such as drugs, lab services, logistics, finance, and human resources. There are many vertical programs creating their own program-specific databases which are not integrated with the national HMIS.

II. STATEMENT OF THE PROBLEM

Research so far indicates that it is important for hospitals to use Health Management Information Systems in conducting various services within themselves but these same researches have not indicated what kind of HMIS has more weight than the other. On the other hand, most hospitals are known to be not for profit making and therefore few researches have been done to illustrate the use of integrated HMIS to enhance operational and financial performance. Finally, from the researchers I have shown, none of them have given weight to data management systems, the drug inventory systems and the importance of electronic billing system. It is with this regard therefore that this research was aimed at filling the gap by conducting a thorough research on the effect of Health Management Information system on operational performance of private hospitals.

III. SPECIFIC OBJECTIVES

1. To examine the effect of use of drug inventory systems on operational performance of private hospitals in Kenya
2. To determine the effect of implementation of Electronic Billing system on the

operational performance of private hospitals in Kenya

3. To ascertain the effect of enacting Automated patient data management system on the operational performance of private hospitals in Kenya
4. To determine the effect of electronic doctor booking system on operational performance of private hospitals in Kenya

IV. LITERATURE REVIEW

Conceptual Framework

A conceptual framework is a research tool envisioned at assisting a researcher to develop awareness and understanding of the situation under enquiry and to communicate it. When clearly articulated, a conceptual framework has prospective usefulness as a tool to assist a researcher to make meaning of consequent findings. It forms part of the package for negotiation to be inspected, tested, reviewed, and reformed as a result of investigation and it explains the possible connections between the variables (Smith, 2004).

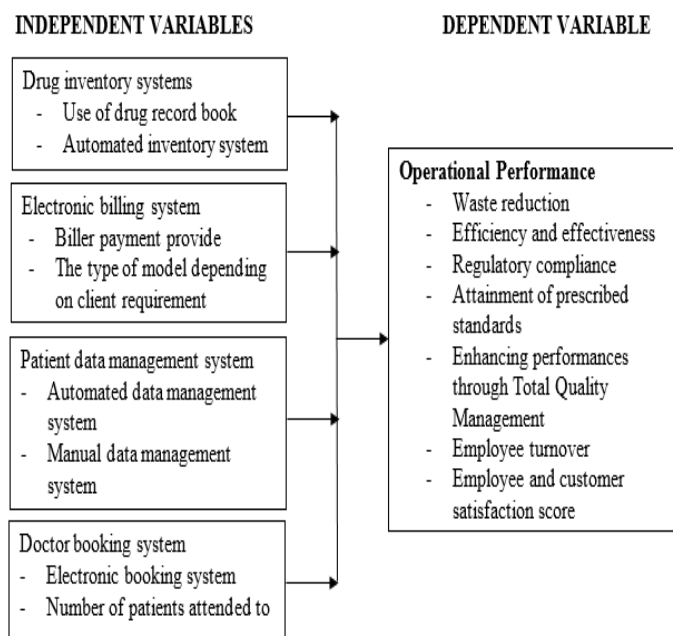


Figure 1: conceptual framework

V. RESEARCH METHODOLOGY

The study adopted a descriptive survey research design. The study focused on 248 employees as it's the target population and used a sample of 75 respondents of whom questionnaires were distributed to in a bid to obtain the required data. A pre-test of the questionnaire was conducted on 10 purposively selected respondents. Data collected from the questionnaires was coded by a code book prepared for this study then the data was keyed into a computer and was analyzed using statistical package for social sciences. A multiple linear regression model was adopted to test the relationship between variables. Analysis of Variance (ANOVA) was employed to test the hypothesis that there is no significant effect of health management information system on operational performance of private hospitals in Kenya test the hypotheses developed for the study, appropriate statistical tests such as the F-test was used.

VI. RESEARCH FINDINGS AND DISCUSSION

Drug inventory systems and operational performance

The drug inventory management system consists of various tools required for managing adequate inventory of drugs. The process includes tracking of drug shipments, inventory, and replacements. The system in an organization performs high-level tracking at a particular site of an inventory besides eliminating the use of paper and human errors, thus increasing the efficiency of the service. The job of drug inventory authorities requires painstaking handling of goods received followed by effective testing of the drugs. The study sought to examine if the respondents used computerized inventory systems and if there were feature within the inventory system that alerted the user if inventory levels were below or above certain levels. Results were summarized in table 1.

Table 1: Cross tabulation on presence of computerized inventory and alerts to the user

| | | Do you use a computerized inventory system | | Total |
|--|-----|--|----------|-----------|
| | | Yes | No | |
| Is there a feature within the inventory system that alerts the user if inventory levels are below or above certain levels? | Yes | 64 | 0 | 64 |
| | No | 0 | 7 | 7 |
| Total | | 64 | 7 | 71 |

In determining the presence of computerized inventory systems, majority of the respondents (64) indicated that there existed while only 7 of the respondents indicated that there was no computerized inventory systems within their departments. Among those who had indicated that there existed computerized inventory systems, all of them also agreed that there existed features within their departments that alerted them in case the levels of inventory were below or above the required levels. Inventory can be a vital part of managing supply chains. Because of this, the status of a firm's inventory is often used as a litmus test for the overall health of its supply chain management processes and decision-making. Such high safety stock is indeed a problem in and of itself because of the costs of holding this inventory and the opportunity costs of having working capital tied up in assets that aren't being converted to sales. The larger issue here, however, is that this safety stock situation is likely a symptom of some sort of ineffective supply chain management decision-making. Due to the fact that there exist computerized inventory systems and the existence of features within the inventory systems that alerts the user if inventory levels were below or above the required, the researcher therefore sought to identify how the organizations handed the situation and the results were summarized in table 2.

Table 2: Handling inventory situation

| | Frequency | Percentage |
|---|-----------|--------------|
| Need to review your inventory buying practices | 34 | 47.9 |
| Inventory buildup intended to meet pending spikes in demand | 16 | 22.5 |
| Pay Attention to Seasons | 21 | 29.6 |
| Total | 71 | 100.0 |

Results indicated that 34 (47.9%) of the respondents indicated that there existed a need to review inventory buying practices. A high turnover in an organization is typically preferred and shows strong sales performance. Turning over inventory quickly also improves an organization’s liquidity, or ability to keep up with near-term debt obligations. High turnover also can be misleading, however. An organization’s high ratio may result because it tends to buy too little inventory to keep up with customer demands. Buying smaller inventory amounts regularly means you pay higher price points. This inflates an organization’s cost of goods sold, which makes for a higher turnover ratio. About 16 (22.5%) respondents indicated that inventory buildup intended to meet pending spikes in demand.

Finally, 22(29.6%) of the respondents indicated that they solved the situation by paying attention to seasons. For the purposes of inventory turnover, when an organization stock a certain product is just as if not more important than what it choose to stock. Products on specific months or seasons can be a bit more complicated. Making the wrong choices here can cause an organization to miss an opportunity with its target market, or even to have an excess of inventory lying around all the way until next season until it gets depleted. On the other hand, the researcher wanted to determine how often the organizations conducted inventory counts. The results were summarized in figure 2

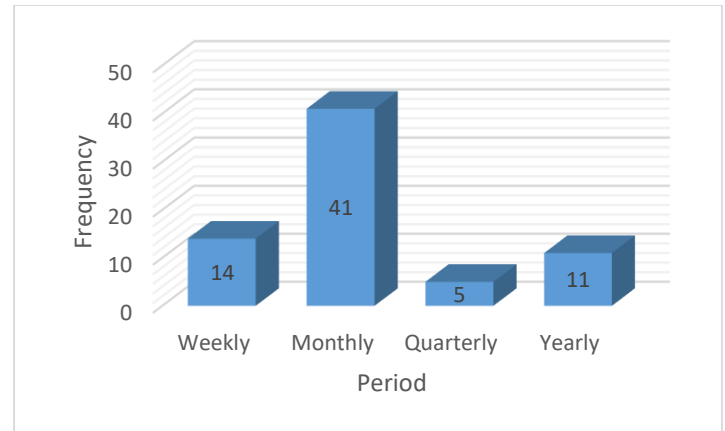


Figure 2: Period of inventory count

Results from figure 2 indicated that majority of the respondent did inventory count monthly (41), this was followed by 14 respondents who did inventory count weekly while 1 respondents did inventory count yearly. About 5 respondents did inventory counts quarterly. The results indicated that there exists an importance of doing inventory counts quite often so that organizations can know when they needed stock, how much stock is left and how long it can take the organization before the next stock is needed. In inventory valuation, there exist a discrepancy between amounts of drug-purchased received and amount ordered. Respondents were put to task to explain the process of reconciling this discrepancy and the results were summarized in table 3.

Table 3: Process of reconciling inventory discrepancies

| Process | Frequency | Percent | Cumulative Percent |
|--|-----------|--------------|--------------------|
| Manually match an invoice reconciliation document | 4 | 5.6 | |
| Adjust the advance payments made to the supplier against the invoices received for the purchase order. | 9 | 12.7 | 5.6 |
| Verifying that data is consistent across purchase orders | 5 | 7.0 | 18.3 |
| Auditors are specifically on the lookout for financial discrepancies | 6 | 8.5 | 25.4 |
| N/A | 47 | 66.2 | 33.8 |
| Total | 71 | 100.0 | 100.0 |

The results from table 3 indicated that they manually matched an invoice reconciliation document as a whole to a purchase order or a contract. About 5.6% of the respondents indicated that the organization can manually match one or more line items on an invoice with the appropriate line item on an order or a contract. On the other hand, 12.7% of the respondents indicated that their organization adjusts the advance payments made to the supplier against the invoices received for the purchase order. This helped the organization in ensuring that duplicate or extra payments were not made for a purchase order. Verifying that data is consistent across purchase order was said by 7.0% of the respondents while 8.5% of the respondents indicated that Auditors were specifically on the lookout for financial discrepancies. Compiling these documents in advance of an audit and checking that the numbers line up using the three-way matching process was a big step in the right direction. The respondents were asked to provide information on to what extent they agreed or disagreed on statements regarding the effect of inventory drug management system on the operational performance of private hospitals in Kenya and the results were presented in table 4.

Table 4: Statements on Drug inventory systems

| | Strongly Agree | Agree | Neutral | Disagree | Strongly Disagree | Total |
|---|----------------|-------|---------|----------|-------------------|-------|
| | % | % | % | % | % | % |
| My organization has embraced effectively the use of automated drug inventory system | 20 | 39 | 28 | 9 | 4 | 100 |
| All purchase order transactions are completely prepared and recorded on a timely basis | 28 | 34 | 16 | 6 | 7 | 100 |
| Inventory management system in your company has fulfilled the needs for which it was evolved | 49 | 23 | 13 | 10 | 6 | 100 |
| Organization gives more emphasis on software than skilled manpower with regard to inventory management | 23 | 42 | 17 | 11 | 7 | 100 |
| The organization uses computer system which is updated daily to monitor the amount of medicines received, the amount issued, and the amount present today | 18 | 20 | 28 | 10 | 14 | 100 |
| The inventory system has reduced the number of complaints from customers using it | 23 | 3 | 18 | 35 | 21 | 100 |

Private hospitals in a bid to enhance their operational performance have embraced effectively the use of automated drug inventory systems. Majority (39%) of the respondents agreed, 28% were neutral, 20% of the respondents strongly agreed while 9% of the respondents disagreed. Only 4% of the respondents strongly disagreed. Automation in the drug distribution processes is helpful to hospitals in creating new medical services. An automated drug inventory system is a mechanical system that performs operations or activities with respect to the storage and packaging of drugs or medications, and with respect to their dispensing or distribution directly to patients. These findings were in line with the studies of Toshio *et al* (2005) who conducted a study on automation in drug inventory management saves personnel time and budget. They also indicated that hospitals must

embrace automated drug inventory systems to enhance their performance.

On the other hand, the researcher asked whether all purchase order transactions were completely prepared and recorded on a timely basis. Equally, majority (34%) of the respondents agreed, 28% strongly agreed, 16% were neutral, 6% disagreed while 7% of the respondents strongly disagreed. The researcher went further to ask whether organizations gave more emphasis on software than skilled manpower with regard to inventory management. Majority (42%) of the respondents agreed, 23% of them strongly agreed, 17% of the respondents were neutral, 11% of them disagreed while 7% of them strongly disagreed. The researcher also asked whether the organizations used computer system which is updated daily to monitor the amount of medicines received, the amount issued, and the amount present today. Majority (28%) of the respondents were neutral to the statement with an impact that private hospitals updated and did not update their computer systems on an equal measure. This was followed by 20% of the respondents who agreed, 18% strongly agreed, 10% of the respondents disagreed while 14% of them strongly disagreed. Similar studies were conducted by Meadows (2002) who also found that because drug inventories were automated, computers have to be updated in a bid to monitor the amount of drug received and issued.

The researcher also wanted to determine whether all purchase order transactions were completely prepared and recorded on a timely basis. Majority (34%) of the respondents agreed, 28% of them strongly agreed, 16% of the respondents were neutral, 6% of them disagreed while 7% of them strongly disagreed. In a bid to understand if the inventory management in private hospitals had fulfilled the needs for which it was evolved, majority (49%) of the respondents strongly agreed, 23% agreed, 13% were neutral, 10% of them disagreed, while 6% of the respondents strongly disagreed. This also concurs with the results of

Donald (2017) who conducted a study on inventory management in a supply chain industry. He found that for an organization to attain operational performance, it must ensure that the inventory system adopted must serve the very purpose and this helps to reduce complaints from the clients.

Electronic billing system and operational performance

Electronic medical billing is the process by which a health care provider electronically submits a bill, or claim, to a health insurance company, or payer, for the rendering of medical services. Electronic billing or electronic bill payment and presentment, is when a company, organization, or group sends its bills over the internet, and customers pay the bills electronically. Regarding electronic billing system, the searcher posed various statements to understand the extent to which the respondents agreed or disagreed on them and the results were summarized in table 5.

Table 5: Feelings on electronic billing system and operational performance

| | Strongly Agree | Agree | Neutral | Disagree | Strongly Disagree | Total |
|---|----------------|-------|---------|----------|-------------------|-------|
| | % | % | % | % | % | % |
| The use of e-bill has led to reduced paper usage which helps conserve environment and reduces paperwork in the office | 13 | 30 | 27 | 16 | 16 | 100 |
| Reduced operational costs | 9 | 75 | 9 | 9 | - | 100 |
| The system provides an efficient and effective service delivery | 34 | 45 | 7 | 7 | 7 | 100 |
| The organization faces inadequate time for implementation challenge in trying to implement the electronic billing system | 7 | 49 | 4 | 7 | 32 | 100 |
| The organization faces lack of training on the new system challenge in trying to implement the electronic billing system | 3 | 59 | 3 | 4 | 31 | 100 |
| The organization faces limited information from the system challenge in trying to implement the electronic billing system | 31 | 25 | 24 | 20 | - | 100 |

The use of electronic billing system had led to reduced paper usage which helped to conserve the

environment and reduced paper work in the office. Majority (30%) of the respondents agreed with the statement. It was important to note that the use of electronic billing system instead of paper in a great deal helped reduce paper work in the organization. This was followed by 27% of the respondents who were neutral, 13% of the respondents strongly agreed while each 16% disagreed and strongly disagreed. This may have been due to the fact that in as much as electronic billing system was introduced, there could be other billing services that still required paper for example, after doing the billing electronically, some organizations could opt to have receipts given to the patients in form of paper thus not reducing paper work. The researcher went further to determine whether the introduction of electronic billing system reduced operational costs. An overwhelming majority (75%) agreed to the statement, each 9% strongly agreed, were neutral and disagreed respectively. This was an indication that electronic billing to a large extent reduced operational costs of the organization. Electronic billing can save hospitals' money, time, and other resources. Aside from the paper itself, traditional statements require a hefty and constant supply of printing materials, postage, and effort. Paper statements also require arrangements and regular correspondence with a postal or shipping service. Electronic statements are more cost-effective than paper statements, they can help hospitals cut back on recurring monthly expenses and improve bottom lines. On the other hand, the researcher also asked if the system provided an efficient and effective service delivery. Equally an overwhelming majority (45%) agreed, 34% of the respondents strongly agreed, 7% each were neutral, disagreed and strongly disagreed respectively.

The organization faces inadequate time for implementation challenge in trying to implement the electronic billing system was another statement posed by the researcher. Majority of the respondents (49%) agreed, 32% of the respondents strongly disagreed with the statement, 7% each strongly agreed and disagreed respectively while

4% of the respondents were neutral. On the other hand, the organization faces lack of training on the new system challenge in trying to implement the electronic billing system. Majority (59%) of the respondents agreed, 31% of the respondents strongly disagreed, 3% each strongly agreed and neutral respectively while 4% of the respondents disagreed. Electronic statements can accelerate payments from customers in addition to accelerating internal business operations. Much is left up to the customer when paper statements are sent via mail; weeks could go by before the customer ever opens the bill, leaving a lengthy period of time between a business's request for payment and the actual receipt of funds. Because email is instant and such a regular part of most customers' daily lives, an electronic statement is likely to be viewed sooner.

Finally, the researcher wanted to know the extent to which respondents agreed or disagreed on the fact that the organization faced limited information from the system challenge in trying to implement the electronic billing system. Majority (31%) of the respondents strongly agreed, 25% of the respondents agreed, 24% of them were neutral while 20% of the respondents disagreed. None of the respondents strongly disagreed.

This prompted the researcher to ask for the recommendations that the respondents can make on the electronic billing system to the organization in a bid to improve its operational performance. Table 6 had a summary of the results.

Table 6: Recommendations on the Electronic Billing System

| | Frequency | Percent |
|---|-----------|--------------|
| Set up a secure electronic backup system to ensure records are safely stored and regularly backed up. | 26 | 36.6 |
| Cloud computing provides a way for your business to manage your computing resources and records online. | 13 | 18.3 |
| Use a simple, paper-based record keeping system | 9 | 12.7 |
| Record consultants' time in different increments, depending on the project | 6 | 8.5 |
| Introducing invoicing methods | 17 | 23.9 |
| Total | 71 | 100.0 |

Results from table 6 indicated a mixed reaction on the recommendations. Majority (36.6%) of the respondents were of the opinion that in a bid to enhance operational performance, private hospitals in Kenya should set up a secure electronic backup system to ensure records are safely stored and regularly backed up. Daily backups are recommended, particularly for important records. Hospitals should make sure the backup copies are stored in a separate location to your business in case of fire, theft or a natural disaster. This was followed by 18.3% of the respondents who said that private hospitals should engage in cloud computing which provides a way for private hospitals to manage their computing resources and records online. This will build up operational performance. Cloud backup services are becoming more popular and can be automated for the organization's convenience, but it should make sure the method it chooses protects the privacy and security of the organization and its customers. Similarly, 12.7% of the respondents indicated that some private hospitals may want to use a simple, paper-based record keeping system. There are certain advantages to using manual record keeping. On the other hand, about 8.5% of the respondents indicated that private hospitals may wish to record consultants' time in different increments, depending on the project. Respondents recommends that private hospitals should look for systems that allow their consultants to enter time in

hours, fractions of an hour or minutes. The smaller the recording increment, the more accurate it can make its billing. To make it easy for hospitals to record their time wherever they are working, they should look for systems that operate on smart phones or mobile devices such as tablet computers as well as desktop computers or laptops. Finally, 23.9% of the respondents recommended a billing system with a choice of invoicing methods which gives hospitals the flexibility to bill its clients in the way that suits its cash flow requirements and clients' preferences. With the right system, the organization can invoice individual projects at the end of each stage, or on completion. If hospitals are handling concurrent projects for the same patient, it can provide individual project invoices or consolidated invoices covering all projects.

Patient Data Management system and Operational Performance

The researcher prompted the respondents to describe the status of data quality improvement initiatives in their institutions. The response was summarized in table 7.

Table 7: Descriptive of Data Quality Improvement Initiative

| | Frequency | Percent |
|---|-----------|--------------|
| At least one initiative completed in past 24 months. | 18 | 25.4 |
| Initiative under way. | 4 | 5.6 |
| Initiative is planned. | 27 | 38.0 |
| No initiative planned, under way, or completed in past 24 months. | 22 | 31.0 |
| Total | 71 | 100.0 |

The findings as summarized in table 7 about the descriptive of the data quality improvement initiative showed that 25.4% of the respondents said that there existed at least one initiative that was completed in the past 24 months. This was important because it enabled the private hospitals to have a check on its operational performance. About 5.6% of the respondents were of the opinion that this kind of an initiative was underway. Majority of the respondents (38.0%) indicated that the

initiative was planned, which meant that it had not even started. This was not good for the organization. For private hospitals to enhance its operations, at least this kind of an initiative should be in existence. About 31.0% of the respondents to the worst indicated that there was no initiative planned, no initiative was underway or even completed in the last 24 months. This was dangerous to the organizations operational performance.

In a bid to understand the effect of patient data management system and operational performance, the researcher posed various statements in a view to examine the extent to which respondents agreed or disagreed to them. Results were summarized in table 8.

Table 8: Effect of Patient Data Management System and Operational Performance

| | Strongly Agree | Agree | Neutral | Disagree | Strongly Disagree | Total |
|--|----------------|-------|---------|----------|-------------------|-------|
| | % | % | % | % | % | % |
| My institution has documented electronic records retention schedules for patients | 14 | 61 | 1 | 6 | 18 | 100 |
| My institution has documented policies regarding automated patient data management | 8 | 51 | 7 | 9 | 25 | 100 |
| My organization can easily make strategic decisions very fast because of enacting automated patient data management | 9 | 62 | 10 | 10 | 10 | 100 |
| We effectively manage all the varieties of data and digital content that the institution needs. | 16 | 55 | 14 | 9 | 7 | 100 |
| My organization has undertaken automated data management initiative because it is an institutional leadership mandate for data quality improvement | 1 | 58 | 1 | 11 | 28 | 100 |
| My organization has undertaken automated data management initiative in order to improve reporting/analytics | 7 | 66 | 7 | 7 | 13 | 100 |

My institution has documented electronic records retention schedules for patients was the first statement. About 14% of the respondents strongly agreed, majority (61%) of the respondents agreed,

1% of the respondents were neutral, and 6% disagreed while 18% of them strongly disagreed. This was an indication that in most private hospitals, there existed documentation of electronic records retention schedules for patients which in turn elicited operational performance. On the other side, private hospitals had documented policies regarding automated patient data management. This was strongly agreed by 8% of the respondents, an overwhelming majority (51%) of the respondents agreed, 7% of the respondents were neutral, 9% of them disagreed while about 25% of them strongly disagreed. Private hospitals can easily make strategic decisions very fast because of enacting automated patient data management. About 9% of the respondents strongly agreed, 62% of the respondents agreed, each 10% of the respondents were neutral, disagreed and strongly disagreed respectively. On the other hand, private hospitals effectively manage all the varieties of data and digital content that the institution need. About 16% of the respondents strongly agreed, 55% of the respondents agreed, 14% of them were neutral, 9% of the respondents disagreed while 75 of the respondents strongly disagreed.

The researcher went further to ascertain whether private hospitals had undertaken automated data management initiative because it was an institutional leadership mandate for data quality improvement. Each 1% of the respondents strongly agreed and were neutral respectively, 58% of the respondents agreed, 11% of them disagreed while 28% of the respondents strongly disagreed. Finally private hospitals have undertaken automated data management initiative in order to improve reporting/analytics. About 7% of the respondents strongly agreed, 66% of them agreed, 7% each were neutral and disagreed respectively while 13% of them strongly disagreed.

Doctor Booking System and Operational Performance

The researcher also prompted the respondents to determine elements which best describes doctor

booking initiatives put in place in their hospitals. It elicited mixed reactions and the results were summarized in table 9.

Table 9: Status of Electronic Doctor Booking Initiatives

| | Frequency | Percent |
|---|-----------|--------------|
| At least one initiative completed in past 24 months. | 18 | 25.4 |
| Initiative under way. | 9 | 12.7 |
| Initiative is planned. | 22 | 31.0 |
| No initiative planned, under way, or completed in past 24 months. | 22 | 31.0 |
| Total | 71 | 100.0 |

The findings as summarized in table 9 about the descriptive of the status of electronic doctor booking initiative showed that 25.4% of the respondents said that there existed at least one initiative that was completed in the past 24 months. This was important because it enabled the private hospitals to have a check on its operational performance. About 12.7% of the respondents were of the opinion that this kind of an initiative was underway. About 31.0% indicated that the initiative was planned, which meant that it had not even started. This was not good for the organization. For private hospitals to enhance its operations, at least this kind of an initiative should be in existence. About another 31.0% of the respondents to the worst indicated that there was no initiative planned, no initiative was underway or even completed in the last 24 months. This was dangerous to the organizations’ operational performance.

This prompted the researcher to pose statements to the respondents to determine the extent to which they agreed or disagreed to them regarding the effect of electronic doctor booking system on operational performance. The results were summarized in table 10.

Table 10: Effect of Electronic Doctor Booking System on Operational Performance

| | Strongly Agree | Agree | Neutral | Disagree | Strongly Disagree | Total |
|---|----------------|-------|---------|----------|-------------------|-------|
| | % | % | % | % | % | % |
| Electronic appointments are easy to make and can be handled anytime. | 17 | 52 | 14 | 10 | 7 | 100 |
| Electronic appointment is more reliable than manual or without appointment visit to the doctor | - | 51 | 9 | 14 | 29 | 100 |
| The electronic appointment gives better experience because if you have a pre-booked appointment then you would not need to face the waiting time periods. | 9 | 66 | 9 | 7 | 10 | 100 |
| You can see the entire details and profile of a doctor so you can rest assured that you have got the best assistance for you medical problem. | 38 | 54 | - | 7 | 1 | 100 |
| Electronic scheduling has allowed practices to save money and the time of certain secretarial positions. | 1 | 45 | 7 | 13 | 34 | 100 |
| Patients won't understand certain nuances in a doctor's scheduling system | 10 | 63 | 10 | 10 | 7 | 100 |

Electronic appointments are easy to make and can be handled anytime was the first statement. Results from table 10 indicated that 17% of the respondents strongly agreed, 52% of them agreed, 14% were neutral, 10% disagreed while the remaining 7% strongly disagreed. From this response, it can be seen that majority of the respondents agreed. On the other hand, the researcher asked if electronic appointment was more reliable than manual or without appointment visit to the doctor. In this case, none of the respondent who strongly agreed, 51% of the respondents agreed, 9% of them were neutral, 14% disagreed while about 29% strongly disagreed. The researcher also asked if the electronic appointment gave better experience because if the organizations had a pre-booked appointment, then they would need to face the waiting time periods. In this case, 9% of the respondents strongly agreed,

66% of them agreed, which was the majority, 9% of them were neutral, and 7% disagreed while 10% of the respondents strongly disagreed. This was an indication that electronic appointments made it easy then manual and enhanced operational performance of the organizations. On the other hand, you can see the entire details and profile of a doctor so you can rest assured that you have got the best assistance for you medical problem. An overwhelming majority (54%) of the respondents agreed while 38% strongly agreed. Electronic doctor booking enabled patients to know in advance the kind of a doctor who is going to handle them, it saves time and even money which is a prerequisite to proper operational efficiency.

Conditional Tests for Multiple Regression

Regression can only be accurately and properly estimated if the basic assumptions of multiple linear regressions are observed Greene (2003). Therefore, various diagnostic tests which included sampling adequacy tests, normality tests and autocorrelation tests were conducted to ensure accuracy of the results.

Sampling Adequacy Test

The researcher considered the use of Kaiser-Meyer-Olkin (KMO) measure of sampling adequacy which was conducted to determine adequacy of the sample size. According to Magd (2008) KMO is an index used to examine and justify the appropriateness of application of Factor Analysis; values between 0.5-1.0 indicate that a factor is significant. The KMO statistic values varies between 0 and 1 in which a value of 0 indicates that the sum of partial correlations is large relative to the sum of correlations, indicating diffusion in the pattern of correlations. A value close to 1 indicates that patterns of correlations are relatively compact. In this case, Kaiser (1974) recommended accepting values greater than 0.5 as acceptable. Table 11 illustrates the KMO values for this study.

Table 10: KMO and Bartlett's Test

| | | |
|---|--------------------|--------|
| Kaiser-Meyer-Olkin Measure of Sampling Adequacy | | .763 |
| Bartlett's Test of Sphericity | Approx. Chi-Square | 19.694 |
| | df | 10 |
| | Sig. | .032 |

The results in Table 11 indicated that the KMO test of the variables of this study produced an appropriate value of 0.763 which is more than 0.7 with the implication that the sample size was adequate for further analysis for purposes of generating the research findings for this study. This was supported by the Bartlett’s test of sphericity which had a chi-square value of 19.694 with a p-value of 0.032 which is less than 0.05. Since the p-value is less than 0.05 this shows that there is a strong relationship among the study variables under investigation and hence the Bartlett’s test is highly significant.

Autocorrelation Test

Autocorrelation is correlation between the residue terms for any two observations; it is expected that the residue terms for any two observations should be independent (Field *et al.* 2005). Durbin-Watson test was used to test for the presence of autocorrelation between variables. According to Gujarati (2004), Durbin-Watson statistic ranges from 0 to 4. A value near 0 indicates positive autocorrelation while a value close to 4 indicates negative autocorrelation. On the other hand, a value ranging from 1.5 to 2.5 indicates that there is no presence of statistically significant autocorrelation, thus it was applied in the study according to table 12.

Table 12: Durbin-Watson Model Summary

| Model | R | R Square | Adjusted R Square | Std. Error of the Estimate | Durbin-Watson |
|-------|-------------------|----------|-------------------|----------------------------|---------------|
| 1 | .342 ^a | .117 | .064 | 3.01602 | 2.111 |

a. Predictors: (Constant), Electronicdoc, Automated, Inventory, Electronicbill

b. Dependent Variable: Operationalperf

The most celebrated test for detecting serial correlation is that developed by statisticians Durbin and Watson (Gujarati, 2004). Table 12 shows that the value for Durbin-Watson for the general model was 2.111 implying that there was no presence of statistically significant autocorrelation which ensured the independence of errors and enhanced accuracy of the regression models.

Correlation Analysis

Correlation analysis was conducted in order to determine the direction and the strength of the relationship between the dependent variable and independent variables. In this study Pearson correlation coefficient was used to determine the magnitude and the direction of the relationships between the dependent variable and independent variables. Pearson Correlation Coefficient was computed to show the relationship existing between the variables and the results were presented in Table 13.

Table 13: Correlations

| | | Inventory | Electronic bill | Automated | Electronic doc | Operational perf |
|------------------|-----------------|-----------|-----------------|-----------|----------------|------------------|
| Inventory | Pearson | 1 | | | | |
| | Correlation | | | | | |
| | Sig. (2-tailed) | | | | | |
| | N | 71 | | | | |
| Electronic bill | Pearson | .056 | 1 | | | |
| | Correlation | | | | | |
| | Sig. (2-tailed) | .645 | | | | |
| | N | 71 | 71 | | | |
| Automated | Pearson | .257* | -.134 | 1 | | |
| | Correlation | | | | | |
| | Sig. (2-tailed) | .031 | .267 | | | |
| | N | 71 | 71 | 71 | | |
| Electronic doc | Pearson | .026 | .263* | -.020 | 1 | |
| | Correlation | | | | | |
| | Sig. (2-tailed) | .829 | .027 | .870 | | |
| | N | 71 | 71 | 71 | 71 | |
| Operational perf | Pearson | .626* | .726* | -.624** | .509** | 1 |
| | Correlation | | | | | |
| | Sig. (2-tailed) | .031 | .004 | .000 | .009 | |
| | N | 71 | 71 | 71 | 71 | 71 |

*. Correlation is significant at the 0.05 level (2-tailed).

**. Correlation is significant at the 0.01 level (2-tailed).

The values of the correlation coefficient (R) are supposed to be between -1 and +1. A value of 0 implies no relationship, +1 correlation coefficient indicates that the two variables are perfectly correlated in a positive linear sense, that is, both variables increase together while a values of -1 correlation coefficient indicates that two variables are perfectly correlated in a negative linear sense, that is, one variable increases as the other decreases (Sekeran, 2008).

A correlation analysis between drug inventory system and operational performance of private hospitals in Kenya indicated a strong positive correlation with a Pearson correlation coefficient of 0.626 which is significant at 0.05 significant level with a p-value of 0.031. This kind of a relationship shows that automated drug inventory system contributes heavily to the operational performance of private hospitals. On the other hand, a correlation between electronic billing system and operational performance also indicated a strong positive correlation with a correlation coefficient of 0.726 which is also significant at 0.05 significance level. It also indicated that for private hospitals to do better in terms of their operational performance, it must enhance electronic billing systems. Contrary to that, the researcher also found a strong negative relationship between patient data management systems and operational performance. This was seen by a correlation coefficient of -.624 with a p-value of 0.000. Finally, there existed a positive correlation between electronic and automated doctor booking system and operational performance which was significant at 0.01 significance level and a correlation coefficient of 0.509.

Regression Analysis

Regression analysis was done in order to measure the ability of the independent variables to predict an outcome in the dependent variable where there is a linear relationship between them. In order to test the hypotheses of the of the regression model that there is no significant relationship between health

management information system and operational performance of private hospitals in Kenya, Analysis of Variance (ANOVA) was used (Cooper & Schindler, 2010). According to Anderson *et al.* (2002) Analysis of Variance can be used to test the relationship between independent variables on the access to finance by SMEs and to test the goodness of fit of the regression model that is how well the model fits the data.

Cooper and Schindler (2010) argued that regression analysis can also be used determine the strength of the relationship between the independent and dependent variables and to determine the combined effect of all the independent variables on the dependent variable. The coefficient of determination (R^2) was used to measure the change in dependent variable explained by the change in independent variables. F –test was carried out to evaluate the significance of the overall model and to define the relationship between the dependent variable and independent variables; t- test was used to test the significance of the individual independent variables to the dependent variable. In fitting the multiple linear regression model, a regression analysis conducted was summarized in tables 14, 15 and 16.

Table 14: Regression Model Summary

| Model | R | R Square | Adjusted R Square | Std. Error of the Estimate |
|-------|-------------------|----------|-------------------|----------------------------|
| 1 | .342 ^a | .117 | .064 | 3.01602 |

a. Predictors: (Constant), Electronicdoc, Automated, Inventory, Electronicbill

Table 15: ANOVA^a

| Model | | Sum of Squares | df | Mean Square | F | Sig. |
|-------|------------|----------------|----|-------------|-------|-------------------|
| 1 | Regression | 79.640 | 4 | 19.910 | 2.189 | .030 ^b |
| | Residual | 600.360 | 66 | 9.096 | | |
| | Total | 680.000 | 70 | | | |

a. Dependent Variable: Operationalperf

b. Predictors: (Constant), Electronicdoc, Automated Inventory, Electronicbill

Table 16: Coefficients^a

| Model | | Unstandardized Coefficients | | Standardized Beta | t | Sig. |
|-------|---------------|-----------------------------|------------|-------------------|-------|------|
| | | B | Std. Error | | | |
| 1 | (Constant) | 9.952 | 4.276 | | 2.327 | .023 |
| | Inventory | .114 | .099 | .138 | 1.152 | .031 |
| | Electronicbil | -.048 | .078 | -.075 | -.618 | .004 |
| | Automated | -.069 | .133 | -.063 | -.523 | .000 |
| | Electronicdo | .278 | .103 | .324 | 2.701 | .009 |

a. Dependent Variable: Operationalperf

Table 14 indicated the model summary while table 15 shows the analysis of variance. The R value represents the simple correlation and is 0.342 which indicates a high degree of correlation between the dependent and independent variables. The R Square indicates how much the total variation in the dependent variable can be explained by the independent variable. It is also called the coefficient of determination. In this case, it is 0.117 which means the independent variables determines 11.7% of the dependent variable.

Table 15 is the ANOVA table, which reports how well the regression equation fits the data (predicts the dependent variable). This table indicates that the regression model predicts the dependent variable significantly well. The sig of .030 indicates the statistical significance of the regression model that was run. Here, $p < 0.030$, which is less than 0.05, and indicates that, overall, the regression model statistically significantly predicts the outcome variable (it is a good fit for the data). Since

the p-value is less than 0.05 as stated in the methodology, the study rejected the general null hypothesis which stated that health management information system had no significant effect on operational performance of private hospitals in Kenya.

In fitting the regression model, the researcher determined the regression coefficients which showed the extent to which each independent variable contributed to the dependent variable and the results were shown in table 16.

The fitted model

$$Y = 9.952 + .114X_1 - .048X_2 - .069X_3 + .278X_4 + \varepsilon$$

Where:

Y = Operational performance

X₁ = Drug Inventory System

X₂ = Electronic billing system

X₃ = Automated patient data management system

X₄ = Electronic Doctor booking system

ε = Error term

VII. SUMMARY

Drug inventory systems and operational performance

Inventory can be a vital part of managing supply chains. Because of this, the status of a firm's inventory is often used as a litmus test for the overall health of its supply chain management processes and decision-making. Such high safety stock is indeed a problem in and of itself because of the costs of holding this inventory and the opportunity costs of having working capital tied up in assets that aren't being converted to sales. The larger issue here, however, is that this safety stock situation is likely a symptom of some sort of ineffective supply chain management decision-making. Results indicated that majority of the respondents indicated that there existed a need to review inventory buying practices. A high turnover in an organization was typically preferred and

shows strong sales performance. Turning over inventory quickly also improves an organization's liquidity, or ability to keep up with near-term debt obligations. For the purposes of inventory turnover, when an organization stock a certain product is just as if not more important than what it choose to stock. Products on specific months or seasons can be a bit more complicated.

On the other hand, the researcher wanted to determine how often the organizations conducted inventory counts. Majority of the respondent did inventory count monthly. The results indicated that there exists an importance of doing inventory counts quite often so that organizations can know when they needed stock, how much stock is left and how long it can take h organization before the next stock is needed. In inventory valuation, there exist a discrepancy between amounts of drug-purchased received and amount ordered. Respondents manually matched an invoice reconciliation document as a whole to a purchase order or a contract. Others adjusted the advance payments made to the supplier against the invoices received for the purchase order. The respondents were also asked to provide information on to what extent they agreed or disagreed on statements regarding the effect of inventory drug management system on the operational performance of private hospitals in Kenya. Majority agreed that private hospitals in a bid to enhance their operational performance have embraced effectively the use of automated drug inventory systems.

Electronic billing system and operational performance

Electronic medical billing is the process by which a health care provider electronically submits a bill, or claim, to a health insurance company, or payer, for the rendering of medical services. The use of electronic billing system had led to reduced paper usage which helped to conserve the environment and reduced paper work in the office. Majority of the respondents agreed with the statement. The researcher went further to determine whether the

introduction of electronic billing system reduced operational costs. An overwhelming majority agreed to the statement. This was an indication that electronic billing to a large extent reduced operational costs of the organization. Electronic billing can save hospitals' money, time, and other resources. The organization faces inadequate time for implementation challenge in trying to implement the electronic billing system was another statement posed by the researcher. Majority of the respondents agreed. Electronic statements can accelerate payments from customers in addition to accelerating internal business operations. Much is left up to the customer when paper statements are sent via mail; weeks could go by before the customer ever opens the bill, leaving a lengthy period of time between a business's request for payment and the actual receipt of funds.

Patient Data Management system and Operational Performance

The researcher prompted the respondents to describe the status of data quality improvement initiatives in their institutions. Majority of the respondents indicated that the initiative was planned, which meant that it had not even started. In a bid to understand the effect of patient data management system and operational performance, the researcher posed various statements in a view to examine the extent to which respondents agreed or disagreed to them. The institution had documented electronic records retention schedules for patients was the first statement. Majority of the respondents agreed. This was an indication that in most private hospitals, there existed documentation of electronic records retention schedules for patients which in turn elicited operational performance. On the other side, private hospitals had documented policies regarding automated patient data management. Majority of the respondents agreed. The researcher went further to ascertain whether private hospitals had undertaken automated data management initiative because it was an institutional leadership

mandate for data quality improvement and majority of the respondents agreed.

Doctor Booking System and Operational Performance

This booking system provides patients or any user an easy way of booking a doctor's appointment online or electronically. It offers patients the ability to make online appointments with doctors from every computer and mobile device connected to the internet at any time. Managing doctor appointments and calendars makes the health center a streamlined organization which works on an efficient schedule that makes full use of its resources and improves the well-being of the patients. When the researcher asked if electronic appointments were easy to make and can be handled any time, majority of the respondents agreed. The researcher also asked if the electronic appointment gave better experience because if the organizations had a pre-booked appointment, then they would need to face the waiting time periods. Majority of the respondents agreed. This was an indication that electronic appointments made it easy then manual and enhanced operational performance of the organizations. On the other hand, you can see the entire details and profile of a doctor so you can rest assured that you have got the best assistance for you medical problem. Electronic doctor booking enabled patients to know in advance the kind of a doctor who is going to handle them; it saves time and even money which is a prerequisite to proper operational efficiency.

VIII. CONCLUSION

The study made conclusions based on the general and specific objectives. The general objective of the study was to establish the effect of health management information system on operational performance of private hospitals in Kenya. On examining the effect of drug inventory systems on operational performance of private hospital in Kenya, the study rejected the null hypothesis which stated that drug inventory management system had

no significant effect on operational performance of private hospitals. The study concluded that the drug inventory logistics played a crucial role in the hospital operational performance and that for hospitals to sustain themselves, there was a great need to have an extensive drug inventory system as a strategy to enhance both operational and financial efficiency. On the other hand, the study concluded that measures put in place within hospitals to control drug inventory management were not sufficient.

On determining the effect of the implementation of electronic billing system on operational performance of private hospitals in Kenya, also the study rejected the null hypothesis which stated that the implementation of electronic billing did not have significant effect on the operational performance of private hospitals in Kenya. The study immensely discovered that electronic billing contributed to the operational performance of private hospitals. The study arrived to this conclusion due to the fact that electronic billing as a strategy to boost operations led to reduced paper usage, which helped to conserve the environment and enhanced proper data storage. It also provided an efficient and effective service delivery to the hospitals.

The study also rejected the third null hypothesis which stated that enacting automated patient data management system did not have a significant effect on the operational performance of private hospital in Kenya. This was because the study found that data management had a crucial weight on the operations of hospitals. The study concluded that automated data management systems helped hospitals to easily make strategic decisions very fast and helped to manage all varieties of data and digital content that the institution needed.

Finally, the study also rejected the fourth null hypothesis which stated that electronic doctor booking system did not have significant effect on the operational performance of private hospitals in Kenya. This was due to the fact that the study found

a strong effect on electronic doctor booking and operational performance of hospitals. This was because it enabled easy making of doctor appointments, it was more reliable than manual appointments and saved time. The electronic appointment gave better experience because if you have a pre-booked appointment then you would not need to face the waiting time periods. On the other hand Electronic scheduling had allowed practices of saving money and the time of certain secretarial positions thereby enhancing operational performance.

IX. RECOMMENDATIONS

Based on the findings and conclusions of this study, the researcher made the following recommendations;

In enhancing proper drug inventory systems, hospitals should build up drug tracking systems that avoids human errors thus increasing efficiency of the service. Hospitals should also obtain a feature in their drug inventory system that alerts the users if the inventory levels are below or above some desired levels. Equally, hospitals must review regularly the inventory buying practices according to seasons.

To enable electronic billing systems in hospitals, the researcher recommended that they should set up a secure electronic backup system that ensures records are safely stored and regularly backed up. Hospitals should also adopt cloud computing which provides for hospitals to manage computing resources and records online. Equally, hospitals should introduce invoicing methods.

On Patient Data Management system, the study recommends that the initiative should be practiced regularly. Equally, hospitals should have policies regarding data management within the organization to help them make decisions very fast and effectively manage all digital content that the institutions need. The organization has to undertake automated data management initiative because it is

an institutional leadership mandate for data quality improvement.

Finally on electronic doctor booking, the study recommends that the initiative should be made a regular practice within the organization.

REFERENCES

- Cooper, D. & Schindler, P. (2006) *Business Research Methods*, McGraw-Hill
- Donald, W. (2017), *Inventory Management*, in Ann M. Brewer, Kenneth J. Button, David A. Hensher (ed.) *Handbook of Logistics and Supply-Chain Management (Handbooks in Transport) 2*:195 - 212
- James, A., Parag, C. & David, J. (1996). *End-user perceptions of quality and information technology in health care. Journal of High Technology Management Research*, 7(2), 133-147.
- Kris, M. & Law, Y (2016). *How schedule issues affect drug logistics operations: an empirical study in hospitals in China, Industrial Management & Data Systems*, 116 (3)369-387.
- Kumar, V. (2011). *Impact of Health Information Systems on Organizational Health Communication and Behavior. The Internet Journal of Allied Health Sciences and Practice*. 9(2), Article 8.
- Mark, R., Tim, K., Harry, B. & Wolter, L. (2009) *How new billing processes reshape the mobile industry, info*, 11(1)78-93.
- Republic Of Kenya (2008). *Ministry of Health Annual Health Sector Status Report 2005-2007*. Retrieved on August 23, 2017 from http://www.health.go.ke/Healthfacilities/Annual%20Report%20_%20HMIS.pdf
- Schindler, P. (2006). *Research Design, Qualitative, Quantitative and Mixed Method Approaches*, 3rd Edition, Sage Publications Inc.
- Tiina, M., Tarja, S., Paula, A., Marianne, M., & Ilmari, R. (2009). *The outcomes of regional healthcare information systems in health care: A review of the research literature. International journal of medical informatics*, 78(11), 757.
- Ting-Ting, L. (2004). *Evaluation of Computerized Nursing Care Plan: Instrument Development. Journal of Professional Nursing*, 20(4), 230-238.
- Toshio, A., Ko-ichi, O., Takehiro, Y., Kuniko, Y., Toshiyuki, M., Yu-ichi, I., Yoshikazu, T., Nobumasa, H. & Kazuo, M. (2005). *Automation in Drug Inventory Management Saves Personnel Time and Budget. The Pharmaceutical Society of Japan* 125(5) 427—432