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**The American University in Cairo**  
**School of Global Affairs and Public Policy**

**ASSESSING READINESS FOR E-HEALTH IN EGYPT: A CASE  
STUDY OF CAIRO UNIVERSITY HOSPITALS**

**A Thesis Submitted to the**

**Public Policy and Administration Department**

**in partial fulfillment of the requirements for the degree of  
Master of Public Policy**

**By**

**Jessica Stadelmann**

**January 2012**

The American University in Cairo  
School of Global Affairs and Public Policy  
Public Policy and Administration Department

## ASSESSING READINESS FOR E-HEALTH IN EGYPT: A CASE STUDY OF CAIRO

### UNIVERSITY HOSPITALS

Jessica Stadelmann

Supervised by Dr. Hamid Ali

### ABSTRACT

Implementing E-Health can improve quality of care by increasing accessibility to patient health records, improving governance and administration, and integrating health information into an organized system. However, before implementation occurs, E-Readiness Assessment is an important tool used to evaluate an organization's likelihood of successful adoption. Cairo University Hospitals are still in early stages of implementation, and measures to improve E-Readiness would contribute to the transition from an almost complete lack of health information accessibility to successful adoption of an electronic system. This paper discusses how Cairo University Hospitals would be able to raise the quality of service delivery through E-Readiness and successful implementation of E-Health. Through information gathered from health officials and a case study of Cairo University Hospitals, the benefits of E-Health are reviewed and recommendations for adoption of E-Health are made.

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## I. INTRODUCTION

There is a universal need to enhance the quality of health care delivery. The Institute of Medicine (IOM) defines quality care as, “the degree to which health services for individuals and populations increase the likelihood of desired health outcomes and are consistent with current professional knowledge”. The IOM illustrates six domains encompassing quality of care. They include: safety, effectiveness, patient-centeredness, timeliness, efficiency and equity (Cooperberg et al., 2009).

The quality of care can significantly be improved with the implementation of E-Health. E-Health contributes to healthcare by improving the accuracy and quality of data input in a health record, allowing a patient’s healthcare information to be shared among practitioners long-term, providing health information immediately at all times for patient care, improving the efficiency of the health care records, and by containing healthcare costs (WHO, 2006). E-Health is an application of management systems information and can lead to adoption of other applications, in addition to patient medical records, such as telemedicine, medical transcription software, integrating departments into one system to share imaging, and patient history. The main objective of E-Health is to improve quality of care, in addition to improving efficiency and effectiveness in the management systems. However, E-Health is not a replacement of paper records, and must be consistent with privacy and confidentiality practices in healthcare.

E-readiness assessments provide incremental feedback in the implementation process by increasing awareness of the organization's adoption level in order to allow customization based on its readiness level (HITECH). E-readiness assessment tools have been used in the following areas: e-business, e-commerce, e-learning, and e-government. E-readiness is important for the pre-implementation phase in assessing the weaknesses and challenges the organization or institution must overcome for successful implementation. This paper will evaluate the degree of readiness for implementation of the Electronic Medical Record (EMR) system in Cairo University Hospitals. E-governance improves the efficiency in both finance and administration. By being implemented in a hospital setting, it not only improves the efficiency in finance and administration, but also in the quality of care. Therefore, it is necessary to assess the

readiness of E-Health implementation in Cairo University Hospitals using an assessment tool provided by the government or organization promoting successful implementation of e-governance.

The case study showed how implementation of Electronic Medical Record system (EMR) can improve the quality of care in Cairo University Hospitals. This research consisted of a case study on Cairo University Hospitals, several interviews and data acquired from several officials, and an e-readiness assessment. Analysis was done on the acquired information. Following the analysis, policy and implementation measures were suggested to improve the efficiency and effectiveness and improve the quality of care. Lastly, based on the observations from this study recommendations for Cairo University Hospitals are provided regarding how to overcome their assessed weaknesses for successful implementation.

By answering the following research questions, the researcher helped identify common problems in hospital administration that occurred locally and globally in developing countries. The basic research questions were the following:

1. To what extent are Cairo University Hospitals ready to implement Electronic Health Records?
2. According to the results provided by the e-readiness assessment, what obstacles and challenges do Cairo University Hospitals need to address to meet successful implementation?
3. What is the potential for use of e-Health to increase efficiency of health care delivery?

#### **A. Problem**

Health care inequity is a current topic of interest in the health care sector. The rise of the quality movement in health care builds on emerging quality theories and practices from the industrial sector, concerns about rising health care costs, and changes in the health care industry (Friedman, 1995).

Low-income countries face efficiency problems in hospitals due to poor resource allocation (McPake et al., 2003). Being classified as a lower-middle income country,

according to the World Bank, Egypt's health sector status is relatively low, even compared to other countries at the same socioeconomic level. It spends about 4.75% of GDP on health (Table 1).

Currently Cairo University Hospitals are governed by the Ministry of Higher Education. The Ministry of Finance provides the resources to the Higher Education, which manages and funds all university teaching hospitals. Therefore, it receives the majority of its funding from the Ministry of Higher Education and donors. The Ministry of Health does not allocate funding to Cairo University Hospitals. In addition, HIO, the national health insurance organization program, which covers about 50% of Egypt, does not pay for care at Cairo University Hospitals. HIO has its own hospitals and the MOH has its own hospitals for Egyptians who receive some form of government insurance (Cairo University Hospital Administrator, personal communication). Regardless of the facts presented that HIO does not cover medical services at public university hospitals, and the Ministry of Health does not help fund the public university hospitals, the Ministry of Health still refers patients to the public university hospitals, further expanding the budget deficit. With a reliable health information system implemented, Cairo University Hospitals can keep more accurate records of the patients referred to them by MOH and HIO and the debt owed by MOH and HIO. Figure 1 outlines a breakdown of the governance system for Cairo University Hospitals.

The system is almost completely centralized, leaving all decision-making to the Ministry of Higher Education under Decree 3300 of 1965 limiting management autonomy in university hospitals. This law limits direct purchases made from the Dean and President of the university and any purchases made over 100,000 EGP (16,566.70 USD) has to be approved by the Prime Minister. In addition, management cannot fire any employees (Cairo University Hospitals, 2010).

Table 1. Egypt in Comparison to Other Middle-Income Countries in the Region (2008).

	<b>%GDP Spend on Health</b>	<b>Government Spending as the Percentage</b>	<b>Health Spending as Percentage of Total Government Budget</b>	<b>Out-of-Pocket Expenditure as Percentage of Total</b>	<b>Per Capita Health Spending (Constant 2005 US\$)</b>
<b>Algeria</b>	4.49	83.85	10.65	15.30	205
<b>Djibouti</b>	8.54	76.07	14.15	23.60	81
<b>Egypt</b>	4.75	33.00	5.00	60.00	111
<b>Iran</b>	6.30	45.72	11.40	51.68	294
<b>Jordan</b>	9.10	62.20	11.35	33.40	273
<b>Lebanon</b>	8.76	48.99	12.39	39.95	551
<b>Libya</b>	2.80	75.88	5.38	24.12	383
<b>Morocco</b>	5.33	34.97	6.17	56.13	133
<b>Syria</b>	3.23	45.13	6.01	54.87	76
<b>Tunisia</b>	5.95	49.57	8.90	42.52	213

Sources: World Health Organization (WHO) NHA data, Egypt NHA results, Jordan NHA report.

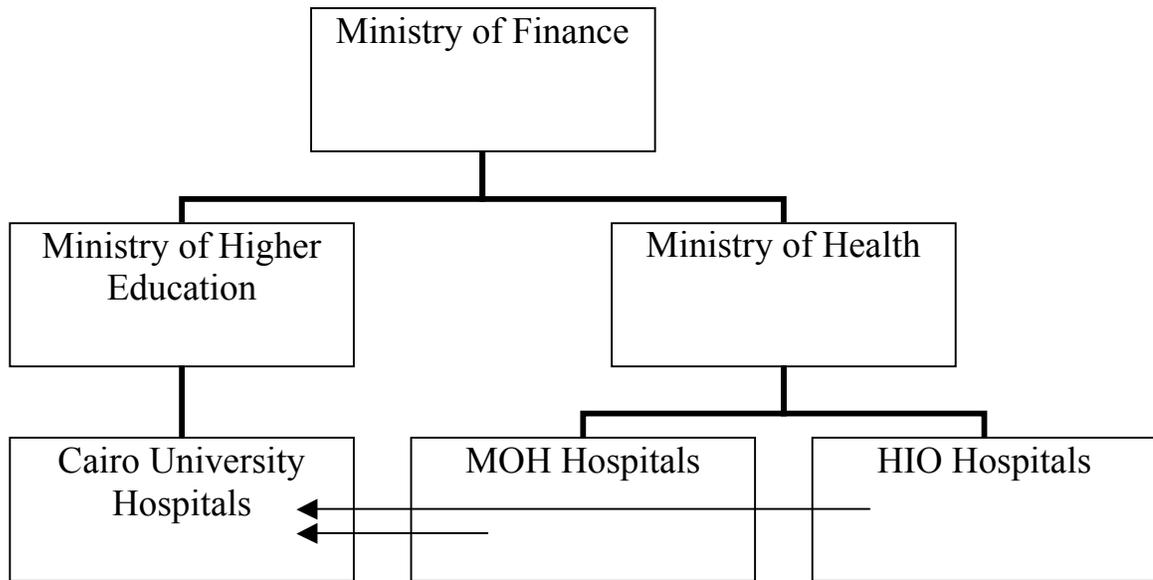


Figure 1. Management System of Cairo University Hospitals. Cairo University hospitals have no direct relationship to MOH or HIO hospitals; however, patients are referred by these hospitals to the CU Hospitals.

### B. Thesis Statement

Electronic health records can improve efficiency and effectiveness in Cairo University Hospitals regarding finance, governance, and administration. Figure 2 outlines the proposed benefits of implementing EHR in hospitals to improve the quality of care. This top-down diagram demonstrates the relationship between the improvement of quality care and applications of E-Health. The lowest level consists of four potential applications of E-Health; increased transparency and liability of staff, medical transcription, system of tracking professional development and progress, and documented accounting records. The second line, improved governance, is a result of these applications. The third line, improved administration, is a result of improved governance. By implementing E-Health, quality of care can be improved long-term.

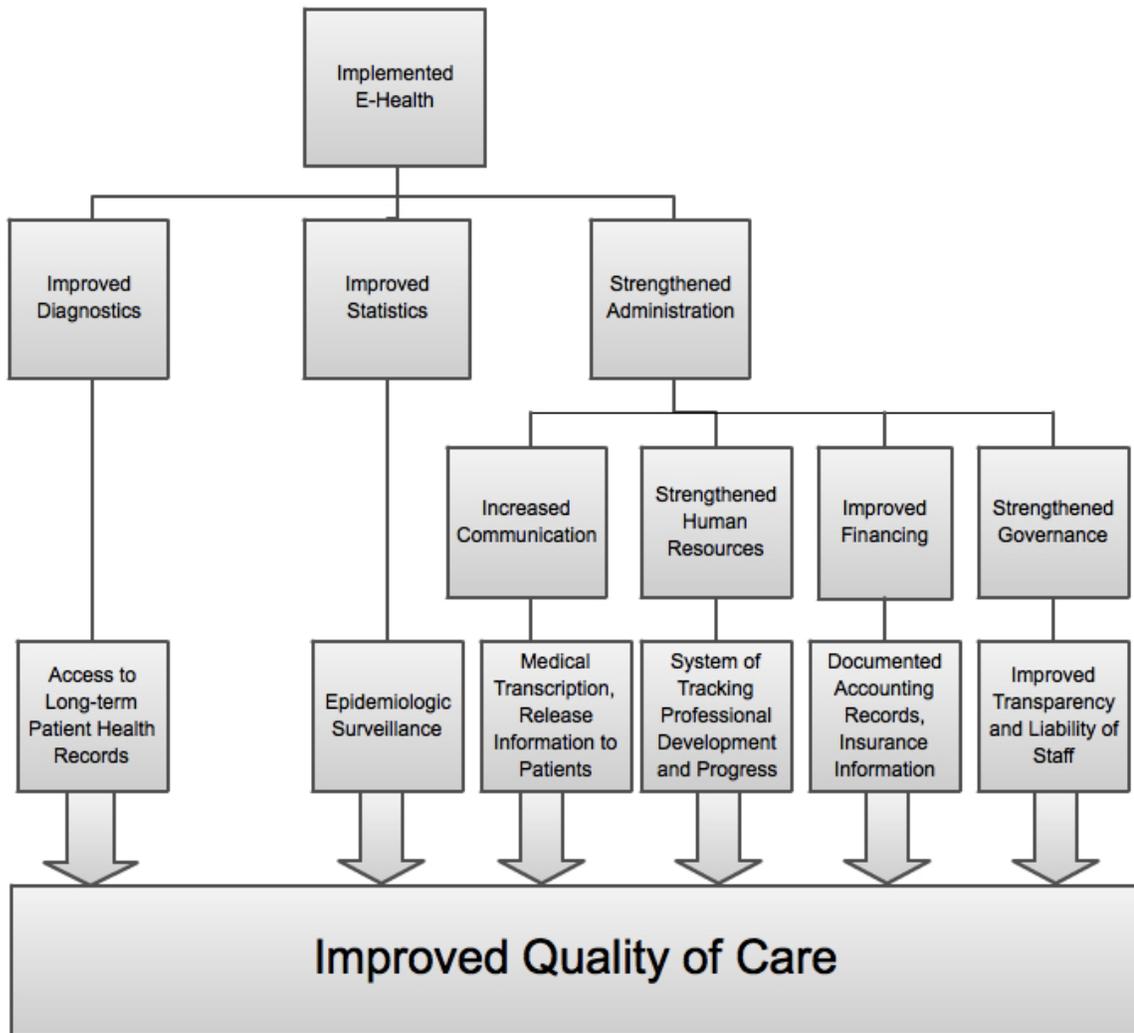


Figure 2. Effect of Implementing E-Health.

### C. Background

Egypt has just undergone a Revolution and removed the authoritarian regime under Mubarak. With a population of 80 million people, Egypt is classified as a middle-income country. Officials in power are being reassigned and decision-making is limited during its transition to Democracy. The Minister of Health has been changed twice since January 25 (Cairo University Hospital administrator, personal communication).

As previously stated, 4.75% of GDP is allocated towards health. In 2006, Egypt analyzed current problems within its health care system. The results showed that, regarding coverage, 60% of health care is paid out-of-pocket, with the public health

insurance, Health Insurance Organization, only reaching 20% of the public sector. The quality lacks in an accreditation process and quality indicators. Regarding skills, the weakest doctors are allocated to rural areas that are understaffed and 92% of nurses are only educated at the secondary level (Hatem Al Gabali).

The Health Insurance Organization (HIO) is the organization responsible for social health insurance coverage in Egypt. It is an independent government organization under the supervision of the Minister of Health, financing health care through payroll and taxes. HIO delivers health care through its own network of hospitals, clinics, pharmacies, and contracting private sector providers. Coverage is only available for half of the population, which is 80 million, which includes one-third of the active labor force. It covers government employees (Law 32<sup>1</sup>), government, public and private sector employees, widows and pensioners (Law 79<sup>2</sup>), school children (Law 99<sup>3</sup>), and newborn children. The unemployed, self-employed and informal sector workers, and out-of-school children are not covered by HIO. HIO does not cover services provided at the Cairo University Hospitals (Salah, 2007).

Health care providers in the government include the Ministry of Health, teaching and university hospitals, HIO and the Ministry of Interior and Defense. There are three main classifications of hospitals in Egypt: the Ministry of Health hospitals, private hospitals, and public university hospitals. Public University hospitals in Egypt have a reputation for treatment provided by credible doctors, but low quality of service delivery (Salah, 2007).

Cairo University hospitals are the oldest and greatest teaching and curative care hospitals in the Middle East, operating since 1837. Cairo University Hospitals have a good reputation among patients for having a high quality of doctor and technologically advanced equipment. It provides one of the biggest Burn Centers in Cairo. The hospitals hold the biggest capacity of patients, an estimated 2 million per year, and all specialists

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<sup>1</sup> Employees covered through Law 32 of the year 1975 include all employees working in the government sector.

<sup>2</sup> Employees covered through Law 79 of 1975 include some public and private sector employees, and pensioners and widows.

<sup>3</sup> School children and newborn children are covered under Law 99.

and services are free and available 24 hours a day, 7 days a week (Cairo University Hospitals, 2010). Specialties include: surgery, internal medicine, ophthalmology, dermatology, and venereology. The Cairo University website lists eleven branches and six hospitals that make up the Cairo University Hospitals, which include: Al Manial University Hospital, Gynecology and Diseases Hospital, Internal Medicine Diseases Hospital, New University Child Hospital, Out-Patient Clinic, and New Kasr Al-Aini Teaching Hospital.

- \_ Al Manial Hospital contains 1,794 beds and is administratively sub-divided into three administrative units. The Al Manial Al Bahari Hospital supervises general surgery departments, urinary passage departments, internal medicine, osteology, and includes accident reception and central radiology. The Al Manial Al Kibli Hospital supervises general surgery, a cardiac and chest departments, a cerebrum and neurology departments, cardiac and eye disease departments, nero disease departments, and a psychiatric department. In addition, it includes chest, internal medicine, gynecology, ENT, and psychiatric support. The third Al Manial unit includes 16 operation theatres for the two previous units.
- \_ The Gynecology Diseases and Delivery Hospital has 297 hospital beds and contains five departments for treatment of gynecological diseases and delivery. In addition, there it includes operation theatres and two departments for neonatal surgery and laboratories.
- \_ The Internal Medicine Diseases Hospital contains 306 beds treating internal diseases. In addition, it contains radiology laboratories and equipment to support treatment.
- \_ The New Child University Hospital is equipped with 185 beds, four operation theatre radiology devices and specialized laboratories. This hospital has an advanced ranking among pediatrics and child-related surgery.
- \_ The Out-Patient Clinic comprises of diagnostic and curative services to support a variety of branches of medicine. In addition is provides medication for its patients.
- \_ The New Kasr Al-Aini Teaching Hospital contains 1,200 hospital beds. Two of its floors are dedicated to paid services and contain the latest teaching medical

devices and equipment in the world. It consists of eight departments for general internal medicine, six departments for specialized services, five departments for eight general internal surgeries, an intensive care unit, a blood bank, endoscopes, central laboratories, a diagnostic rays department, and a surgical operations unit (Scientific Computation Center- Cairo University).

University hospitals play an important role in delivering tertiary care. The Ministry of Health refers patients to the university hospitals, which are administered under the Ministry of Higher Education. However, the Ministry of Health does not give financial support to the university hospitals. There are 53 university hospitals in Egypt; eleven of these are branches of Cairo University Faculty of Medicine. Despite its strengths for having the largest capacity and reputable doctors, weaknesses include; lack of funds, lack of technical staff/nurses, lack of maintenance, lack of integrated health information systems, lack of clear of career path for non-medical staff, and crowded and untidy environment flooded with visitors and patients in waiting area (Cairo University Hospitals, 2010).

The Ministry of Higher Education Hospitals depends on the Ministry of Finance, providing 72% of its funding. The remainder of funding for the Ministry of Higher Education Hospitals comes from revenues, 27.6%, and donors, which only provide 0.4%. The 2007/2008 National Health Account reported a net of 2.7 billion LE allocated to university hospitals. In the overall health spending for fiscal year 2007/2008, 35.5% was received by the Ministry of Finance, 1.7% from public firms, 2.2% from private firms, 60% from households and 0.6% from external sources. Government expenditure comprises one-third of total health spending, and there has been no increase in expenditure as income has increased over the years. The largest source of health care financing comes from out-of-pocket, accounting for 60% of the total health expenditure. Egypt has the highest out-of-pocket spending in the Eastern Mediterranean Region among all the middle-income countries. For families of lower-income levels, the Cairo University Hospitals are appealing because of the free service provided (NHA, 2007/2008).

Table 2. Use of MOH Funds in 2007/2008.

Use	HQ	Regions	Total	Percent
<b>MOH Hospital</b>	490,766,711	1,331,230,243	1,821,996,954	20.2
<b>HIO Hospitals</b>	2,5707,537	-	25,707,537	0.3
<b>University Hospitals</b>	225,355,326	-	225,355,326	2.5
<b>THIO Hospital</b>	94,444,079	-	94,444,079	1.0
<b>CCO Hospitals</b>	43080102	-	43080102	0.5
<b>MOD Hospitals</b>	20,000,000		20,000,000	0.2
<b>MOH Specialized Hospital</b>	459,603,802		459,603,802	5.1
<b>Private Hospital</b>	126,736,530		126,736,530	1.4
<b>Family Planning Center</b>	14,191,000	1,561,827,661	1,576,018,661	17.5
<b>Ambulance Service</b>	732,835,325		732,835,325	8.1
<b>Blood and Organ Bank</b>	5,525,000		5,525,000	0.1
<b>Pharmacies</b>	453,866,325	583,099,758		11.5
<b>Other Providers of Medical Good</b>	104,773,142		104,773,142	1.2
<b>Gov. Administration of Health</b>	1,099,741,691	287,128,092	1,386,869,783	15.4
<b>Rest of the World</b>	28,060,000		28060000	0.3
<b>Total</b>	4,689,615,245	4,312,036,013	9,001,651,258	100

Sources: World Health Organization (WHO) NHA data, Egypt NHA results.

## II. LITERATURE REVIEW

### A. Elements of E-Health

E-Health can be defined and classified in a number of ways. When referring to E-Health, the following terms have been used: Automated Health Records (AHR), Electronic Medical Record (EMR), Computer-based Patient Record (CPR), and Electronic Health Record (EHR). AHR includes a collection of scanned images on an optical disk. EMR include imaging or systems, such as patient identification details, medications and prescription generation, laboratory results and all healthcare information recorded by the patient during the visit. EMR is used in a medical practice or healthcare facility. CPR includes a collection of health information such as data on a patient's registration, admission, and financial details, and recording information from nurses, laboratory, radiology, and pharmacy. CPR was limited to inpatient facilities. Lastly, EHR is a longitudinal health record and includes all information contained in a health record such as a patient's health profile, behavioral and environmental information. This information includes data obtained from multiple episodes and providers, with the intention of being a lifetime medical record. The EHR contains all the personal health information belonging to an individual, is entered electronically by healthcare providers over the person's lifetime, and extends beyond inpatient care to ambulatory care settings (WHO, 2006).

Hospital management information system (HMIS) provides patient billing, patient scheduling and tracking, and electronic medical records that include personal history, diagnostic records, and clinical history. Electronic health records have many advantages in the health care field. It allows patient information to be shared from multiple locations, even worldwide. It prevents files from being moved from hospital to hospital and access can be obtained easily with access rights. The type-written records prevent misinterpretation of patient data. The presentation of patient information can be easily altered and customized. The patient record can assure completeness by preventing the record from being complete with missing data fields. Physicians have the ability to make decisions more accurately for clinical and medical care with a complete patient record. Lastly, EHR provides support for other data analysis such as medical research,

epidemiological surveillance, and disease trend analysis. Information technology can also allow x-rays, charts, and recordings, diagrams, and pathology reports to be documented and accessed easily (Al-Shorbaji, 2006).

## **B. Examples of Adopted EHR in Other Countries**

Electronic health records have been implemented in many developed and developing countries. Malaysia implemented EHR in 2004 in two hospitals. The hospitals are currently using HIMAS which includes Administrative Telephone Services (ATS), patient scheduling, and medical records tracking applications, pharmacy ordering, laboratory/reporting, radiological ordering and reporting, patient accounting and a small system on case-mix, which keeps record of the types of patients treated (WHO, 2006).

In Korea, 11 hospitals have implemented EMR and include all inpatient and outpatient information since 2004. Data is entered per patient case, signed consent forms for treatment are scanned after discharge and connected to the EMR in addition to any letters from referring practitioners and hospitals. Test reports are produced from equipment and scanned after discharge for the EMR. However, hospitals in Korea with the EMR system can only share data with one branch of the hospital, and hope to expand to all national hospitals and public healthcare facilities (WHO, 2006).

An EHR system is being developed in Indonesia, and currently several primary healthcare centers in Java are using Local Area network to determine how many TB patients are being treated as well as other diseases in the area. Australia has implemented nationwide electronic health records and healthcare information is documented at the point-of-care and can be retrieved online, with patient's consent, between authorized healthcare professionals. Other countries such as Singapore, Taiwan, Hong Kong and Thailand are developing electronic health records with successful implementation (WHO, 2006).

Several other developing countries have shown similar weaknesses and challenges for implementation.

- a. Ghana: Information infrastructure and data collection and management is a challenge for Ghana in implementing EHR. Communication and data

exchange are weak due to lack in provision of computers and weak workflow. There is slow communication of information, such as laboratory reports, among the departments. Lessons learned from Ghana are that the departments need to make collaborative efforts in order to speed workflow. In addition, training and education on technology usage should be a collaborative effort between the staff and the implemented system.

- b. Kenya: Power interruptions, poor computer skills of personnel, limited institutional framework and political commitment, work overload and poor motivation set back the implementation of EHR in Kenya. In addition, the system's sustainability suffered because of frequent power outages and trained personnel leaving the organization.
- c. Cameroon: Cameroon suffered from the same challenges that Kenya experienced. Lessons learned from Kenya and Cameroon is that human resources should increase sustainability by motivating the staff to continue EHR implementation despite the unexpected obstacles. Another improvement can be in the information infrastructure (Abdula, 2009).

Results taken from the National Ambulatory Medical Care Survey, conducted in the United States, showed that EHR reduces the amount of adverse drug events, bed days and dollars in inpatient care. In addition, the number of ambulatory drug adverse events could potentially be reduced by one-third to one-half with EHR. Disease prevention measures and chronic disease management will be improved with the use EHR. EHR can improve workflow by integrating screening exams with patient history in order to identify patients in need of specific services such as reminding patients to schedule visits such as breastfeeding or cervical cancer screening tests. Disease management can be improved by EHR by reminding patients of tests, increasing communication between the specialist and patient, and reduce complications and the need for acute care interventions by monitoring their condition (Hillestad e al., 2005).

According to President Obama's health policy document, Electronic Medical Records System will save 77 Billion USD per year, improve coordination of care, measure quality of care, and reduce the number of medical errors. In addition to finances,

EHR will save time. It will save time because patient demographics only need to be entered on the first visit. During the visit, it will save time by preventing duplication of care. The patient record will be available and the physician will know the previous case from the electronic record file. By avoiding duplication, resources will also be saved such as examinations and staff taking clinical history and repeating laboratory tests. In addition, a Clinical Decision Support system can be implemented as well as e-Library to benefit residents and physicians (Abdula, 2009).

### **C. E-Health Pilot Study in Egypt**

A Medical Records Assessment in Montazah, Alexandria, was performed in 2000 at five health centers and identified many problems with patients' records. This is problematic because administrative weaknesses negatively affect the operations and delivery of care. Absence of a comprehensive health care record file was one of the main concerns gathered from the assessment (Forte, 2000).

The Medical Records System assessment was conducted in Egypt in 2000 in health facilities in Montazah, Alexandria. The assessment team conducted on-site reviews of medical records, patient encounter and referral forms, the patient-based system, activity logs, monitor security, access, safety, and environment, and interviewed personnel. Findings included redundancy of patient care documentation and inadequacy of current patient forms such as family file folder used for physicians. In addition, patient time was spent on data entry by physicians, as well as inadequate history and physical examination forms on female, child, and emergency patients. The study concluded from its findings the need for improvement of the referral system and shortening of patient waiting time, in addition to expressed concern on lack of space for medical records (Forte, 2000).

### III. METHODOLOGY

#### A. Objective of Research

Electronic health records (EHR) form the core of an E-Health system. The success of creating and operating an EHR system determines the strength of the E-Health system. As shown in Figure 2, EHR improves the quality of care directly by improving diagnostics. With more accessibility to patient health records, physicians can diagnose patients more efficiently. The EHR readiness assessment reveals the success of adoption rate and acceptance of EHR in healthcare facilities. E-readiness is a tool that has been used as a response to the digital divide between developed and developing countries. By integrating Information Communication Technology (ICT), organizations and communities anticipate narrowing the digital divide in developing countries. These tools focus on developed countries, and do not address the lack of accessibility to ICT in developing countries (Li et al., 2008). These tools can be applied to developing countries by considering the lack of available ICT resources.

The type of research conducted was evaluation research. Evaluation research is done to explore the phases of planning, development, implementation, and operation in the Information Systems (IS) field. The objective of this study was to evaluate and analyze the challenges and weaknesses for implementation of E-Health in Cairo University Hospitals as means to enhance the quality of health care delivery in Egypt.

Five pre-implementation areas were analyzed, based on those used by Li (2008): relevance, problem areas, feasibility, completeness and consistency, and elements of risk. Relevance determines whether the solution is able to solve the problems and meet the demands of the organization. Problem areas include identifying the weakness and risks in formulating the solution. Feasibility assesses the gaps in organizational resources. Completeness and consistency assess whether there is coherence in the EHR system that will be implemented. Lastly, elements of risk assess whether there are an external threats to the project. E-readiness assessments are important to perform in developing countries' health sectors because E-Health programs in these countries often experience failure due to lack of readiness, including lack of required ICT support, lack of awareness among stakeholders, and lack of a drive to adopt new systems (Li et al., 2008).

## **B. Choice of Methodology**

Several different methodologies for assessing E-Health Readiness have been developed and tested over the past decade. Campbell et al. (2001) developed a readiness framework by conducting interviews followed by thematic analysis. The thematic analysis revealed six themes: turf, efficacy, practice context, apprehension, time to learn, and ownership. This readiness assessment was criticized since it did not involve organizational, public or patient readiness for E-Health. Also, this readiness assessment has not been tested.

Demiris et al. (2004) used two existing readiness scales: the Organizational Information Technology/Systems Innovation Readiness Scale (OITIRS) and the organizational and functioning readiness for change (ORC). The framework assesses staff exposure to technology and institutional resources. The problem with this framework is that it assesses practitioner readiness instead of organizational readiness, with an emphasis on staff competency using technology.

Jennett et al. (2003) conducted sixteen telephone interviews to four sets of stakeholders (patient, practitioner, organization and public). Social, political, organizational and infrastructure factors were examined. The findings showed four types of readiness: core readiness, engagement readiness, structural readiness, and concerns arising with regard to a lack of readiness to implement E-Health. Although Jennett et al. assessed both patient and practitioner readiness unlike the other assessments, reliability has not been assessed.

Wickramasinghe et al. (2005) assessed three domains of E-Health readiness: practitioner, organization and public. The key elements for successful E-Health implementation were analyzed and his framework outlines the pre-requisites and impacts for implementation of E-Health. Wickramasinghe et al.'s framework can be used to assess a country's potential for implementing E-Health.

Overhage et al. (2005) assessed system readiness evaluation by analyzing data from communities on funding better healthcare programs. Seven determinants were identified in creating successful health information exchange: clinical component,

demonstration of community commitment and leadership, matching funds, overall technical readiness, plans for sustainable business model, use of data standards, and use of replicable and scalable tools. However, Overhage et al.'s study was criticized of assessing funding allocation rather than e-readiness.

Khoja et al. (2007) developed two e-health readiness assessment tools in Pakistan for healthcare institutions in developing countries. The first tool was developed for managers and the other tool was developed for providers. Five categories were assessed using the tools: core readiness, technological readiness, learning readiness, societal readiness, and policy readiness. Core readiness addressed the overall planning process and emphasized the importance of a needs assessment, key aspects of planning, and the determinants of accessibility to technology, and integration of technology and pre-existing services. Technological readiness addressed the availability and affordability of ICT, and supporting hardware and software required for implementation. The third category, learning readiness, addressed training and capacity building for healthcare workers in technology. Societal readiness addressed the interaction of the institution with other healthcare institutions in the region. In addition, socio-cultural factors were addressed, including inequity in gender and social classes. The fifth category, policy readiness, addressed the existence of policies at the government and institutional levels to address licensing, liability, and reimbursement (Li et al., 2008).

Li et al. (2008) developed an E-Health Readiness Assessment Framework (EHRAF) by integrating components from each of the existing frameworks mentioned above followed by graph theory to assess the readiness. The EHRAF used four main readiness components: core readiness from Jennett et al., engagement readiness from Campbell et al., technological readiness from Demiris et al., and societal readiness from Khoja et al. However, a questionnaire and survey were not developed in order to perform the graph theory analysis, which would theoretically quantify e-readiness indicators to rank overall E-Health readiness as low, low-medium, medium, medium-high, or high. Also, it has not been used in any studies.

The California Community Clinic EHR Assessment and Readiness Starter Assessment (CCCEAR) was developed in 2005 to assess e-readiness in health clinics.

The CCCEAR is now used in over 100 clinics across the United States. Lessons learned from the assessment results were outlined by Tides and The California Endowment (2009). First, the readiness assessment in the clinics revealed the need for an incremental approach to implementation of EHRs. In addition education and information should be incorporated in the process through web-based communities. Thirdly, readiness assessments, technical expertise, and collaborative support should establish sufficient infrastructure to transition smoothly into E-Health. Lastly, the CCCEAR prepared clinics for data collection and reporting data to improve patient care delivery.

### **C. Methodology**

This study used the California Community Clinics EHR Assessment and Readiness survey. This survey was chosen because the questions assess many of the areas from each of the EHR frameworks discussed. In addition to assessing technology, the survey assessed the degree of teamwork, collaboration and readiness in the facility. The chosen framework contains two sections with subtopics consisting of the following indicators:

1. Section 1: Organizational Alignment for EHR
  - a. Culture
  - b. Leadership
  - c. Strategy
2. Section 2: Organization Capacity for EHR
  - a. Information Management
  - b. Clinical and Administrative Staff
  - c. Training
  - d. Workflow Process
  - e. Accountability
  - f. Finance and Budget
  - g. Patient Involvement
  - h. IT Management and Support
  - i. IT Infrastructure

The CCEAR defined each readiness area. Culture is defined as the environment and its conditions that enable the implementation to be successful. Organization is defined as the leadership and support for information flow, decision-making, and problem resolution. Leadership is defined as commitment to the objectives of the team and organization, to improve the quality of care. Strategy is the approach to prioritizing the vision and mission. Information Management is defined as the communication and disbursement of data, or information. Clinical and Administrative Staff is the staff's capacity and competency to be trained and work to achieve the goals and objectives of the organization. Training uses the available recourses to contribute to the on-going dedication of implementing EHR. Workflow Process is composed of the tools and methods for managing and developing policies, quality control, and monitoring performance. Accountability is the role and responsibility used to achieve results and goals. Finance and budget is defined as the capital and resources to operate and manage EHR. Patient Involvement is defined as the process of patient care including patient follow-up and continuing care. IT Management and Support consists of the organization's capacity to maintain IT Management and Support in compliance with the instilled policies. Lastly, IT Infrastructure is information systems and its environment.

Each indicator, or readiness area, is broken down into readiness components with questions associated to them. The questions are based on a scale of 0-5, 0 being not yet prepared and 5 being highly prepared. The scoring system consists of an absolute scale from 0-40 in Section 1, Organizational Alignment for HER, and from 0-100 for Section 2, Organizational Capacity for HER. In addition, there is an Overall Score from 0-140. The assessment includes a score report, which subdivides Section 1, Section 2, and the Overall Score section into 3 subdivisions. Next to each subdivision, there is a score report analysis which clearly defines the strengths and weaknesses in the future EHR system. This CCEAR was used by the expert at Cairo University Hospitals in the E-Health implementation (Appendix A).

#### **D. The Sample**

This study was done in Cairo University Hospitals, located in Giza. The population consists of patients and staff at the hospitals. The estimated staff is over three thousand (Cairo University Hospitals, 2010) and 2 million patients per year. The implementation of e-health will allow national expansion, as well as world-wide communication. The full implementation of e-health would allow unlimited access and sharing of health records and health information on Cairo University Hospitals.

The Cairo University Hospitals were chosen because they are the oldest and largest hospital in the Middle East, with the highest number of patients seen per year. Officials were interviewed from Ministry of State for Administrative Development (MSAD), Cairo University Hospitals, and the health care field in order to gather basic information on the administration laws in Egypt, as well as issues with e-readiness implementation in Egypt. These officials were chosen as a non-probability sample because experts in the health care and administrative fields were necessary to provide accurate information. The officials consisted of the following:

- \_ Three officials from Cairo University Hospital
- \_ Two officials from the Ministry of State for Administrative Development (MSAD)
- \_ The former Vice President of El Manial Hospital

#### **E. Proposed Framework**

A variety of methods can be used to assess e-readiness in health in addition to the e-readiness assessment methods discussed above. These include balanced scorecards, field studies, focus group interviews, and organizational readiness (Li et al., 2008). This study used a combination of field study, focus group interviews, and organizational readiness assessment. The methodology used consisted of qualitative and quantitative measures. Initially, a case study done by Cairo University Hospitals was analyzed and findings were used for this study. In addition, interviews were conducted with members of the health care sector in Cairo to acquire information regarding efficiency and effectiveness within the administration. Lastly, an expert in E-Health, who was referred

by the university hospital president, filled out an assessment for e-readiness of EHR in Cairo University Hospitals. The assessment was given to her at an interview, and filled out independently by the expert, to determine the suitability of the methodology to conditions in Egypt and to provide an initial assessment of EHR. Initially, it was intended to have two other experts also fill out the assessment; however, due to compliance and time constraints, only one assessment was collected by the interviewer two weeks after it was submitted.

Data analysis was done based on both quantitative and qualitative methods. First, the findings from the case study of Cairo University Hospitals are outlined. Next, the findings from interviews are discussed. Lastly information gathered from the assessment was scored and analyzed qualitatively, supplemented with information from the case study and interviews. The analysis covered each problem area used as an indicator to determine the strengths and weaknesses (Figure 3). Finally, recommendations were developed on how to improve the success of implementation and where the gaps and challenges are in the administrative system regarding medical health records.

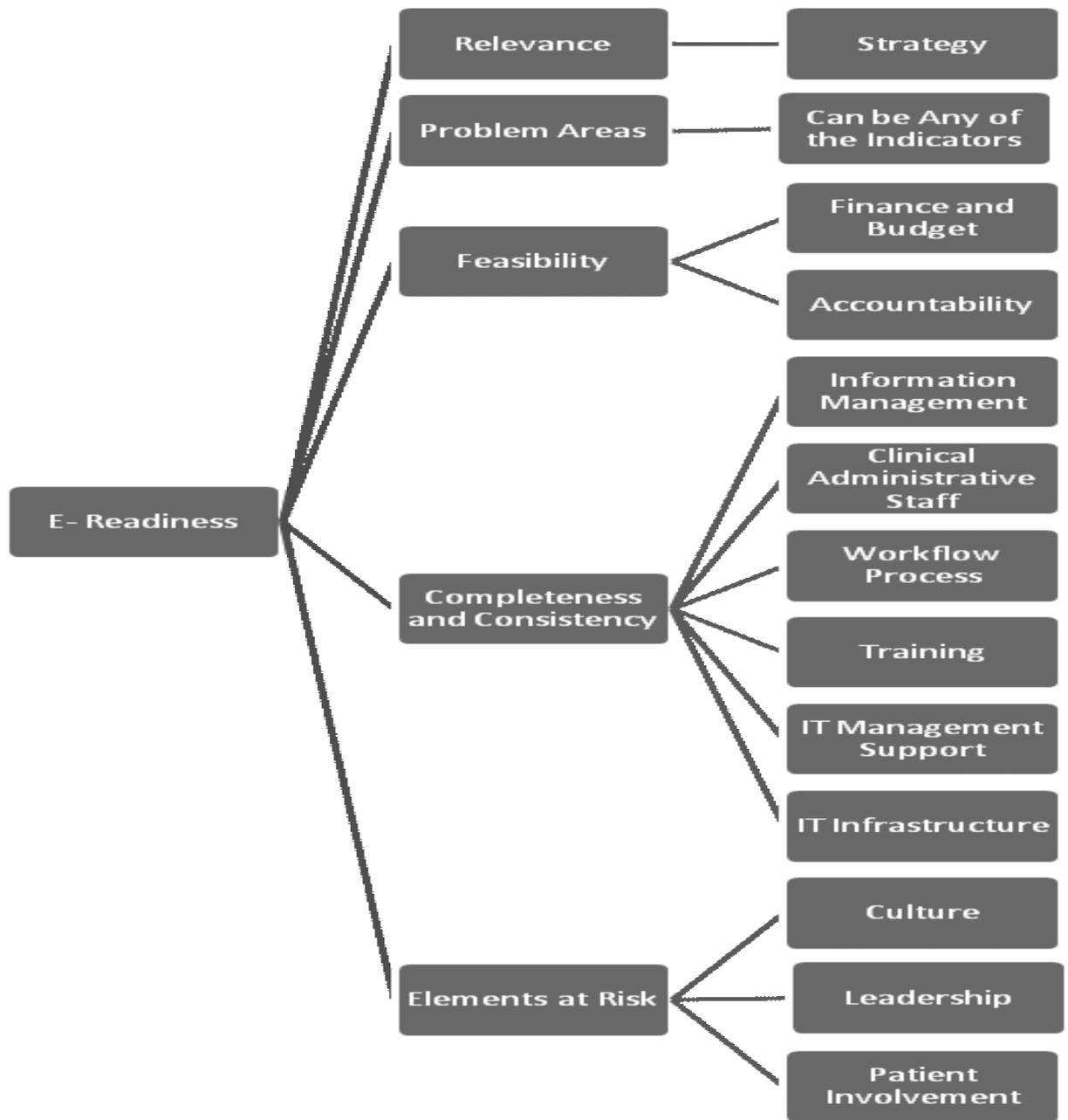


Figure 3: Indicators and areas to assess e-readiness in healthcare (HITECH, 2009).

## F. Data Collection Plan

### 1. Interviews

The interviews were conducted in order to gather information on the system in Cairo University Hospitals. The major problems and concerns were addressed in order to

determine where the weaknesses and challenges are in Cairo University Hospitals. The interviews at MSAD mainly discussed the policy and administration laws that pertain to Egypt. The interviews with the officials from Cairo University Hospitals discussed the weaknesses in Cairo University Hospitals and how implementation of E-Health improves the quality of care. Lastly, the interviews with the former president of El Manial Hospital was done to gather information on how hospital management and administration is organized, particularly in Cairo University Hospital. Each interview was conducted face-to-face in order to maximize the results and provide potential further information not proposed in this study.

## **2. Surveys**

First the objective of the research was clearly defined and stated. Next, an informed consent was distributed before the participant filled out the assessment. The assessment was administered to a Project Manager of the E-Health implementation at Cairo University Hospitals.

## **G. Data Analysis Plan**

The data collected from the interviews and assessment was analyzed using both qualitative and quantitative measures. Qualitative analysis was performed based on the case study and on the information gathered by the interviews with the officials. Quantitative data analysis was performed based on the results from the scores provided by the assessment. Descriptive statistics were presented based on the scores from the assessment. Each of the Readiness Areas (Culture, Leadership, Strategy, Information Management, Clinical and Administrative Staff, Training, Workflow Process, Accountability, Finance and Budget, Patient Involvement, IT Management, and IT Infrastructure) was analyzed individually. Since each readiness area differs in the number of readiness components, the average for each readiness area was calculated as percentages in order to standardize the results. The total scores were calculated as percentages, as well as the cumulative score in order to compare the different scores. The indicators defined where there are problem areas and feasibility issues, the degree of

relevance, completeness and consistency, and the elements at risk that affect the e-readiness.

Lastly, using findings from the case study analysis done by Cairo University Hospitals, this study showed how EHR can improve the key issues identified in the analysis. By connecting findings from the assessment and interviews, EHR can demonstrate the benefits of implementation in Cairo University Hospitals. The analysis on the case study, interviews, and assessment showed where the gaps can be filled by using Electronic Health Records

## **H. Limitations and Challenges**

Limitations of the study include lack of published information on Cairo University Hospitals, lack of experts to distribute the assessment, and the environment of the hospitals. Much of the information was gathered from the interviews conducted with officials. However, since this study was conducted on a public institution, interviewees may have been cautious in disclosing too much information, withholding some context about the institution.

Ethical issues were addressed in this study using an informed consent form, approved by the Institutional Review Board at the American University in Cairo. The assessment was completed by one person, the Project Manager for E-Health implementation. Lastly, working with government officials and officials in hospital environments made it challenging to schedule interviews and collect information; other anticipated participants were not able to fill out the assessment due to difficulty in accessing experts in E-Health. Doctors have busy schedules and especially during Egypt's period of transition, the administration is constantly working hard to keep the operation of the hospitals fully operational despite demonstrations and dynamic instability. Therefore, this study cannot be generalized. However, it was noted in an interview that hospitals in Egypt tend to follow models initially used by Cairo University Hospitals (Aly El Mofty, personal communication).

## IV. FINDINGS

### A. Interviews

Findings from the interviews were consolidated into three main topics: human resources, communication and governance, and finance and budget problems. Each section summarizes main concerns regarding administration in Cairo University Hospitals.

- 1. Human Resources:** Many problems can be resolved by the front office. Poor adaptation by employees can make E-Health system fail (senior official at MSAD, personal communication). This statement is supported by the results displayed in the assessment showing that the organizational alignment and capacity are weak and need changes before implementation of EHR can be successful. Both officials from MSAD interviewed emphasized that Cairo University Hospitals lack authority with doctors. Since many of the doctors are managers in the hospitals, it is difficult to utilize authority with co-workers, especially doctors, because of conflicting interests. The role of Human Resources is also critical in EHR implementation by maintaining staff education and training and emphasizing the importance of the role of advancement in technology in improving the quality of health care.
- 2. Communication and Governance:** One of the interviewees stressed that without EHR, anything related to improve the quality of care will fail. Without an implemented E-Health system, there is no communication, no governance, no professional development, no epidemiological surveillance, and no E-Medicine. E-Health allows the ability for medical staff to communicate, both internally and externally.

Governance is another problem in Cairo University Hospitals because there is no system to keep track of when the patient was seen. With E-Health there will be more monitoring involved with patient-staff interaction. Professional development and tracking progress based on correct diagnosis and clinical indicators is a key component missing in Cairo University Hospitals. With E-Health, professional development can positively or

negatively reinforce staff to yield better results. E-Health can be used to track epidemiological surveillance in Egypt. Different epidemiological trends occur in different environments and with E-Health, Egypt can be more aware of its threats to health. Lastly, with the implementation of E-Health, E-Medicine can be used as a tool to improve the quality of care and knowledge of staff (Cairo University Hospital administrator, personal communication).

- 3. Finance and Budget Problems:** Cairo University hospitals treat approximately 2 million patients per year and the cost per patient is 80 EGP (13.56 USD). Results from the interviews showed that Cairo University Hospitals are not getting adequate funding (Table 3).

Table 3. Summary of Hospital Statistics for Cairo University Hospitals gathered during interviews (Cairo University Hospital administrator, personal communication).

Hospitals	9
Capacity	5000 beds
Faculty	3000 doctors
Employees	13,000
Patients	2 million
Expenditure	160 million EGP/year
Cost per patient	80LE/patient

EHR is a new and innovative technique and must be implemented with the necessary support of administration, medical and nursing staff, and clerical personnel. Cairo University Hospitals plan to implement an electronic centralized medical record system through a public-private partnership based on payment per transaction to the vendor. The vendor will purchase the service, not the license, and outsource to reduce the cost of implementation and adoption of EHR (Cairo University Hospital administrator, personal communication).

**a. Cairo University Hospitals Debt**

According to Egypt's National Health Account (2007/2008), the Ministry of Finance funds 72% of the university hospitals under the Ministry of Higher

Education (Figure 4). Cairo University Hospitals are in this category. The Ministry of Finance funds 93% of Cairo University Hospitals (Figure 5).

The annual budget for the Cairo University Hospitals was reported during an interview to be 160million EGP for 2011-2012. Compared to the past three fiscal years, the budget from the Ministry of Finance to the Ministry of Higher Education is decreasing (Table 4). This fiscal year, 2010-2011, no funding was given for equipment (Cairo University Hospital administrator, personal communication) and in 2009-2010 half the budget, 172,756,299.59 EGP, from MOF was allocated towards supplies and services. Also, for 2009-2010, the broken down budget reported 2,031,857 EGP. However, a different page of the analysis reported total donations in 2009-2010 to be 37.5 million EGP. This shows there may be some discrepancy in the reported data (Cairo, 2010).

In addition to the decrease in the annual budget of Cairo University Hospitals, HIO and the Program of Treatment at the Expense of State are in arrears in their payments to Cairo University Hospitals (Figure 6). Approximately 50% of health care is paid out-of-pocket, 30% is state-sponsored by PTES, and 20% is paid by HIO or Private Health Insurances (Cairo University Hospital administrator, personal communication). With an EHR system implemented, the number of patients with the Health Insurance Organization (HIO) and PTES who are seen at Cairo University Hospitals can accurately be recorded and followed up for billing purposes.

Table 4. Sources of Budget for Cairo University Hospitals in the Past Four Fiscal Years.

	2007/2008	2008/2009	2009/2010	2010/2011
<b>MOF</b>	273,275,797	368,806,615	350,017,500	160,000,000
<b>Self Fund</b>	19,739,511	10,639,930	11,373,018	
<b>Total Donations</b>		1,344,074	37,500,000	
<b>Private Section</b>		101,165,501	132,966,877	
<b>Total</b>	293,015,308	481,956,121	531,857,400	160,000,000

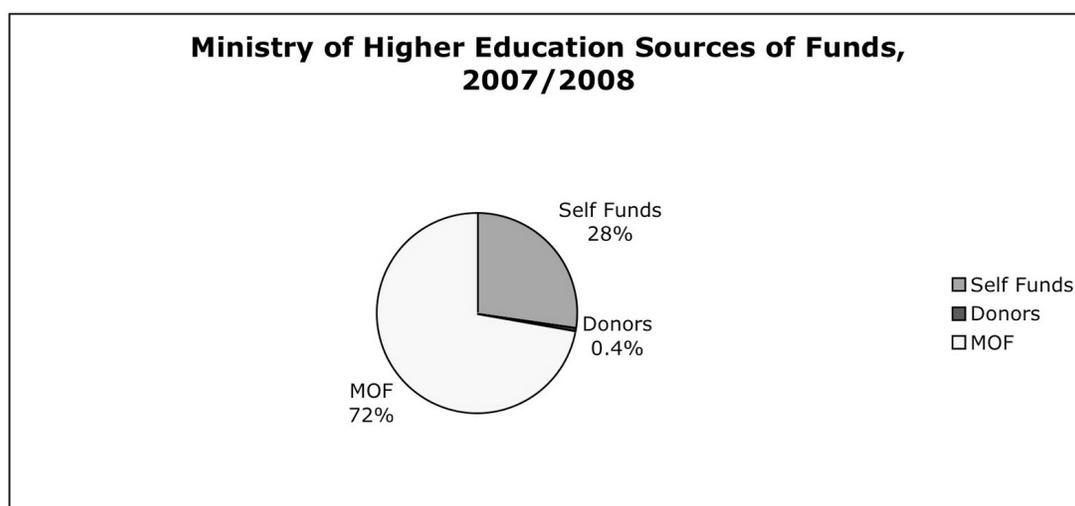


Figure 4. Ministry of Higher Education Sources of Funds.

Sources: World Health Organization (WHO) NHA data, Egypt NHA results.

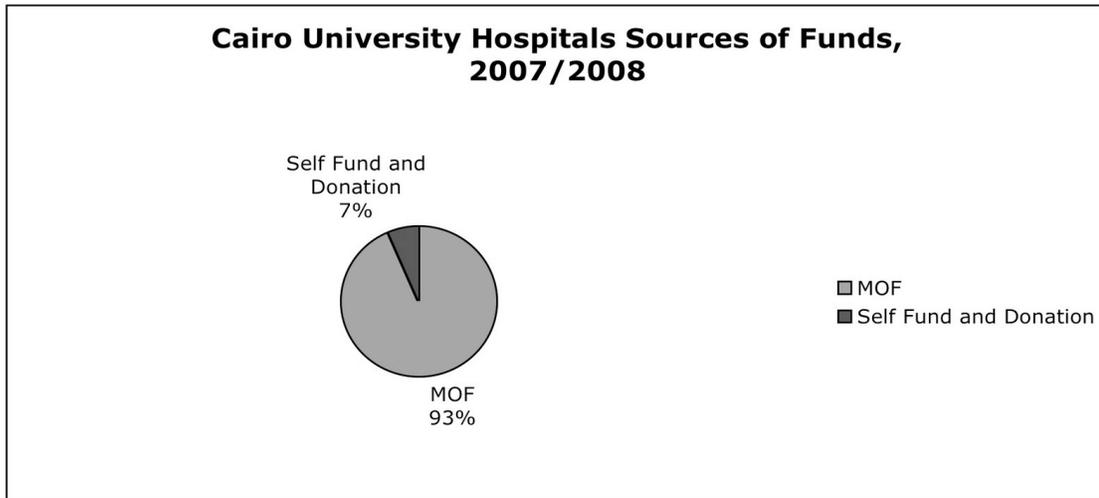


Figure 5. Cairo University Hospitals Sources of Funds, 2007/2008.

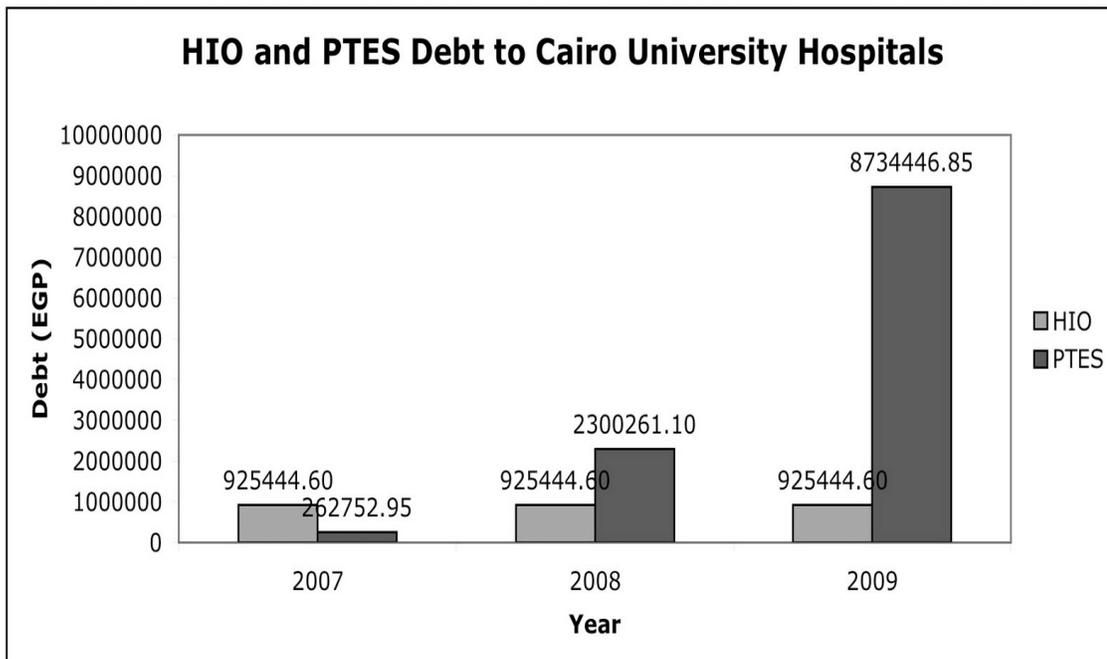


Figure 6. Debt owed to Cairo University Hospitals from HIO and Program of Treatment at the Expense of State (PTES).

### B. Assessment

This pilot study was done to test the EHR methodology in Egypt and to provide a preliminary determination of the e-readiness for E-Health implementation at Cairo University Hospitals. Based on the cumulative score, the overall result of the assessment indicates that, Cairo University Hospitals are not fully prepared for EHR implementation.

The weaknesses in human resources, governance and finance were evident from the case study and interviews. The administration has awareness of the gaps and obstacles it needs to overcome to improve the quality of healthcare delivery. However, the assessment should be used to take the need to fill these gaps more seriously in order to establish clear priorities for improving the system prior to implementing E-Health. Although the interviews showed managerial will, a more comprehensive plan for management is suggested in order to educate the departments on EHR and build their capacity (Figure 9).

The total score for organizational alignment was in a higher score range than that for the total score of organizational capacity. Regarding organizational alignment, Cairo University Hospitals understand the value of EHR, but more clarity is needed on its object goals and its impact on patient care. Regarding organizational capacity, Cairo University Hospitals have a weak capacity in areas that are vital for EHR adoption. The assessment recommends a plan of action outlined with weaknesses and capacity building objectives (Table 5). Regarding the readiness areas, culture was the weakest area in the organizational alignment section (Figure 7) and IT Management was the weakest area in the organizational capacity section (Figure 8).

Table 5. Summary of Score Report According to the California Community Clinics EHR Assessment and Readiness Starter Assessment.

<b>Categories</b>	<b>Absolute Score</b>	<b>Score Report</b>
<b>Organizational Alignment Total</b>	17	Score = 16 - 30: A score in this range may indicate that there is an understanding of the value of EHR, but that detailed exploration of how EHR enables the clinic's ability to achieve its strategic goals and what impact it will have on clinic operations and patient management may be less clear. Consider additional management and cross-departmental planning discussions about the areas of weakness, using this tool and/or the Readiness Assessment as a guide to understanding where differences in opinions or lack of detailed understanding may be.
<b>Organizational Capacity Total</b>	30	Score = 0 - 33: A score in this range may indicate that there is weak capacity in several areas that are critical to EHR adoption success. Identify the exact categories of weakness and consider a more comprehensive analysis of requirements for EHR adoption and develop a plan to improve capacity in those areas before moving forward with other EHR adoption activities
<b>Cumulative Score</b>	47	Score = 0 - 48: A score in this range may indicate that your clinic is not currently prepared to move forward with EHR adoption. Consider developing a more comprehensive plan to facilitate management and cross departmental education and planning processes to determine why your clinic is interested in EHR adoption and how to build the capacity to ensure successful adoption and use.

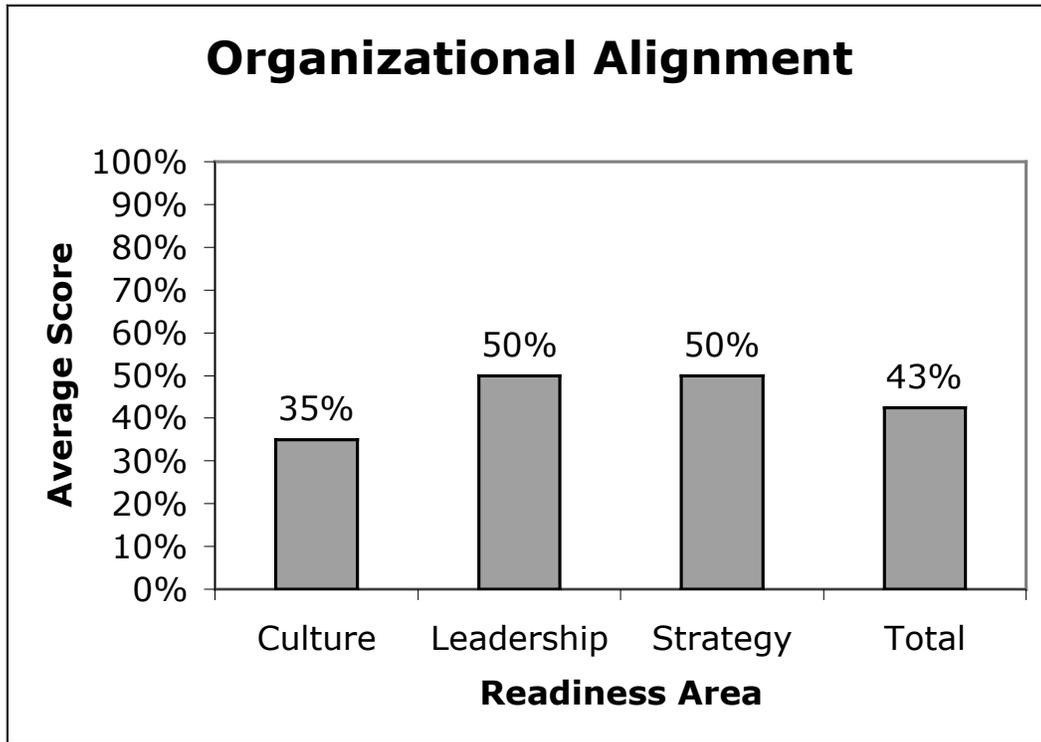


Figure 7. Average score for each readiness out of total possible points in the Organizational Alignment section. The total is an average of all the readiness areas combined.

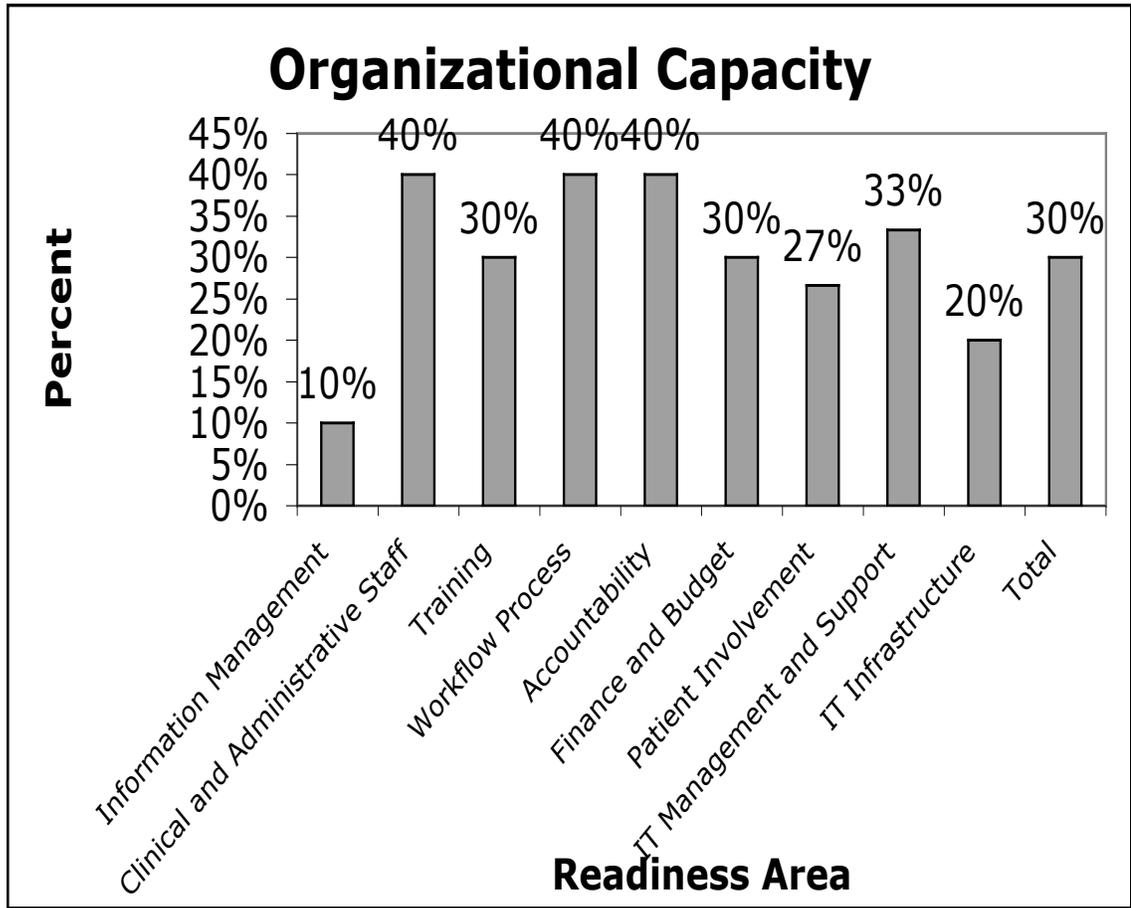


Figure 8. Average scores for each readiness out of total possible points in the Organizational Alignment section. The total is an average of all the readiness areas combined.

## V. DISCUSSION

### A. Case Study: Cairo University Hospitals Analysis

In an analysis conducted by the Cairo University Hospitals, the main key issues were identified; governance, financing, and quality and operational performance. Regarding governance, there are duplications of specialties in three of the hospitals for Cardiology. These hospitals have no internal referrals or coordination. In addition, the Board spends little time on strategy. Training programs are limited to develop staff education. There is no coordination of support services among the hospitals and departments. Faculty attendance is low, where 75% of the staff is not present on an average day. Lastly, there is little coordination with the rest of the health system in Cairo. There was a reported incident that patients arrived to the ER by MOH ambulances and waited for ICU beds to be free, and after much effort were transferred to another hospital (Cairo University Hospitals, 2010).

Regarding financing, the hospitals submit a budget to the Ministry of Finance, and the resulting budget is based on this initial request, historical budget of the hospital, and negotiation. There is lack of transparency in finances and weak finance management. Financial data is stored on paper and retrieving financial statements takes many days. Also, donations in kind are barely documented (Cairo University Hospitals, 2010).

Operational performance includes clinical care, training and education, and research. Regarding clinical care, there is no proper documentation in all departments. Documentation is completed by memory and provided on demand when residents are forced to complete them. Patient files are not organized and retrieval is difficult. Patient records are missing information such as medical history. Treatment, examinations and diagnoses occur without any patient files and documentation. Blood analyses are conducted on paper and are labor-intensive and inefficient. The departments each have its own information systems and lack coordination. Regarding training and education, dissatisfaction by students is difficult to monitor and attendance rate affects the teaching for students. Lastly, regarding research, publications are limited, 0.08 per staff member in Cairo University Hospitals. There is no system to monitor duplication in research (Cairo University Hospitals, 2010).

Many of the key issues presented in the Cairo University Hospitals Analysis can be resolved through EMR. These key issues include coordination and communication, coordination of support services, poor staff attendance, and coordination with the rest of the health system in Egypt. Coordination and communication between the hospitals with duplicative specialties can be resolved with an electronic system. Improving coordination of support services can be done with an electronic system and prevent duplication of activities and identify savings from supplies. Attendance can be monitored with EHR and keep track of how many hours the staff inputs. Lastly, the coordination with the rest of the health system in Egypt will be improved with EHR since a referral of patients can be done with the electronic system showing how many beds are free in each branch and where to refer patients from MOH to the Cairo University Hospitals. Implementing E-Health can overcome these inefficiencies. In order to gain the benefits of EHR, however, the difficulties of implementation need to be addressed first. This can be done by using a strategic plan for implementation and reinforcing the benefits in capacity building (Figure 9).

Regarding financing, the assessment showed that the finance and budget for implementation are a weakness. More money needs to be invested in the adoption of EHR and long-term can potentially save money by reducing the number of adverse events and preventing duplication of medical tests. The savings on care will contribute to the ability to support operations with self-generated funds and reduce pressure on the hospital budget. In addition, an electronic system will increase the transparency about the finances. Currently the financial statements are kept on paper and it takes days to retrieve financial data.

Potential gains from EHR implementation include benefits for quality and operational performance. First, medical records would be electronic and easy to retrieve for diagnosis and treatment. Documentation can be monitored to make sure all patient information is complete, depending on the type of EHR system. Coordination between the departments would be improved with a system for all the hospitals to be on the same network. Regarding training and education, students can give feedback electronically using surveys and attendance of staff will be monitored with an electronic system.

Regarding research, an EHR can lead to E-Library implementation where research can be electronically submitted and stored to monitor research done by faculty and students.

## **B. Interviews**

The interviews conducted confirmed many of the findings of key issues in the Cairo University Hospital Analysis. Governance and communication are important in health care. The areas in finance and human resources were also emphasized during the interviews, with both Cairo University Officials and the officials from MSAD. Also, much of the reported answers from the survey were in compliance with what was said at the interviews about the weaknesses in the system.

## **C. Assessment**

As shown in the findings, each readiness area exhibited weakness. The recommendations provided by the CCEAR should be used in order to strengthen successful adoption and implementation of EHR. . Although strategy scored higher than most of the other readiness areas, it still only scored 50% (Figure 6). These areas of Organizational Alignment and Organizational Capacity are emphasized by the weaknesses stated in the interviews. In order to enhance successful implementation, the assessment should be used to outline these key areas to the staff and reinforce the need to formulate an implementation plan.

## VI. CONCLUSION

Cairo University Hospitals exhibits weaknesses in the key areas; governance, financing, and quality and operational performance. Implementing EHR will contribute to the improvement in each of these areas. The interviews outlined weaknesses in the key areas; human resources, communication and governance, and finance and budget. The e-readiness assessment provided the weaknesses in the readiness areas of organizational alignment and organizational capacity in Cairo University Hospitals. Each readiness area needs to be strengthened. The assessment used in this study can be used to formulate an implementation plan for E-Health. Recommendations based on the case study results and interviews can be applied to the following readiness areas taken from the assessment in Appendix A (HITECH, 2006):

1. **Culture:** Form a Medical Records Committee and Medical Records Department to exhibit commitment to the implementation and decision-making process. Set top priority areas that the institution will use EHR to address, such as those outlined in Figure 2.
2. **Leadership:** Do not fully rely on the vendor. Show how benefits outweigh the costs long-term (i.e. preventing adverse events and duplication of diagnostic testing). Set weekly meeting for the Medical Records Committee to work on quality improvement.
3. **Strategy:** Establish a Strategic Plan with a defined length, such as one year, that guides EHR procurement in the form of a Request for Proposal (RFP) including program specifications that CU Hospitals want to include in their system. Include measurable objectives in the Strategic Plan and set a timeline to meet those objectives.
4. **Information Management:** Decide which system modules will be used in the EHR software (i.e. patient demographics, patient scheduling, insurance information, referrals). Establish standard reports for management, population health and quality improvement.
5. **Clinical and Administrative Staff:** Educate Human Resources on vendor contracting and that the conditions in the RFP are fully understood by HR. This is

critical for HR to authorize decision-making and assure that the vendor will meet the conditions. Include staffing needs in planning and decision-making. Educate staff about EHR functionality and workflow and authorize them in decision-making.

- 6. Training:** Establish a formal training plan for EHR implementation, workflow, and skill-set gaps for management. Include physicians and clinical staff. Establish training programs for project managers and IT staff to ensure they meet the required skills for implementation.
- 7. Workflow:** Document EHR processes in a process map and set evaluation requirements for the software. Formulate policies, procedure and protocols for EHR (i.e. access rights, medical record correction, system downtime, data storage requirements).
- 8. Accountability:** Clearly establish roles and responsibilities for the EHR vendor.
- 9. Finance and Budget:** Recognize EHR technology as a long-term investment, and include non-quantifiable returns.
- 10. Patient Involvement:** Set patient input requirements in the Practice Management System. Establish a plan for communication between patients and external organizations, and include patient release information. Design referral process.
- 11. IT Management and Support:** Form an IT Management Team with experience in system integration. Educate staff in EHR infrastructure and create a Staff Plan for implementation.
- 12. IT Infrastructure:** Perform a needs assessment for hardware, desktop terminals and other devices necessary to support EHR implementation.

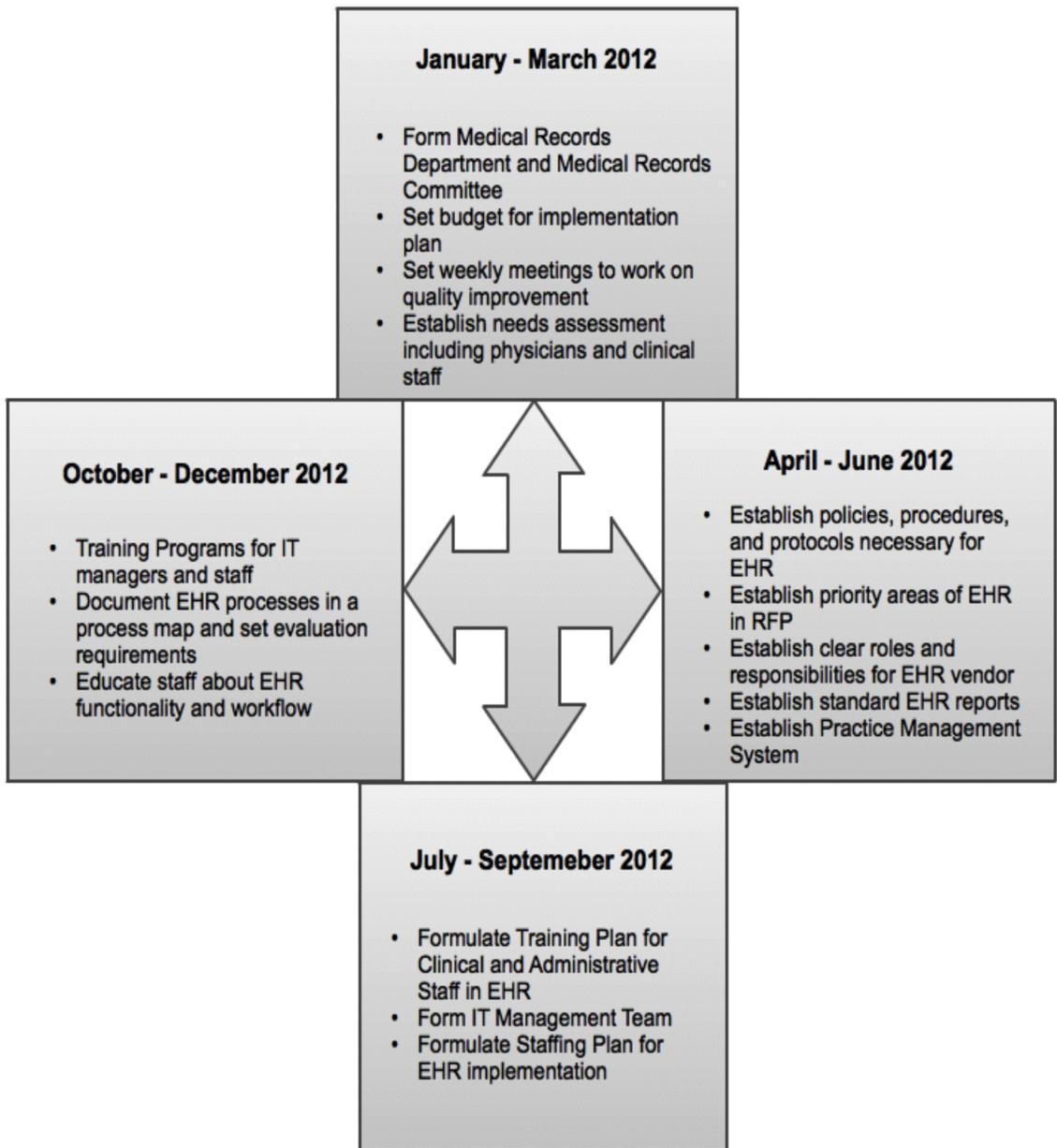


Figure 9. Recommendation for timeline of EHR implementation plan.

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## APPENDIX A: Assessment Tool

This study used the California Community Clinics EHR Assessment and Readiness survey (HITECH, 2009).

### Section 1 – Organizational Alignment for EHR

Readiness Area	Readiness Component	Not Yet Prepared 0 -1	Moderately Prepared 2 -3			Highly Prepared 4- 5	Score
<b>Culture</b>	EHR is viewed...	as an IT project to “go paperless” only.		as a clinical technology to achieve workflow efficiencies.	primarily as a technology to enable quality care improvement goals.		
	The EHR-related planning process includes...	top management and/or designated investigator only.		key planners or departments and is participatory.	all departments and is team-oriented.		
	Physician involvement in the EHR process...	limited to a physician advocate to represent clinical interests.		primarily occurs for key decisions; clinical interested are valued.	is active in both planning and decision-making; clinical and managerial interests are aligned.		
	Framework for outlining top EHR priorities has...	not been thoroughly discussed.		been discussed but not documented prior to initiating vendor evaluation.	been documented before initiating vendor evaluation and is being used to facilitate the decision-making process.		
	<b>Leadership</b>	Leadership...	believes EHRs are necessary, but is divided as to how to communicate why and when to pursue.		has studied the pros and cons of implementing an EHR and can make an argument for why benefits outweigh costs.	understands the benefits of the EHR and sets a clear and consistent vision for how EHR supports efficiency and quality improvement goals.	
	The Executive team...	relies on vendor to provide EHR planning guidance.		delegates EHR planning to managers or a specific team.	devotes substantial time to planning for quality improvement with EHR technology.		
<b>Strategy</b>	IT strategic planning has...	not considered part of the strategic planning process		been carved out as a separate part of the organizational	been an integral part of the organizational strategic		

		or Strategic Plan, but operational and addressed through special projects.		strategic planning process and resulted in an IT Strategic Plan.	planning process, resulting in a 3-year Strategic Plan that guides EHR procurement.		
	Quality and efficiency are...	discussed, but not clear objectives of the organization nor connected with EHR technology.		objectives, but not clearly defined in a measurable way nor connected with EHR technology.	documented as key objectives in the Strategic Plan with measurable objectives and corresponding time horizon and are clearly connected with EHR technology.		
<b>TOTAL Organizational Alignment Score</b>							

## Section 2 – Organizational Capacity for EHR

Readiness Area	Readiness Component	Not Yet Prepared 0 -1	Moderately Prepared 2-3	Highly Prepared 4- 5	Score
<b>Information Management</b>	The Practice Management system...	has not been optimized or utilized for patient management.	has been mostly utilized, including a number of features that facilitate patient management.	has been optimized and modules that support patient management fully utilized.	
	Standard EHR-generated reports for management, population health and quality improvement...	have not been defined or documented.	have been partially defined but have not been documented.	have been defined, documented and requirements included in the product evaluation process.	
<b>Clinical and Administrative Staff</b>	Staff and other human resource(s) dedicated to EHR vendor contracting...	are involved in specific aspects the EHR decision-making process but does not have vendor selection or negotiation experience; publicly available RFP is used “out of the box” for system selection.	has a general understanding of the trade-offs between products but may not have vendor selection or negotiation experience; publicly available RFP has been used as a guideline to determine high priority requirements.	are experienced in IT vendor contracting, driving analyses of products’ ability to meet clinic’s needs and capabilities and determine optimal contract approach and terms; clinic’s requirements have been documented in a detailed RFP that will become an addendum to the contract.	
	Staffing needs for EHR implementation and use...	have not been analyzed.	are generally understood, but a staffing plan has not been developed.	have been documented in a staffing model, detailing current staffing and proposed needs; requirements have been included in the planning process.	
	Staff dedicated to project management, change management and quality improvement for EHR...	have not been specifically identified.	have a basic understanding of EHR functionality and are participating in the EHR decision-making process.	are experienced, have been educated about EHR functionality and workflow impacts and are authorized to lead the decision-making process.	
<b>Training</b>	A formal training plan...	is not part of the planning process; clinical and administrative staff will receive training from the vendor and on-the-job.	including EHR implementation and skill-set gaps for necessary physicians and key staff is part of the planning process.	including EHR implementation, workflow redesign and skill-set gaps for management, physicians and staff is part of the planning process.	
	Training	have not been included as	will be identified as	have been identified	

	programs for project managers and IT staff involved in EHR adoption...	part of the EHR initiative.	necessary by management.	to ensure these staff possess appropriate skill sets.	
<b>Workflow Process</b>	Current and proposed EHR-enabled administrative and clinical processes, including estimated patient volumes and staffing are...	not developed.	generally understood and incorporated into product evaluation, but workflow redesign and change management approaches are not documented.	documented in a process map and requirements are included in product evaluation process; planning process is in place for workflow redesign and change management approaches.	
	Policies, procedures and protocols necessary for EHR-enabled processes...	have been considered but not analyzed.	have been analyzed and a plan for development in place.	have been analyzed and developed including information access rights, medical record correction, system downtime, data storage requirements and record printing.	
<b>Accountability</b>	Roles and responsibilities for analyzing product options, contract terms and negotiating with the EHR vendor...	have not been established or assigned or may exist in a functioning group (i.e. Management Team).	have been developed; requirements are generally understood and prioritized accordingly.	have been assigned and are clear; requirements and expectations have been captured and vendor response documented.	
<b>Finance and Budget</b>	EHR technology is considered...	more of an expense than an investment requiring a return-on-investment based on traditional IT or office automation models.	an investment requiring less than 2-year timeframe for return-on-investment.	an investment rather than an expense; business case is analyzed over a longer time horizon and incorporates non-quantifiable returns.	
	EHR acquisition and on-going maintenance	funds have not been identified.	will be funded with one-time discretionary funds.	will be funded with capital earmarked for such.	
<b>Patient Involvement</b>	Patient interaction with EHR has been...	has not been evaluated.	considered, but no requirements have been documented.	determined with patient input and requirements have been included in the planning process.	
	Policies and procedures for patient corrections or amendments to electronic medical records and release of patient	have not been evaluated.	have been discussed but not documented; a plan is in place to develop policies and procedures.	have been analyzed and requirements included in the planning process; a plan is in place to develop communications for patients and external	

	information...			organizations.	
	EHR-enabled referral processes, e-prescribing and other patient-specific hand-offs...	have not been evaluated.	have been discussed but no specific plan exists.	have been designed and requirements included in the planning process.	
<b>IT Management and Support</b>	IT Management has...	limited experience with system integration or data conversion, and relies heavily on external resources for IT planning and decision-making.	experience with system integration or data conversion but tends to rely on the vendor to detail the tasks and activities.	strong experience with system integration, data conversion and managing expert resources to fill internal skill or knowledge gaps.	
	IT staffing for EHR implementation, maintenance, infrastructure and users...	has not been analyzed.	is generally understood but is not documented in the planning process.	has been documented in a Staffing Plan and requirements have been included in the planning process.	
	IT staff...	are determining IT infrastructure requirements without involvement in process.	are involved in decision-making process to determine IT infrastructure requirements.	have been educated about EHR objectives in order to actively engage in the EHR decision-making process and determine necessary IT infrastructure requirements.	
<b>IT Infrastructure</b>	A needs assessment of hardware, desktop terminals and other devices necessary to support EHR use...	is generally understood but has not been evaluated.	has been performed but not documented in the planning process.	has been performed and requirements included in the planning process.	
	A plan for a technical infrastructure using a high-availability platform, upgraded to be standardized, scalable, and easily maintained....	is not in place; infrastructure will be upgraded according to projected needs as standards-compliant as possible as new systems are purchased.	is being developed and will be standards-compliant with HL7 being considered.	is in place and will be standards-compliant with HIPAA, HL7 and other clinical and administrative transaction standards.	
<b>TOTAL Organizational Capacity Score</b>					
<b>TOTAL Overall Score</b>					

## Score Interpretation

The Starter Assessment is one of the first steps in the evolutionary learning process of EHR adoption. Thus, it should be used as a tool to educate this process along with continual clinic exploration and use of more in-depth tools like the Readiness Assessment. Score interpretation is designed to help you understand how to move forward in the process by learning from expertise embedded in these tools as well as learning what is important from your clinic. Although strong technology and industry research are very important, successful EHR adoption will require teamwork, collaboration and readiness.

Below are ranges of scores for each section and the overall score with some general interpretation and advice.

### 1. • *Organizational Alignment for EHR Adoption:*

1. **O Score = 31 - 45:** A score in this range may indicate that leadership understands and communicates the value of EHR adoption clearly throughout both the documented planning process and the clinic environment. There is likely an environment for achieving success that comprises team work, flexibility and mechanisms to manage communication and collaboration. Organizational alignment is strong and, pending the Organizational Capacity score, consider further assessment with the Readiness Assessment tool that can be found in the library on the Community Clinic website.
2. **O Score = 16 - 30:** A score in this range may indicate that there is an understanding of the value of EHR, but that detailed exploration of how EHR enables the clinic's ability to achieve its strategic goals and what impact it will have on clinic operations and patient management may be less clear. Consider additional management and cross-departmental planning discussions about the areas of weakness, using this tool and/or the Readiness Assessment as a guide to understanding where differences in opinions or lack of detailed understanding may be.
3. **O Score = 0 - 15:** A score in this range may indicate that there is not a strong enough understanding of the value of EHR or how it will impact the clinic's goals or operations to move forward without a process for management and clinic-wide discussion. Consider adopting a longer-term set of planning discussions and a methodology to develop a clinic vision and decision-making to support quality improvement before moving forward with other EHR adoption activities.

### 2. • *Organizational Capacity for EHR Adoption:*

1. **O Score = 67 - 100:** A score in this range may indicate that managerial, operational and IT capacity are strong, although further analysis of scores in individual areas will reveal relative strength in each area. There is likely the capacity for achieving success including management methodologies, staff resources and IT environmental strength. Pending the Organizational Alignment score, consider further assessment with the Readiness Assessment tool that can be found in the library on the Community Clinic website.
2. **O Score = 34 - 66:** A score in this range may indicate that there is adequate capacity in some areas, but not consistently throughout management & staff capacity, operational processes & mechanisms and the IT environment. Identify the exact categories of weakness and consider further management and cross-departmental planning discussions about areas of weakness, using this tool and/or the Readiness Assessment as a guide to understanding how to increase clinic capacity.
3. **O Score = 0 - 33:** A score in this range may indicate that there is weak capacity in several areas that are critical to EHR adoption success. Identify the exact categories of weakness and consider a more comprehensive analysis of requirements for EHR adoption and develop a plan to improve capacity in those areas before moving forward with other EHR adoption activities.

### 3. • *Overall Score:*

1. **O Score = 98 - 145:** A score in this range may indicate that your clinic both understands the value of EHR and has the capacity to see a long and potentially challenging adoption through to success. To ensure readiness for adoption, consider further assessment via the Readiness Assessment tool available through the library on the Community Clinic website.
2. **O Score = 50 - 97:** A score in this range may indicate that your clinic is strong in some areas and weak in others. It is important to identify strength in each area of the assessment to determine where to focus additional managerial and planning attention. Consider using this tool and the Readiness Assessment to inform the process and develop a more targeted plan toward EHR adoption.
3. **O Score = 0 - 48:** A score in this range may indicate that your clinic is not currently prepared to move forward with EHR adoption. Consider developing a more comprehensive plan to facilitate management and cross-departmental education and planning processes to determine why your clinic is interested in EHR adoption and how to build the capacity to ensure successful adoption and use.

