FRAMEWORK FOR THE IMPLEMENTATION OF A PATIENT ELECTRONIC REFERRAL SYSTEM: CASE STUDY OF NAIROBI PROVINCE

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Abstract
The aim of the research was to develop a framework for the implementation of a patient e-referral system. An initial observation showed that hospitals are run as single entities with no information to link among them resulting to discontinuity in care delivery thereby leading to very inefficient patient care because of lack of care continuity and high costs in care delivery. Literature in strategic role of ICTs in health care citing the current and emerging technologies in electronic health care delivery is reviewed. It shows that the challenges of cost and quality care can be overcome if the services were delivered electronically. The key challenges to electronic health care delivery include standards, privacy, trust, security, costs and lack of ICT skills. Data was collected using questionnaires. A response rate of 63% with a total of 228 out of 360 respondents in health facilities in Nairobi province was a considerable response rate to substantiate the findings of the survey. Various models were also reviewed and compared. Key findings to do with data collected showed that majority of public health institutions have not embraced use of ICT tools for handling patient health data. Application programs found to be used in Kenyan health facilities include the following; Ms-access, Ms-Excel, Ms-word, FTP, GIS, health CIS, Care2000- ERP, and e- Hospital. However most of the software reported were available only in private health institutions where the software are used mainly for financial and administrative activities but not for improving health care delivery. To address these challenges, the researcher has proposed a patient e-Referral framework to improve the integration of primary care and specialty care through a common interface. The proposed framework provides a starting point for further work in solving the problem of inefficient referral system.

Key words: E-referral, health care, e-hospital

1 Introduction and Literature Review

The emergent of Information and Telecommunication Technologies (ICTs) have brought about an information revolution, leading to the information society we are living in today (Rindfleisch, 1997). It has transformed business functions (Schiefer, 1999) by changing the way they handle and use information that emanates from their day to day running or that which is availed to them from other sources. Almost every economic sector is affected by the use of information Technology (Reima, 2002). The accompanying technologies such as the world wide web (www) and growing usage of the internet has led to business trading on-line (e-commerce) as well as e-business in commercial business, which the health care industry has benefited by removing boundaries of treatment resulting to e-healthcare (Brown, 1995).

Health care industry, like any other service delivery industry, has undergone changes in its infrastructure and approach to health care. These changes have acted as driving forces to demand for more usage of ICT (Grimson, *et al*, 2000). There is a growing need for improved efficiency and reduction of costs in the health sector and ICTs provides the solution to availability of reliable, consistent and timely data since the sector is an information intensive business (Anderson, 1997). Patients are demanding for better services and are more aware of their rights such as right to their clinical data (Feschi marius, 2002). In addition, the health care providers are faced with very high competition and are therefore exploring ICT opportunities to gain competitive advantage through differentiation and cost reduction (Yiannis *et al*, 2002).

An example of an electronic referral system is exemplified by San Francisco General Hospital (SFGH). See figure 1. The importance of the components is that they have served as a basis for the proposed models of this study. The hospital serves as the hub of the county's safety net delivery system, which includes 35 community health centers, clinics and affiliated partners. The hospital serves as a teaching hospital for the University of California, San Francisco, and this entire system benefits from shared access to patients' SFGH electronic medical records. The system's key components include a centralized electronic queue for each participating specialty service, a distributed e-Referral system to other health centres, designated specialist clinician reviewers and integrated real time hospital electronic medical records (EMR). The system is limited to initial referrals (rather than referral for follow-up care) because these were decided to be the best use of the reviewer's time.

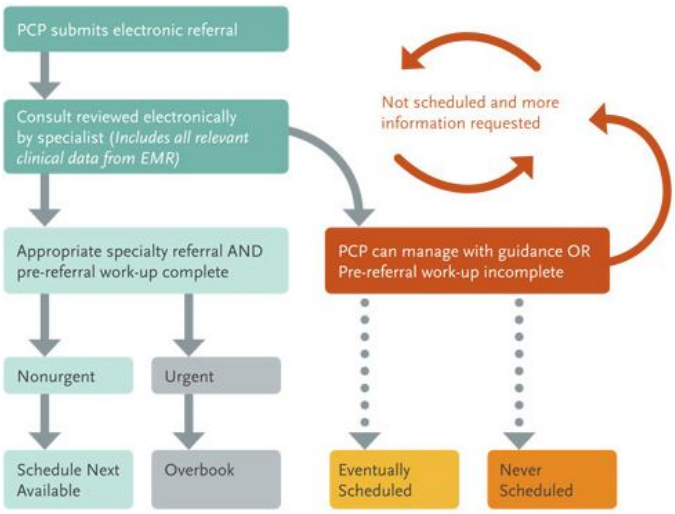

Figure 1: San Francisco General Hospital & Trauma Center eReferral system process

2 Problem Statement

Access to medical specialists is a challenge, in particular in resource constrained settings such as developing countries (e.g. Kenya). The problem is exacerbated by poor manual referral process that is cumbersome, confusing and inefficient. It is common for patients to be referred to a specialist without sufficient information about their conditions, prior work-up, or clear questions for the specialist consultant. Such poorly planned and prepared referrals result in wasted or ineffective specialty visits that further worsen access to specialized care and threaten quality of care.

2.1 Research Objectives

2.1.1 General Objectives

To study the current and emerging ICT technologies used in healthcare delivery system and to develop a framework for the implementation of patient e-referral system.

1.1.2 Specific Objectives

1. To investigate the current and emerging ICT technologies and implementations available for managing patient health data and information in health institutions in Kenya.
2. To assess the perception of health care service providers towards use of ICT tools in handling patient health data and information in health institutions in Kenya.
3. To determine the level of readiness for the implementation of electronic healthcare delivery system in health institutions in Kenya.
4. To review the existing models for managing patient health data and information, suitable for Kenyan health institutions.

2.2 Justification

Paper-based referral process is characterized by lack of tracking of referrals and outcomes, limited standardization, extensive paper-based rework by staff, inadequate information for specialists and lack of specialty feedback to referring providers. This urgently calls for a need for an improved referral process. The proposed patient e-Referral framework will therefore help to improve the integration of primary care and specialty care through a common interface, leading to a shorter and more efficient patient referral process.

3 Research Methodology

A questionnaire was used to collect the data required. A structured approach was adopted using a combination of closed formats with response choices and a few open ended formats. The response choices included response formats such as ‘yes’ or ‘no’, single response while others required multiple responses.

There are a total of 406 health facilities in Nairobi City County **(**HIS, PHRIO, DHRIO - MOH 715 Returns of 30th September 2009. Updated: 5th November 2009). A convenient sample of 70 facilities were randomly selected from across Nairobi province. To test the questionnaire, a pilot was conducted in Thika District Hospital and Ruiru Health Centre. These are facilities outside Nairobi province, but serving similar needs as facilities in Nairobi province. A total of 30 respondents participated in the pilot survey. The collected data was coded and then entered on SPSS (Statistical Package for Social Sciences) version 11.5 for processing. A reliability coefficient (alpha) of 0.70 or higher is considered acceptable reliability. (Esposito, 2002). For our questionnaire, we had a reliability of 0.7289. Out of the 360 respondents targeted, a total of 228 responded resulting in a response rate of 63%.

3.1 Proposed Framework

3.1.1 Integrated/Enterprise Health Management Information System (The Kenyan situation)

The Ministry of Health in Kenya has adopted the integrated Health Management Information System (HMIS) conceptual model. See Figure 2. This is modular model that aggregates data from health facilities to a national Data System. It includes the HIS module(comprising of mortality and morbidity), disease surveillance, patient management (in and out patient), laboratory management, pharmacy management, programs such as TB, Malaria, HIV AIDS, immunization, child health, nutrition, reproductive health, mental health, Ophthalmic services etc. Management information is captured by other modules such as logistics and supplies, Human Resource, inventory of equipment and Finance and Accounting functions. Other modules are external but integral to this HMIS. These include vital registration, census, demographic surveys, weather and environment. Powerful tools for modeling such as Geographical Information Systems (GIS) and Decision Support Systems (DSS) utilize the data from the integrated modules, enhancing decision making and planning, with little effort. Integration and interoperability is achieved by the use of open data standards on the database.

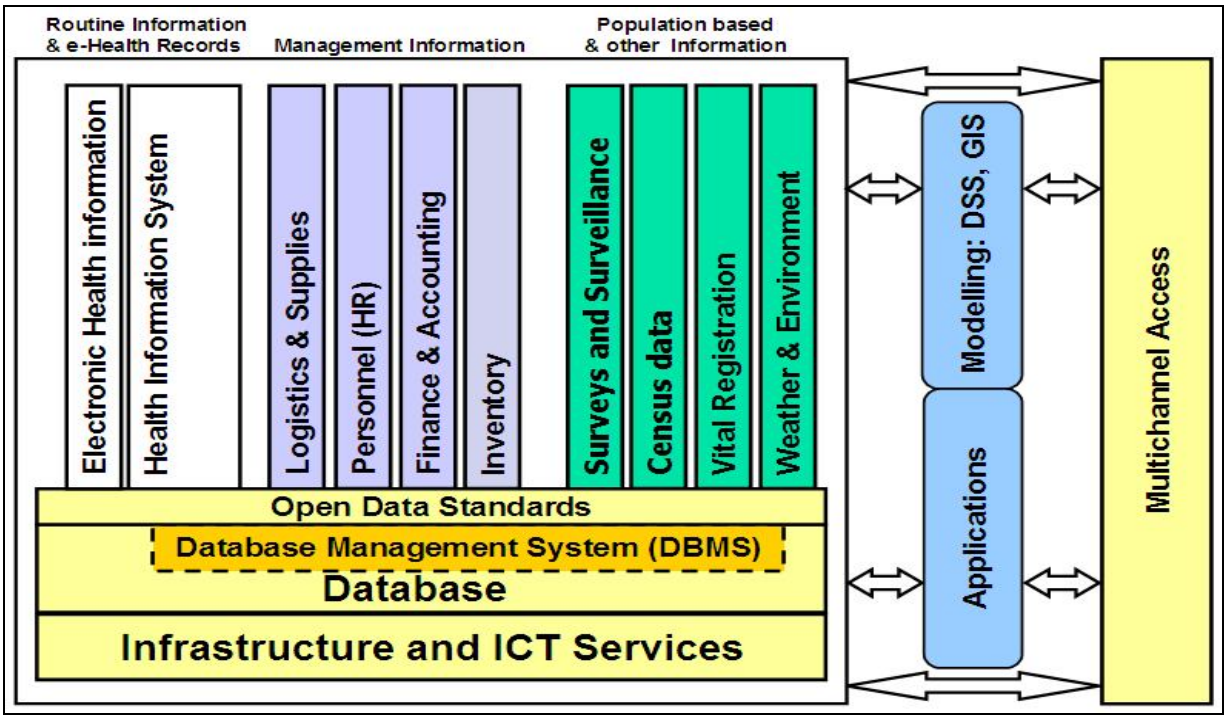

Figure 2: Conceptual Model of Integrated HMIS. Source: Final HMIS software report, UNES (2009)

3.2 Observation

Users are primarily interested in information processing applications, which they may own or gain access to as end-users via communications networks. These services are 'enabled' by other underlying, transparent services provided by information and network service providers.

3.3 Suggested Improvement

In view of this, we have proposed improvement of the reviewed conceptual model (figure 2) by including a middleware services component that will enable knowledge discovery. Middleware services that support the development of the Integrated-Electronic health records are directory services, security services and Terminology services.

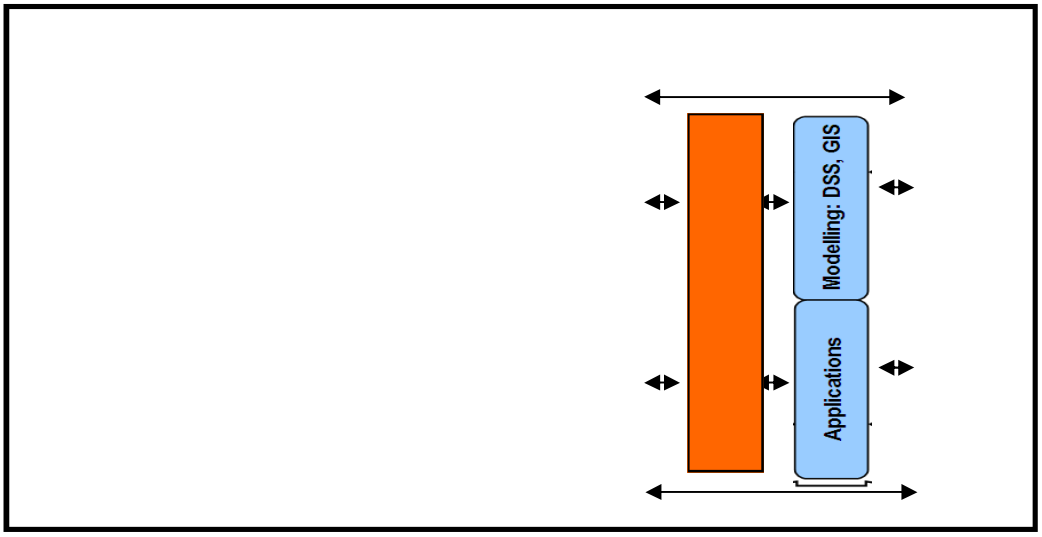

Figure 3: Improved Conceptual Model of Integrated HMIS

We selected Electronic health information component of the above improved conceptual model of integrated HMIS (Figure 3) as the main research area and based on reviews made on other Electronic patient record (EPR) system models as well as e-referral system models coupled with the survey carried out in health institutions in Nairobi province, it was found out that it is feasible to deliver referrals electronically. If e-referral system is implemented, Quality of service was likely to improve through improved efficiency and effectiveness of care delivery while running costs of service provision were likely to decrease. In view of this a patient e-referral has been proposed as illustrated in figure 4 below.

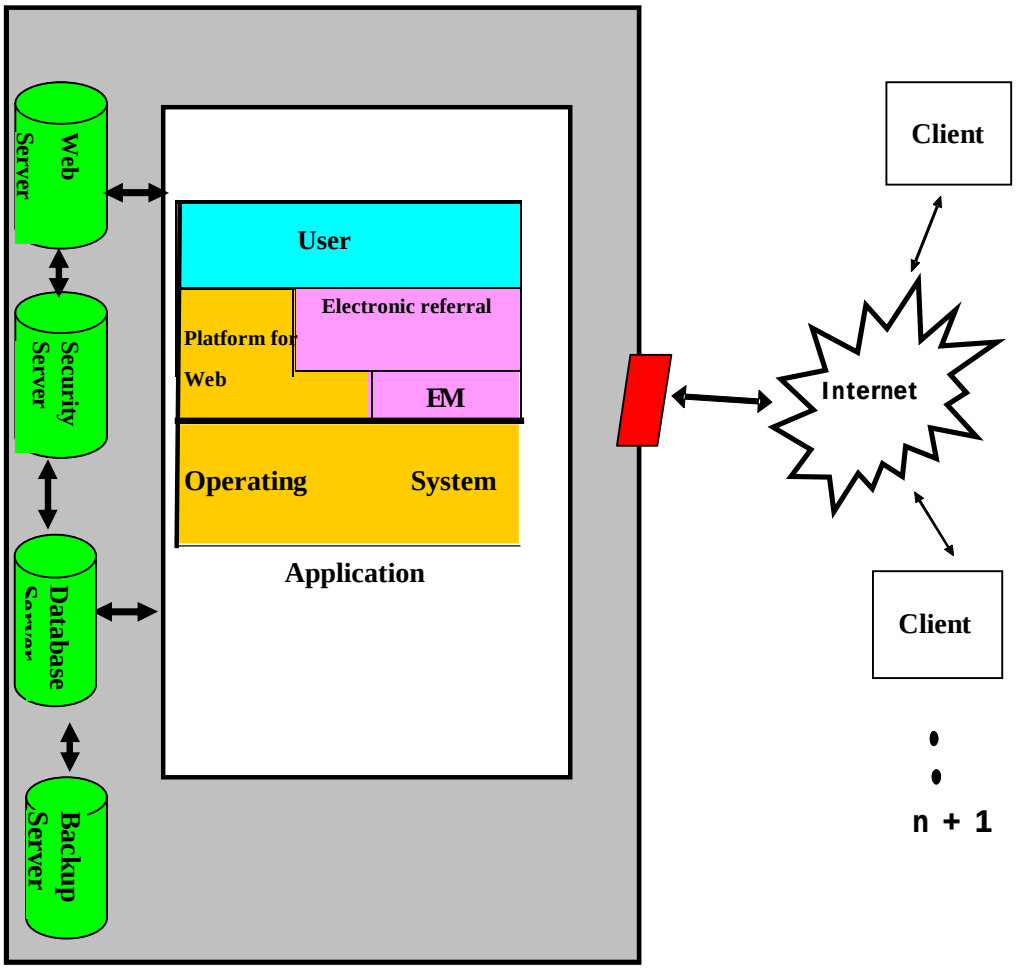

Figure 4: proposed E-referral framework.

3.4 E-referral Framework Components

The proposed system is a web application. The application is divided into 3 layers: user interface, components, and operating system. In the components layer, EMR is the foundation on which e-referral and a user interface is built. EMR manage user accounts, messaging, auditing, and patient data. E-referral component manages the referral process. A referral can be in one of the following states: in the process of being created by a health facility, waiting for action by a specialist, referred, or directed to alternative treatment. The user interface layer is based on a platform for web applications through which specialists can log in and be authenticated in EMR and eReferral components. The web application platform accesses the database, collects the requested data, forms the response in a suitable format and forwards it back to user

3.5 Patient Application to Different Hospitals

In the proposed model, the client is introduced to the system with a unique patient key. Unique patient key is distributed by a central system in response to patient's application. It is assumed that the patient

always applies with this given key. If the patient has never been registered before, then an online registration process is initiated at the health facility where he/she first visits. Upon successful registration a unique patient key is given, and the corresponding demographic information is stored in the central server. It is assumed that all referring health facilities must be registered to use the online e-referral system to refer their patient for specialized services. The patient will not be able to get any specialized service unless his/her application is entered into the online system. This will help prevent cases of self referrals.

3.6 E-referral Transaction Sequences

(i) The specialist clinician at the referring health facility logs in to the web-based referral system, fills in a referral form and submits it to the health institution offering specialized services.

(ii) Each participating health institution offering specialized services has a designated specialist clinician with dedicated time to review and respond to all referral requests. The clinician reviews patients' referrals and sorts the referrals according to the type of problem, severity, geography, and other attributes. The reviewer can send messages using the online system to ask for additional information and to schedule an appointment with a specialist, or forward the referral request to another specialist in another health facility offering specialized services.

(iii) The electronic referral system is tightly integrated with the specialized health facility EMR so that all information exchange is documented in the patient's chart in real time. With an EMR in place, connections can be made to remote health facilities in different locations over a high sped wide area network (WAN), so that the detailed information of the patient such as the treatments undergone, medicines, analyses and radiology images are obtained. The information in the remote health facilities is read-only to the outside. No changes are allowed to be made to the records of the accessed patient data in the remote health facilities offering specialized services.

4 Survey Findings

4.1 Current State of ICT Usage in Health Facilities in Nairobi Province

The hospital Administrators, Heads of Facilities and Heads of departments indicated the departments where computers were used as Pharmacy, Laboratory, Administration, Radiography and Hospital Finance. Figure 5 illustrates these findings.

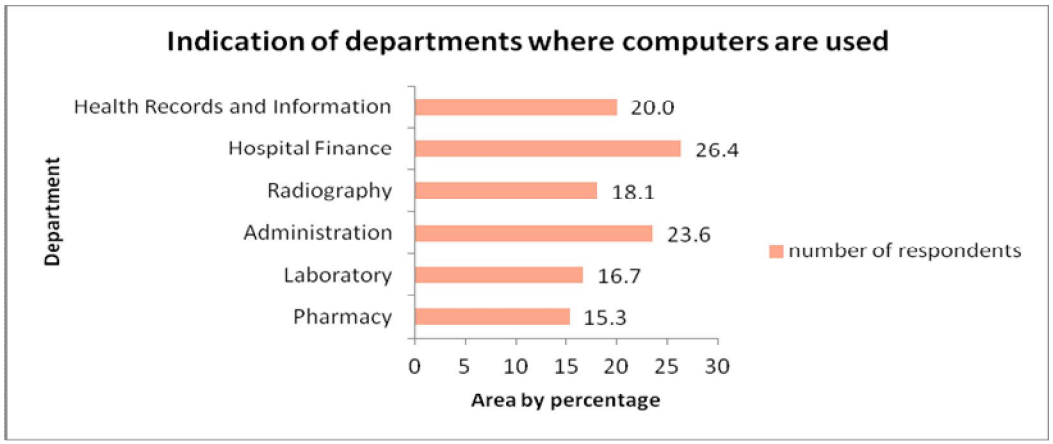

Figure 5: Hospital Administrators, Heads of Facilities, and Heads of departments indications of the departments where computers were used

4.2 Evaluation

From the Hospital Administrators, Heads of Facilities, and Heads of departments' perspective, areas in the departments where computers were used include data collection, data storage, data retrieval, and data analysis. This is a clear indication that most computer operations in hospitals are done by clerical and administrative staff for financial administrative activities. This further shows that there is a high level of awareness amongst administrative staff on the use of computers and very low level of awareness amongst heath service providers such as doctors, clinical officers and nurses.

4.3 Existing ICT Infrastructure

From this study, it was established that ICT tools like laptops, Desktops, Servers, Printers, PDAs and Mobiles Phones were in use in the health facilities. Figure 6 shows the percentage of respondents (Hospital administrators, Heads of Facilities and Heads of Departments) who reported availability of ICT tools in the health institutions, 24.1% of the respondents reported availability of Desktops and printers equally. Only 1.8% of respondents reported availability of laptops and servers in the health institutions. 2.2% reported availability of PDAs and mobile phones in the health facilities.

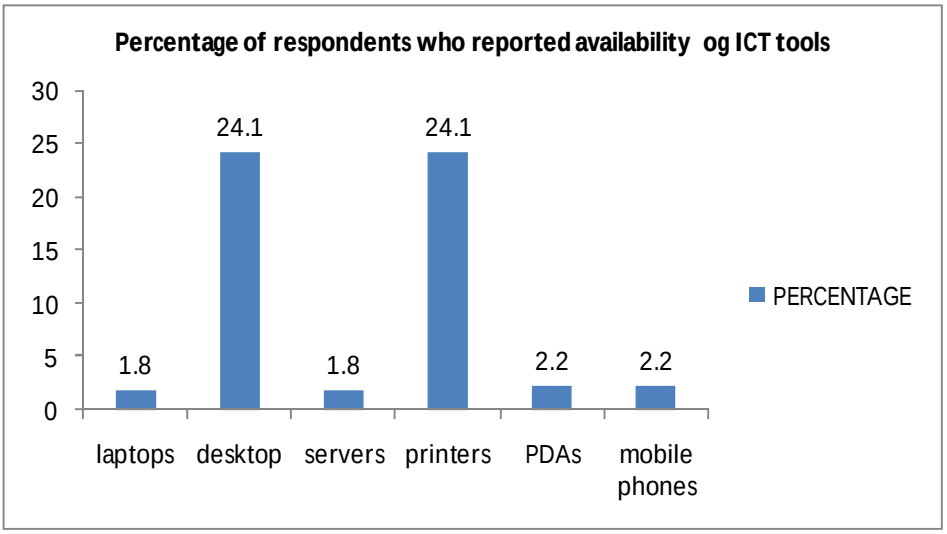

Figure 6: Number of respondents who reported availability of ICT tools

97.8% of the Hospital administrators, Heads of Facilities and Heads of Departments admitted that there was no operational LAN in place as only 2.2% agreed to this effect. In that regard, there were no Internet accesses as no respondents had internet connections.

4.4 Evaluation

Overall, equipment numbers for Laptops, Servers, PDAs and mobile phones is very low and unevenly distributed. It is revealed that there are very few ICT equipments available for use in the health facilities. Computers available at the district level are used for the HMIS function of collating data at the district level and reporting. PDAs are also available at all health districts and are used by District TB and Leprosy Coordinators (DTLC) to capture data as it appears in the registers. It was reported that Kenya Extended Programme on Immunization (KEPI) has instituted data transfer mechanism using cell phones to send vaccine stock balances from health districts to its offices in the Ministry. KEPI is supposed to support the sending of data by offering airtime. The current scenario as reported is that sustainability is not guaranteed every month thus prejudicing the reporting process. District Health Records Information Officers (DHRIOs) use their own mobile phones to carry out this exercise.

The current mode of connectivity between the District Records and HMIS headquarters is through wireless telephone equipment provided by HMIS. It was reported that HMIS has supplied Safaricom modems for use in transferring data and the districts were supposed to sustain the cost of sending data through File Transfer Protocol (FTP). In cases where financing is not available, DHRIOs resort to using cybercafés to access internet at their own cost.

The research further revealed that application programs found to be used in Kenyan health facilities include, Ms-access, Ms-Excel, Ms-word, FTP, GIS, health CIS, Care2000-ERP, and e- Hospital. However most of the software reported was available only in private health institutions where the software is used mainly for financial and administrative activities but not for improving health care delivery. Usage of these technologies varies from hospital to hospital and more so from private to public hospitals. Governments are targeting electronic health care delivery with the starting point being national EMR system. Main barriers to electronic health care delivery include lack of standards, ICT infrastructure, costs, security, privacy and shortage of ICT staff. This has contributed to the slow uptake of ICTs in health care compared to other service delivery industries such as banking industry.

5.0 Conclusion

The key opportunities for electronic referrals include the following:

(i) Common patient identification.
(ii) Common codes for medical treatment, drugs, tests and facilities.
(iii) Common information repository on members shared by healthcare providers and stakeholders, in an on-line system.
(iv) Institutions of higher learning and professional bodies to take up leadership role in ICT and step in to facilitate implementation of common ICT/Healthcare systems.

This framework provides a starting point for further work in solving the problem of inefficient referal system. The research has shown that health facilities in Nairobi province have not embraced uptake of ICT in patient care. The findings from the research on the key challenges indicate the need to overcome the barriers in order to provide an e-referral system. There is need for health care stakeholders to oversee issues pertaining to standards, legal issues as well as policies regarding privacy in the area of electronic health care delivery.

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