Request for Proposal and Data Quality issues of Electronic Medical Record: Radio Frequency Identification Solution

By

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Acknowledgements and Endorsement

This report has been written by me and has not received any previous academic credit at this or any other institution.

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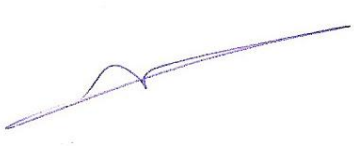
Lastly, I offer my regards and blessings to all of our team, Team Leader Ms. Areej Al-Harthi, Ms. Aseel Alfehaid, and Ms. Maha Aljasser, who all helped me determine the new system requirements of this study.

Yours sincerely,



Malak Alluwaif

Executive Summary

In July 2012, the author was involved with a team that developed a request for proposal (RFP) for an electronic medical record (EMR) system in the Health Informatics department at King Fahad Specialist Hospital in Saudi Arabia. This report focuses and describes problems related to the current health information system (MedicaPlus) and proposes several initiatives for various departments to implement the new system. In determining the new system requirements, the team takes their cue from other health information systems, that provided by market leaders.

The current system at the King Fahad Specialist Hospital does not support the institution's research and development (R&D) goals. Moreover, various departments within the hospital have indentified numerous system challenges and problems that the system's vendor was unable to resolve. Consequently, the hospital administration has decided to replace the current system. To effect this change, the Health Informatics department has been tasked with initiating the replacement procedure, which includes developing an RFP. Our team's EMR RFP covered different departments such as Eligibility, Scheduling Registration Management, Health Information Management, and Billing.

The most important issues with MedicaPlus are its lack of accuracy and validity, which detrimentally affects data quality. Poor data quality will have an impact on planning, decision-making, medical research, patient safety, workload, and cost. In order to overcome the data quality issue, several key recommendations should be taken into consideration. These include preventing data errors by applying solutions, such as, an EMR and Radio Frequency Identification (RFID) system that benefits from new information technology (IT); instituting automated data error detection and collection; and taking action to improve data quality.

1 Introduction

The hospital's health information system has been in development since the institution first started providing health care services in 2005. However, as the current system (MedicaPlus) has failed to meet hospital requirements, the administration is in the process of replacing it with a system that is primarily electronic. The hospital's health information system is responsible for managing the vast number of transactions between various parties involved in health care, such as patients, providers, insurance, and suppliers, and therefore needs a method that can easily and accurately receive and retrieve information (Wager, Lee, & Glaser, 2009).

The hospital's primary purpose in developing a system that can access its comprehensive health information is to integrate clinical applications with the administration's information system (Wager et al., 2009). Moreover, the hospital administration has determined common goals such as reducing funding costs, maintaining patient safety, and improving health care quality, all of which can be achieved by implementing an electronic-based health information system such as the Electronic Medical Record (EMR). Broadly defined by Wager et al. (2009) "EMR is an electronic record of health-related information on an individual that can be created, gathered, managed, and consulted by authorized clinicians and staff in one health care organisation" (p. 111).

The hospital is currently working to replace "MedicaPlus" according to the administration's recommendations. This process is now two years in the making and began shortly after the decision was handed down to align the system with the hospital's business goals. The new system will significantly ease the burdens and problems faced by the hospital and will start by identifying requests for proposals, or RFPs. This stage is scheduled to be finished by the

end of 2012, after which time the project will officially kick off, in early 2013. The plan is for the EMR to go live by the middle of 2014 and "stabilize" by 2015 (EMR Roadmap, 2012).

The objective of this report is to provide an overview of the request for proposal process specifically with regards to electronic record and patient management services at King Fahad Specialist Hospital. It will also explore background about the hospital's decision to choose a new system or replace the existing one. The report will explain also the author's internship work at KFSH-D and how he benefitted from his study, which is Master of Health Informatics (MHI). Additionally, the report will explore and analyse data quality problems and propose RFID solution and then make recommendations. The report at Appendix B will include workflow process and problems of current system which include the following aspects: Eligibility, Scheduling Registration Management, Health Information Management, and Billing. Notice: (The background information that provided in Appendix-B will help the vendor to identify and clarify the current problems and suggest solutions).

1.1 Background

1.1.1 The hospital administration's decision

After indentify the existing system challenges, the hospital gave the current vendor the opportunity to fix the problems, but the vendor was unable to do so. Moreover, during the review opportunity period, new problems arose. Overall, then, the current system does not support the hospital's Research and Development (R&D) goals.

The chief executive officer (CEO), the departments, the system champion, and the end users have all been involved in the decision-making process regarding replacing the current system and choosing the new health information system. However, there is specific team structure for

implementing the electronic medical record (EMR) (see Figure 1), as the EMR should cover different scopes such as functional, nursing, medical services, allied health services, and management tools (see Figure 2).

Figure 1: EMR Project team structure.

Source: (EMR Roadmap, 2012).

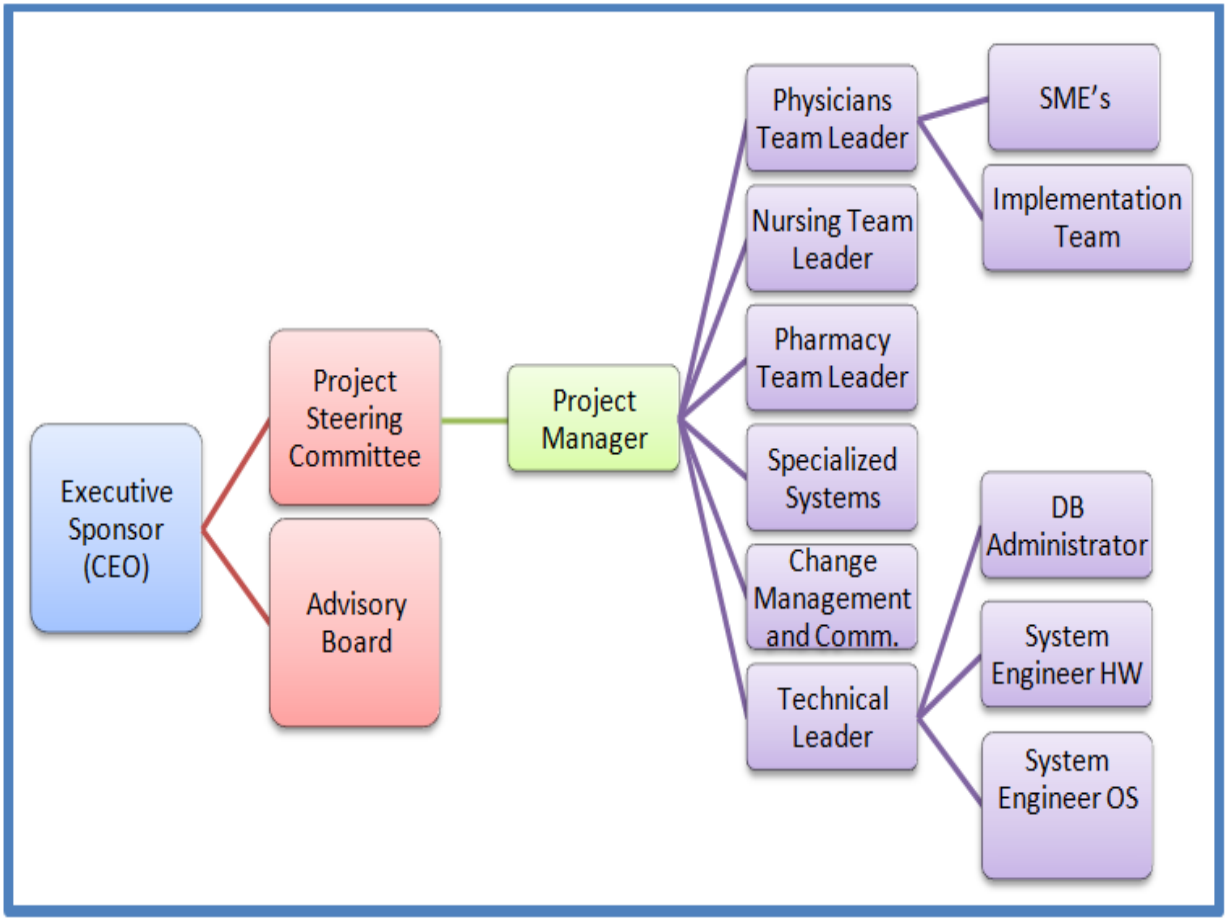
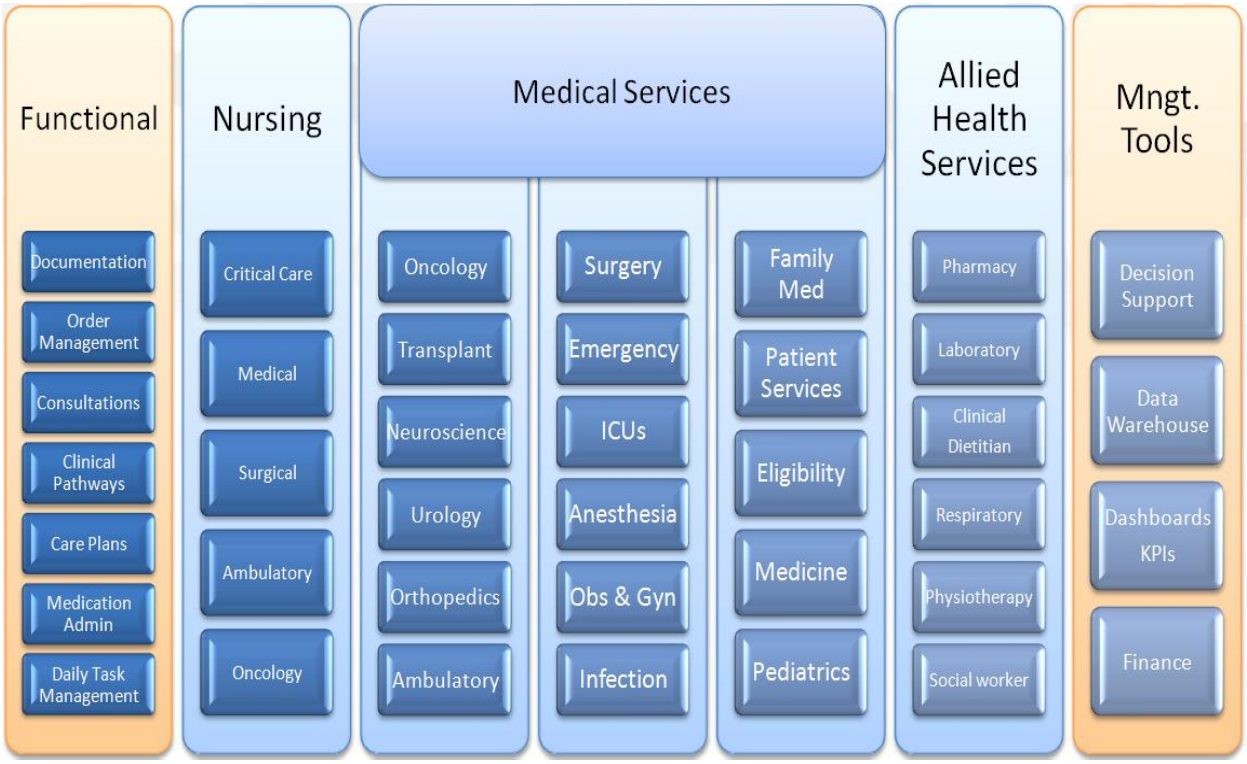


Figure 2: EMR Scope.

Source: (EMR Roadmap, 2012)



When the decision was made to change the current system, the hospital administration took into account the hospital's general objectives and strategies plan. This was accomplished through consultations with the Health Informatics department as well as with senior end users who have a clear vision and a complete picture of their business. Health informatics also closely communicated with executive management in order to ensure that their strategic plan aligned with the hospital's strategic goals. (See Figure 3: Strategic Goals.)

Figure 3: Strategic Goals.

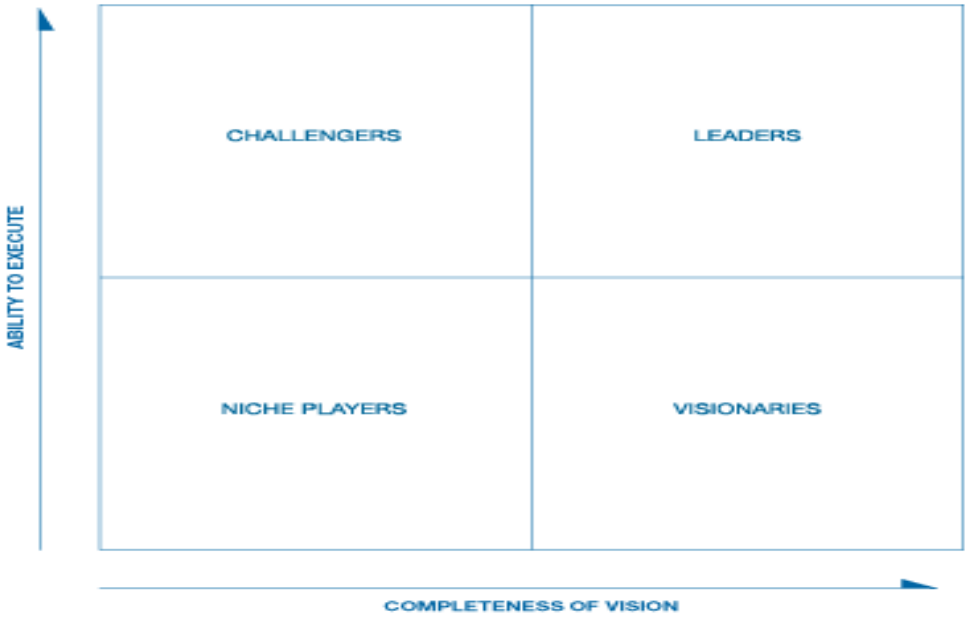
Source: (EMR Roadmap, 2012).

1.1.2 The process and criteria of choosing an EMR

At the beginning of 2011, the hospital applied Gartner's Magic Quadrant chart to establish core criteria for evaluating companies. The chart has four main criteria: challengers, leaders, niche players, and visionaries (see Figure 4) (Gartner, 2012). The hospital used this chart to identify the competing players in major technology for specific markets. The chart also helps the hospital to get to know the players' positions and to identify how they can offer help over the long haul. In addition, the Magic Quadrants gives the viewer a wide-angle perspective to understand the relative positions of the market's competitors (Gartner, 2012), and helps to give a quick idea of how well technology providers are executing, compared to the hospital's vision (Gartner, 2012).

Figure 4: Gartner's Magic Quadrant.

Source: copyright © by (Gartner, 2012).



The hospital began the system acquisition stage in 2012 by starting RFP preparations (see Figure 5). According to the hospital's plan, the implementation stage should start in February 2013, while the methodology might take until 2015 (see Figure 6). In summary, the project's kick-off is scheduled from 2013 to the middle of 2014, at which time the EMR will go live and stabilize by 2015 (see Figure 7).

Figure 5: RFP preparations 2012-2013.

Source: (EMR Roadmap, 2012).

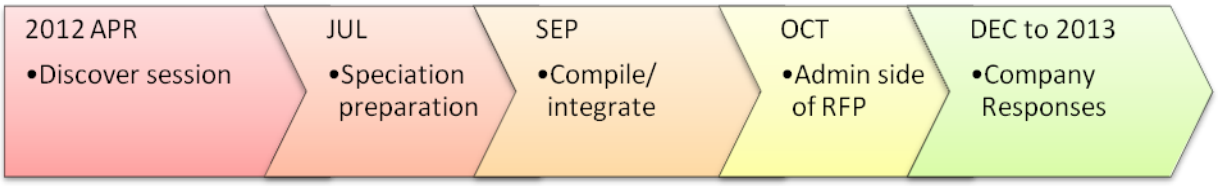


Figure 6: Implementation 2013-2015.

Source: (EMR Roadmap, 2012).

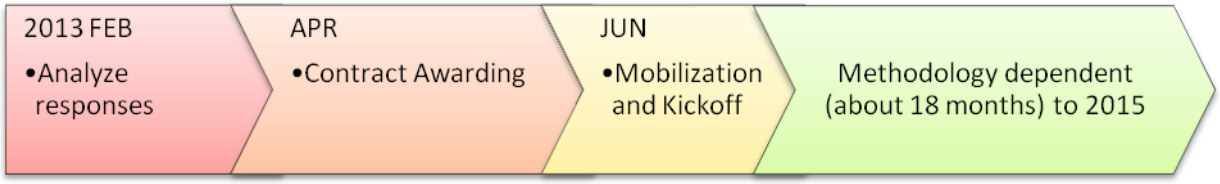
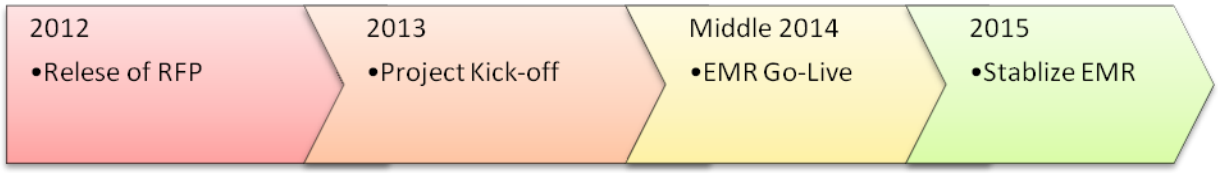


Figure 7: Overall timeline.

Source: (EMR Roadmap, 2012).



The hospital hopes to contract with a company in the EMR field to build a state-of-the-art in-house system. Other types of contract (such as with an application service provider [ASP]) are not appropriate because they take much longer to implement, are more expensive, and need R&D for future technology.

2 Description of the Organization

2.1 King Fahad Specialist Hospital-Dammam (KFSH-D)

King Fahad Specialist Hospital-Dammam (KFSH-D), located in the Eastern Province of Saudi Arabia, has been providing the tertiary care needs of the community since 2005 (Annual report, 2011). Since that time, the premier Ministry of Health hospital has continued to grow to meet rising health care demands by increasing the number of residents and expanding care services (Annual report, 2011). Today, the hospital has 230 beds but is hoping to increase this number to 380 beds by 2013 (EMR Roadmap, 2012). The average number of patient admissions

is 600 per month, or 20 patients per day (EMR Roadmap, 2012). The outpatient average visit is 24,500 patients per month and 800 per day (EMR Roadmap, 2012).

KFSH-D has several medical centers that represent core areas of health care service, such as an Oncology center, a Neuroscience center, a Multi-Organ Transplant center, and a Genetics and Metabolic Disease center. By 2016, the hospital plans to open a further 1500 beds as well as build a medical school and a large research center (EMR Roadmap, 2012). To that end, the hospital received approval in 2011 from the Saudi Ministry of Health to coordinate the construction of a new hospital, the King Khalid Medical City (KKMC) (Annual report, 2011). The new project will be overseen by the KFSH-D's Project Management Office and will take into account the anticipated growth in medical services over the next five years (Annual report, 2011). When the new hospital complex is completed, the KFSH-D will move to the KKMC location and will add a Cardiac Disease center and an Ophthalmology center by 2016 (EMR Roadmap, 2012).

Ultimately, the hospital is looking to the health information system to implement the following goals and strategies: clinical services improvements; patient and staff safety; best practices implementation; standardization; decision support; increased productivity; and cost reduction. (See Figure 3 for more details)

2.2 Description of the Health Informatics Department (HID)

The author was working in the Healthcare Informatics Department, which is a part of Information Technology Services. The department's responsibility is to automate all healthcare business processes through acquiring, managing and implementing clinical systems, enhancing and realigning clinical business processes in the hospital, and providing user support (HID,

2012). The automating of business processes across clinical areas is guided by standards such as the Joint Commission of International Accreditation (JCIA) and the College of American Pathologist (CAP) (HID, 2012).

2.2.1 HID's Services provided

The Healthcare Informatics Department provides a variety of services, the main ones of which are listed below (HID, 2012):

- Supporting clinical systems across the hospital.
- Identifying requirements for new electronic selection in order to serve patient care needs efficiently and at the highest standards.
- Liaising between business users and IT technical teams to meet users' technology needs.
- Providing reports/information by using advanced data warehousing functionality and analytical tools at various management levels to support decision-making.

2.2.2 HID's future goal

The hospital will move to the King Khalid Medical City location within the next four years. Consequently, the Healthcare Informatics Department has implemented an integrated and sophisticated clinical information system as its main future goal (HID, 2012). To that end, the department is working to build a core team and to establish the process of procurement, which is currently in progress (HID, 2012).

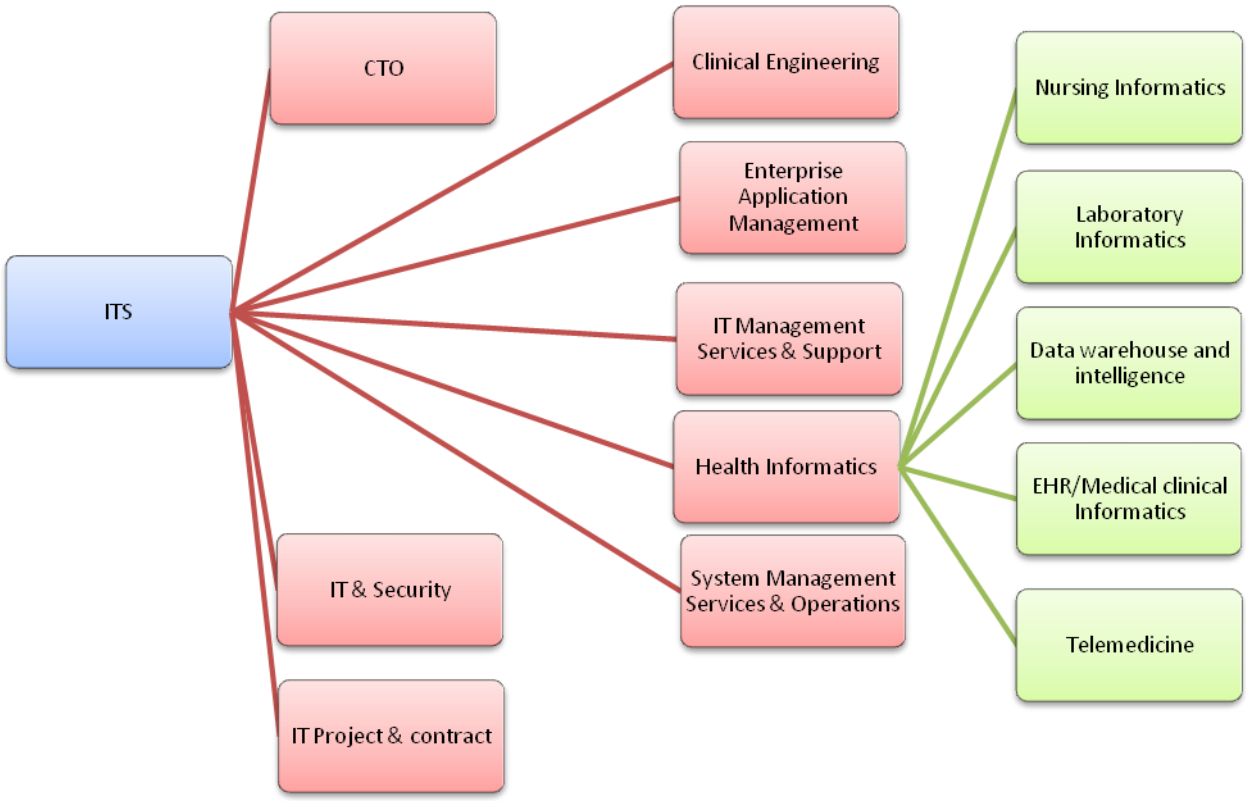
2.2.3 HID Organizational chart (sections in HID)

The Health Informatics Department has five sections that work together to achieve the department's mission (HID, 2012). These sections are: Nursing Informatics, Laboratory

Informatics, Data warehouse and intelligence, EHR/Medical clinical Informatics, and Telemedicine (see Figure 8).

Figure 8: ITS Organizational Chart.

Source: (EMR Roadmap, 2012).



2.2.4 HID's Major Functions

The department processes consist of four major functions (HID, 2012): 1) Managing the hospital information systems; 2) testing new system software or update; 3) granting access to users; and 4) purchasing, upgrading, or changing a system or business solution. The department

also performs other tasks and functions as the need arises. For more details about the previous major function workflow, see Appendix A, Figures 1-4.

3 Description of the Work Performed at the Organization

3.1 Job Description

- Responsible for implementation and enhancement of the System Development Life Cycle (Planning &Analysis, Design, Implementation, and Evaluation & Support).
- Manage the acquirement and implementation of healthcare information systems (which includes identifying system requirements, writing RFPs, devising proposal evaluation and solutions, and implementing project management).
- Identify opportunities for business process improvement and realignment in conjunction with clinical IT systems.
- Ensure that IT is consistent with professional standards of clinical practice (which includes identifying and proposing new technologies and devices and their integration to the clinical system).
- Provide appropriate support and assistance in the implementation and planning of information operations for various clinical departments.
- Analyze workflow, requirements, and procedures of current and future end user departments in order to provide electronic solutions that support decision-making and improve organizational and department operations.
- Ensure the best use of clinical applications by building a positive relationship with end user departments, and provide appropriate levels of end user education and training.

3.2 Objectives

- Perform all activities that are related to implementing a clinical information system in an assigned clinical service area.
- Improve quality of healthcare operations through providing critical patient care information at the management level.
- Efficiently use current and future information technology in the market.
- Improve business workflow and processes in different hospital departments.
- Reduce systemic and random errors (human errors).
- Ensure that the clinical information system is compliant with the hospital's strategic plans, standards, and international accreditation standards.
- Increase data quality by applying automated data collection technique.
- Take part in the department's main project: the EMR project.

3.3 Recent work done

1. **Studied the status of the existing health information system in the hospital.**

   Activities included:

   - Meeting with the hospital's department heads to clarify the main reasons for the hospital's strategic decision to replace the existing system.
   - Identifying the existing system's problems from an end user perspective.
   - Analyzing identified issues relating to the decision support abilities of the existing system.

2. **Proposed solutions to the identified system and business process issues, including:**

- Data quality issues.
- Patient admission and discharge system and business processes.
- Proposed a solution regarding data quality issues by implementing Radio Frequency Identification (RFID) technology and integrating it with the new Electronic Medical Record (EMR).

3. **Participated in the development of a request for proposal (RFP) for the medical electronic record (EMR) project at the Healthcare Informatics department by:**
    - Identifying business requirements through interviewing clinical department heads and senior end users.
    - Researching available heath information systems provided by market leaders.
    - Making use of the department's and hospital staff's experience with the current system through identifying gaps and problems.

4 Relation to Health Informatics

The author was able to identify many problems related to the health information system. In response to these problems, the author was able to successfully implement, apply, and take advantage of information he learned during the various courses he took as part of his Master of Health Informatics (MHI) degree. Related applied information includes:

- Health Information Flow and Standards, where he able to explain different kinds of workflows by using Business Process Modeling (BPM) to identify and analyze process or system problems.

- Health Information Systems and Issues, where he focuses on data quality issues related to the current system, and discusses how the system can impact negatively or positively on data quality.
- Project Management for Health Information Projects, where he uses his acquired skills to manage his tasks and team, and also uses the Gantt chart.
- Information System in Health Administration, where he applies his knowledge to create an RFP, which is the first important stage before choosing a new system. Steps within this knowledge application help to identify which technology can provide a solution for the current system's problems. Moreover, the author benefitted from different topics included in the course, such as: Health care data quality; Current and emerging use of clinical information systems; System acquisition (which includes comprehensive details about RFP and RFI [Request For Information]), and Technologies like RFID that support healthcare information systems.

In fact, the author both gained and obtained experience through his work, such as:

- How to make core criteria for evaluating companies in order to choose the best system in the commercial market based on the Gartner Magic Quadrant chart.
- Analyzing and identifying the current system's problems and using experience gleaned from other systems, like TrakCare Intersystem, Cerner and Meditech, in order to determine future system requirements.
- Identifying reasons for replacing the current system, one of which is a bad vendor contract. Through applying this information and experience, the author identified the importance of an RFP and how it can impact the healthcare organization going forward.

- Identifying the workflow, requirements, and procedures of the various medical departments.
- The author also learned the importance of integrating with other health information systems and applications, as some departments at the hospital still do not have any integration.

5 Requirements of new EMR and Current Problems

Health informatics has the responsibility to gather and manage the new system's requirements. According to the department plan, the RFP should be finished by the end of 2012. The RFP team (of which the author was a member) has finished the first stage, which is determining the new system requirements based on other health care organisations' experiences, current problems, and other health care systems such as TrakCare Intersystem, Cerner, and Meditech. The author was involved in identifying the most important system problems. The RFP team has already met with the medical record and scheduling supervisor to discuss the new system requirements, and is meeting with other departments in the near future. Notice: (The requirements are recorded in confidential documents, as per the recommendations of the head of Health Informatics. For more details about the work, please see Appendix A, Figure 5 [project team Gantt chart]). The author has identified a group of the most important problems that related to the current systems (MedicaPlus) based on workflow process and end user discussion (See Appendix-B).

6 Data Quality Issues Analysis and Discussion

Data quality is important for planning, decision-making, and research (Wager et al., 2009). The hospital administration has designed the project team structure, which includes the project

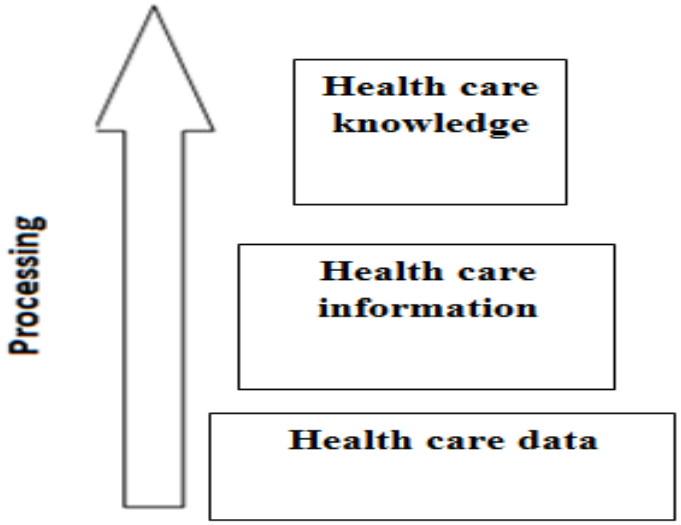
steering committee. However, the project steering committee needs to implement data quality by analysing, evaluating, and supporting the system's implementation (Wager et al., 2009). Currently, the hospital is working on the planning and analysis stage, which is includes RFP. The lack of accuracy and validity in the current system ("MedicaPlus") renders the data quality very poor. As a result, users have lost trust in the system and collect data manually, saving it on an Excel sheet. Consequently, the system is now being used for electronic medical record files only, which means it does not support ad-hoc and automatic collecting of data. Moreover, the system does not support Health Information Management (HIM). Due in major part to the inadequacies of MedicaPlus, and because the vendor has taken too long to solve the ongoing issues with the system, the hospital administration has decided to replace it.

After reviewing various departments' workflow processes, such as eligibility, scheduling, registration management, health information management and related problems at different levels of the current health information system (MedicaPlus), a clear data quality issue emerges. Specifically, the quality of the documentation and data retrieved from the system is poor and the reports generated from the system lack accuracy and validity. As a result, aspects such as decision support and patient safety will be detrimentally affected (Wager et al., 2009). In this regard, however, it is important to distinguish between health care data, health care information, and health care knowledge (see Figure 9) (Wager et al., 2009). Health care data forms the basis of health care information which, when gathered, processed and applied, create the rules of health care knowledge. The obtained results can be used for decision making (Wager et al., 2009). For example, a number without definition is just health care data, but after further defining the number as temperature, it becomes health care information. Then, if a physician analyses this health care information through his specified lens of health care knowledge, s/he

can determine whether the patient has fever or not and make the appropriate decision regarding the patient's care.

Figure 9: From Data to Knowledge.

Source: Copyright © by (Wager, Lee, & Glaser, 2009).



The hospital cannot acquire high-quality health information until high-quality of health care data is ensured. Currently, administrative staff and clinical providers manually gather and document patient health care information by using paper files in most procedures. Poor-quality data reporting and collection can impact the patient's medical record at numerous levels, such as decision making, patient care safety and quality, medical error and cost reduction, poor communication between patients and the hospital, health care research, and continuity of patient care (Wager et al., 2009).

There are two kinds of errors: systemic errors and random (human) errors. Health Informatics staff members should be able to identify which type of error has occurred, as they are responsible

for determining and providing solutions for errors and issues related to the health information system.

6.1 Discharge problem is an example

A prime example of a current problem that can be delineated as a random error occurs during patient discharge. This problem is data-quality-related, whereby the hospital fails to identify the correct number of patients discharged per day. There are three manual (not electronic) steps for patient discharge at the hospital: 1) The physician clears the patient for discharge; 2) the patient takes the clearance paper to the Admission and Registration Office to be signed by staff; and 3) the nurse receives the clearance paper and discharges the patient. The mistakes usually appear when the physicians issue a discharge order without completing the procedures. For example, 1) a patient might leave the hospital without clearance or before completing all discharge procedures; 2) because the system is inefficient, a nurse might complete the manual procedures by using a medical record chart or files and forget to do it on the system; 3) patients, nurses or physicians may not be fully cognizant of the discharge procedures. Any mistake or incompletion of the three manual steps will result in a discharge problem, in which case the patient will be physically discharged from the hospital but still exist in the system as a patient. This problem will cause any or all of the following: inaccurate patient discharge statistic reports, admission delays for new patients, inaccurate occupancy rates, unnecessary costs related to meals and medicine still being provided for non-existent patients.

The Health Informatics department is working hard to implement a new EMR that both fulfills hospital requirements and resolves the current problems. Indeed, there are many random errors as illustrated in previous examples which can be avoided by using new information technology (IT) such as EMR and Radio Frequency Identification (RFID).

6.2 The Quality & Strategic Planning Administration (QSPA)

The Quality & Strategic Planning Administration (QSPA) is responsible for maintaining data quality. Because the current system lacks accuracy and validity, the department has decided to make all data collection and general statistical reports of health care information manually (not electronically). The department will use Excel sheets until the current system is replaced. The new health information system is expected to be implemented within three to four years, according to the hospital plan. Even though the manual collection method takes extra time and effort, it is still more accurate and valid than the present electronic system (MedicaPlus).

The aim is to know how high-quality information can be achieved and data quality measured using a data standard (Wager et al., 2009). However, while there is no clear definition of a data standard, there is an acceptable level, determined by the hospital's strategic plan and objectives (Wager et al., 2009). The hospital can use the quality standard and framework of Medical Records Institute (MRI), American Health Information Managements Association (AHIMA), and Canadian Institute for Health Information (CIHI) in order to assist, build, manage, and ensure data quality. (See Figures 10-A, 10-B and 10-C.)

Figure 10-A: Data quality management tool of MRI.

Source: Adoption from (Wager et al., 2009).

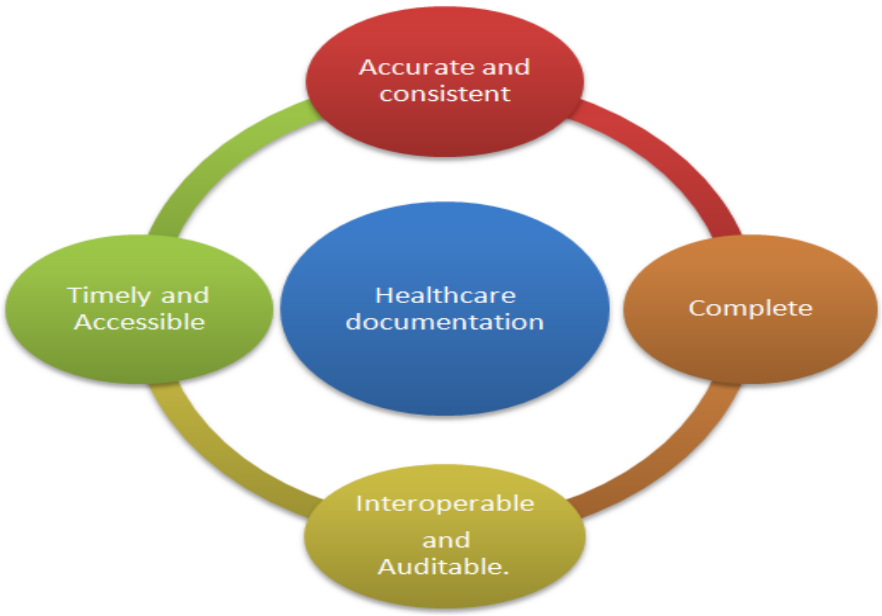


Figure 10-B: AHIMA Data Quality Management Model.

Source: AHIMA, Data Quality Management Task Force, 1998, (Wager et al., 2009).

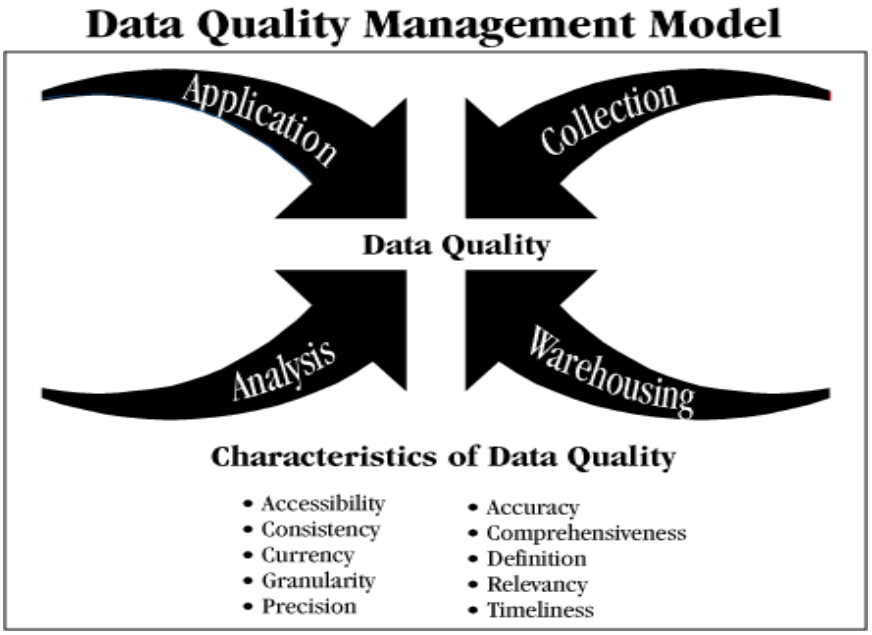
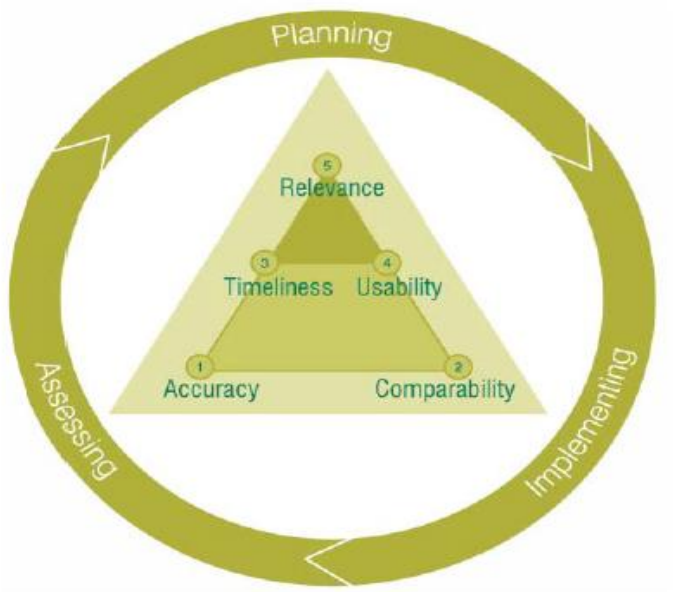


Figure 10-C: Data Quality Framework.

Source: (Ottawa, Ont.: CIHI, 2009).

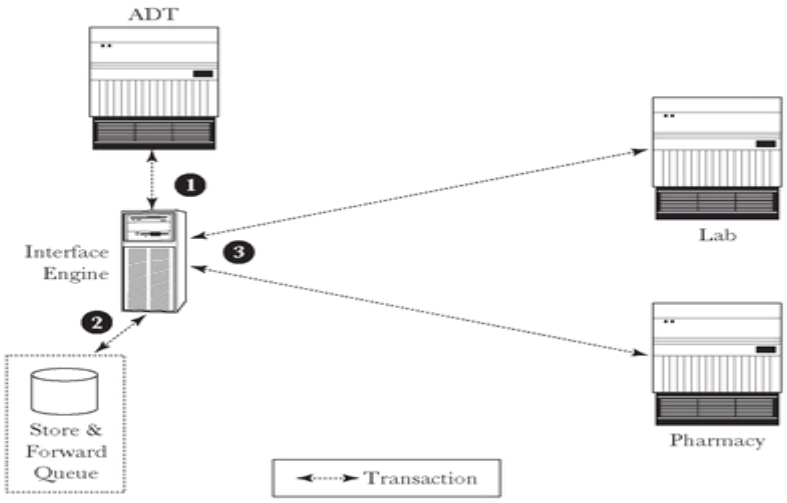


6.3 Radio Frequency Identification (RFID) Solution

Implement a new EMR will solve most of the problems, but not all of the problems. As every EMR has limited features, it will be unable to satisfy all medical and administrative departments without integrating with other health information systems and applications. Therefore, the hospital needs to implement interface engine that make each systems talk to each other (Wager et al., 2009). For example between: pharmacy, lab, and Automated Data Transfer (ADT) system (see Figure.11).

Figure 11: Common Interface Engine Operations.

Source: by Altis Inc. as cited in (Wager et al., 2009).

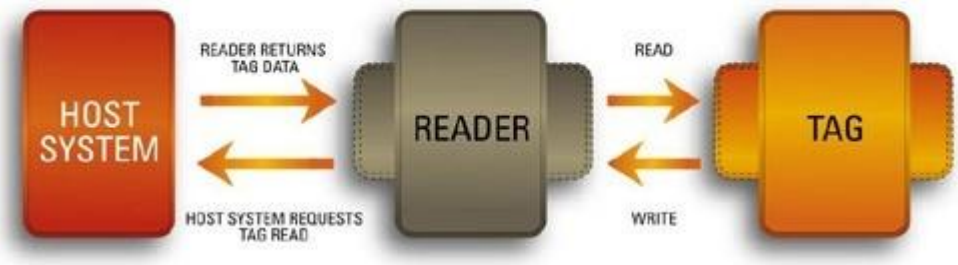


The EMR can be integrate with the RFID system , and the RFID can brought many benefits such as improve data quality, reduce medical errors, increase productivity, and reduce cost and workload (Oranje, 2009). RFID is a wireless technology that is used to identify and track human and equipment locations, as long as the RFID tag passes through the signal of the RFID readers (see Figure 12). Moreover, RIFD technologies can increase efficiency by automatically tracking and identifying any object or person within a specified range (Cavoukian, 2008). RFID is more

flexible than UPC bar-code technology because it does not need a physical line for communication and can scan and monitor numerous equipment or people at once, through any barriers (Cavoukian, 2008). Recently, many health care organizations have implemented RFID for various purposes, such as enhancing their patient management system, tracking diagnostic results, document tracking, waste management, inventory management, and pharmaceutical authentication and control (GAO RFID Inc., 2012). Some general features that make RFID different from other systems are as follows: 1) suitable for wireless and remote communication; 2) can be read through barriers with high accuracy; 3) the RFID tag might include sensors in order to record some vital indictors and identify positioning; 4) automated data is collected, stored, and encrypted inside RFID tags (Cavoukian, 2008).

Figure 12: RFID Components.

Source: copyright © by (RFID Institute SA, 2012)



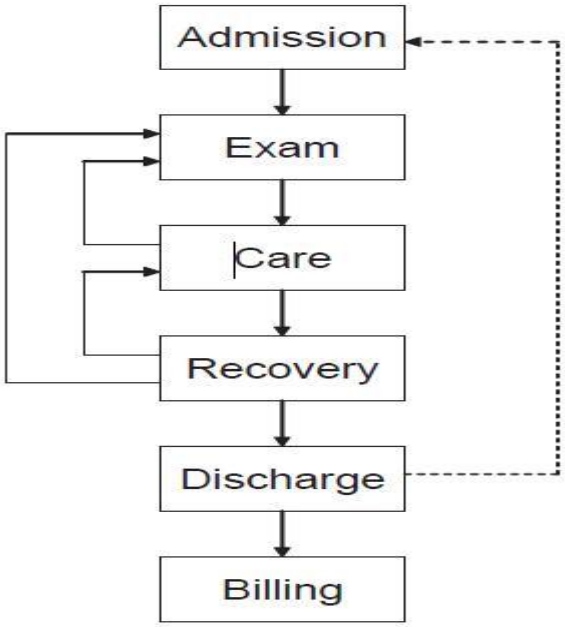
6.4 RFID and patient discharge

To resolve the example of a discharge problem illustrated above, RFID can operate a patient lifecycle (Admission, Exam, Care, Recovery, Discharge, and Billing) by integrating with EMR (see Figure 13) (Cangialosi, Monaly, & Yang, 2007). As long as an RFID tag is attached to a patient's hand, the discharge process can be more streamlined because the RFID tag can capture all kinds of data, such as the patient's health status, length of stay, and care history

(Chao, 2009). Moreover, the monitoring system of bed availability can be automatically notified when an RFID tag has activated or deactivated, based on patient discharge or admission (Huang, Chu, Lin, & Kuo, 2010). Kannry et al. (2007) study shows that RFID can help the monitor detect patient discharges within an average of 25 minutes less compared with the manual system. The RFID thus succeeds in achieving the desired level of accuracy and validity of, for instance, patient discharges and patient data collection (Inoue, Sonoda, & OKA, 2006). The ability of RFID to capture, store and retrieve the data on time and automatically should encourage the hospital to use it to manage its various resources (e.g., the patient management system) and resolve various problems (e.g., the data quality issues).

Figure 13: Patient lifecycle Framework.

Source: Copyright © by (Cangialosi et al, 2007).



6.5 RFID challenges

There remain some general challenges related to RFID which should be taken into consideration. These challenges include the following: 1) Patient information confidentiality and security (Lieshout et al., 2007). In order to overcome this challenge, the hospital needs data encryption and control access (Lieshout et al., 2007). 2) Patient refusal to wear an RFID tag. In this situation, the hospital should inform the patient about the positive impacts of RFID technology in order to counteract any mistrust of the technology (Lieshout et al., 2007). 3) RFID signal can interfere with other medical devices. Therefore, the hospital should use ultrasound signals or low frequency radio signals (Lieshout et al., 2007). 4) The high cost of the technology can be problematic for some organizations, but this cost will be offset by other cost reductions (Yao, Chu, & Li, 2010). Generally, then, there are many benefits to using RFID technology such as increased healthcare outcomes, overall cost-effectiveness, and improved patient flow and safety.

7 Conclusion

The request for proposal is an important element in achieving a comprehensive overview of the hospital situation and the current medical record system. The report analysed and discussed data quality problems, proposed EMR and RFID solutions, and made recommendations. Currently, the Health Informatics Department is working on an RFP and should be finished it by the end of 2012. According to the hospital's plan, the implementation stage will start by February 2013, and the new EMR system will be fully installed, tested, refined and operational by 2016. It is hoped that the vendors and the hospital will take advantage of the findings contained in this report in order to avoid the problems of the current system. It is also hoped that

the vendors will fully implement the requirements that the hospital needs to better facilitate the timely and cost-effective delivery of health care in the present and planned hospital.

8 Recommendations

1- The RFP of the new health information system should be completed by the vendor in order to avoid current system problems.
2- Clear data definitions and collection guidelines should be provided in order to improve data quality.
3- A clear data quality standard should be created based on MRI, AHIMA, and CIHI.
4- Information technology such as RFID and EMR can solve and prevent random and systemic errors.
5- The hospital should avoid errors related to current processes or procedures.
6- End users can share how the quality of reports and the importance of data quality affects decision-making.
7- The administration should delineate and adhere to protocols and guidelines.
8- Health information transactions between different departments should be made electronically instead of manually.
9- Users should be trained to use the new system features and new procedures.
10- The administration should provide a quality assurance plan in order to develop the work and avoid any current or futures problems.
11- Data entry should be continuously checked and data quality audited.
12- Data errors should be controlled through automated correction.

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Appendix A

Figure 1: HIS issue management.

Source: Copyright © by KFSHD-ITS-HID-P01

HIS issue management

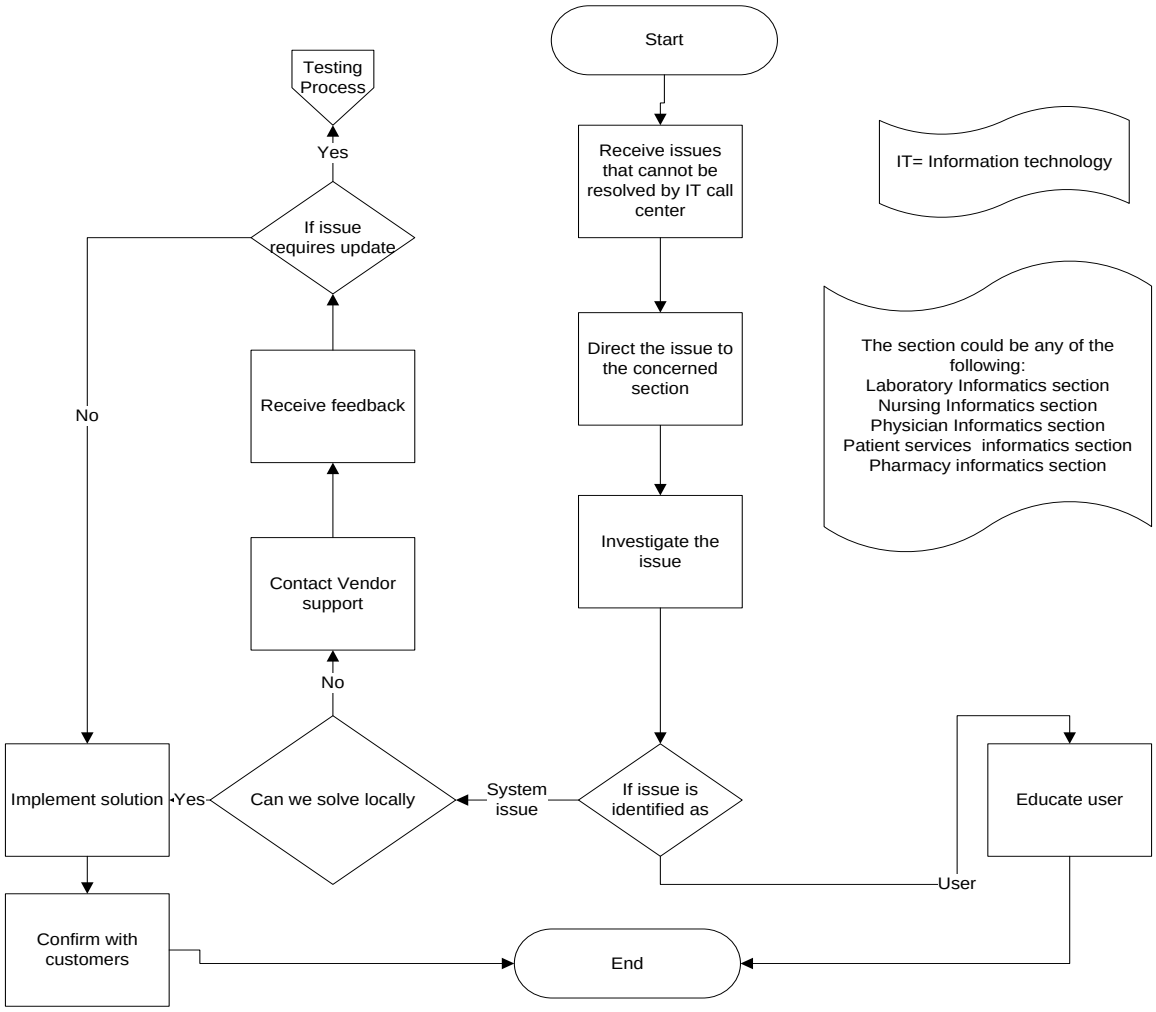


Figure 2: Testing a new system software or update.

Source: Copyright © by KFSHD-ITS-HID-P02

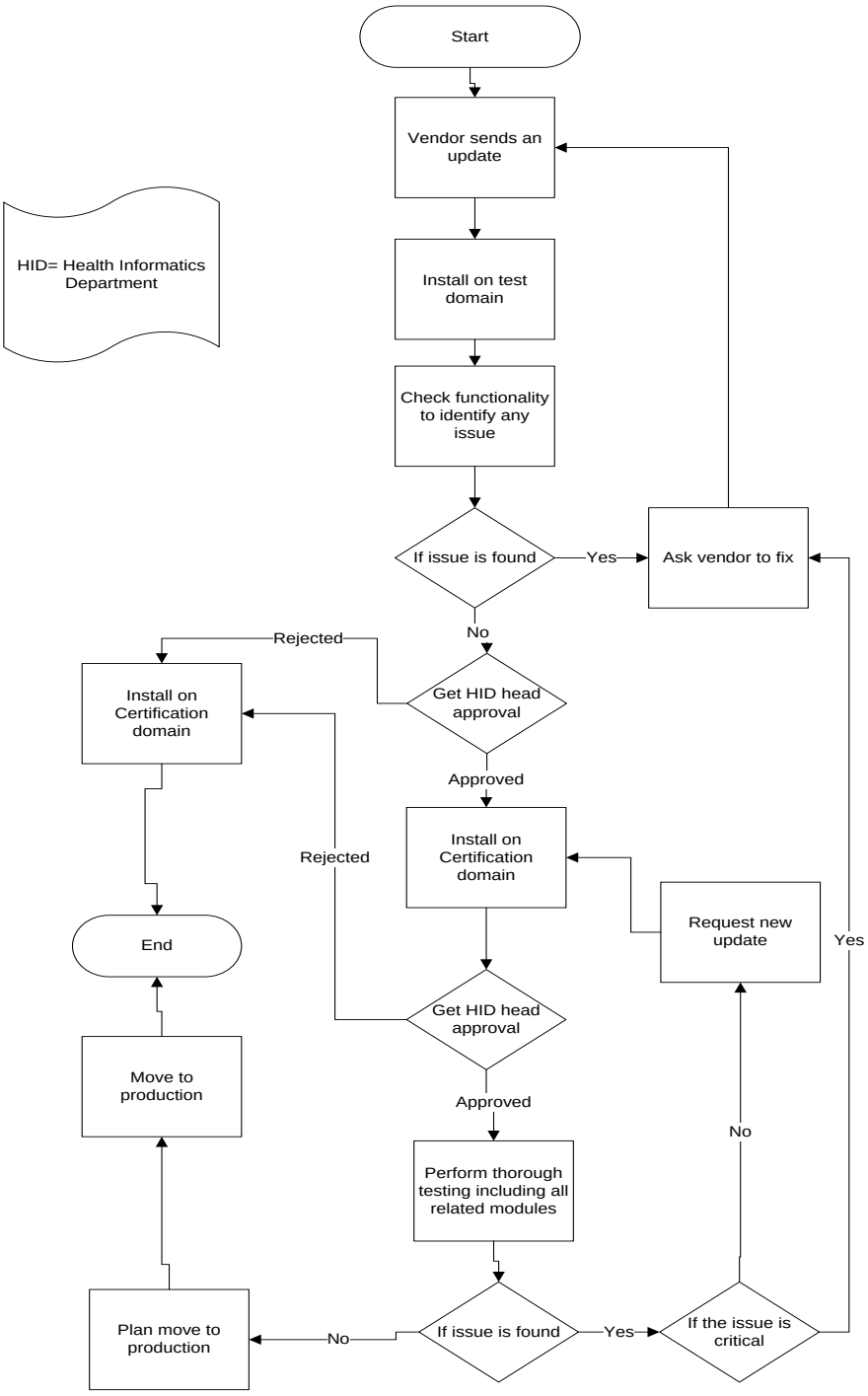


Figure 3: Granting access to users.

Source: Copyright © by KFSHD-ITS-HID-P03

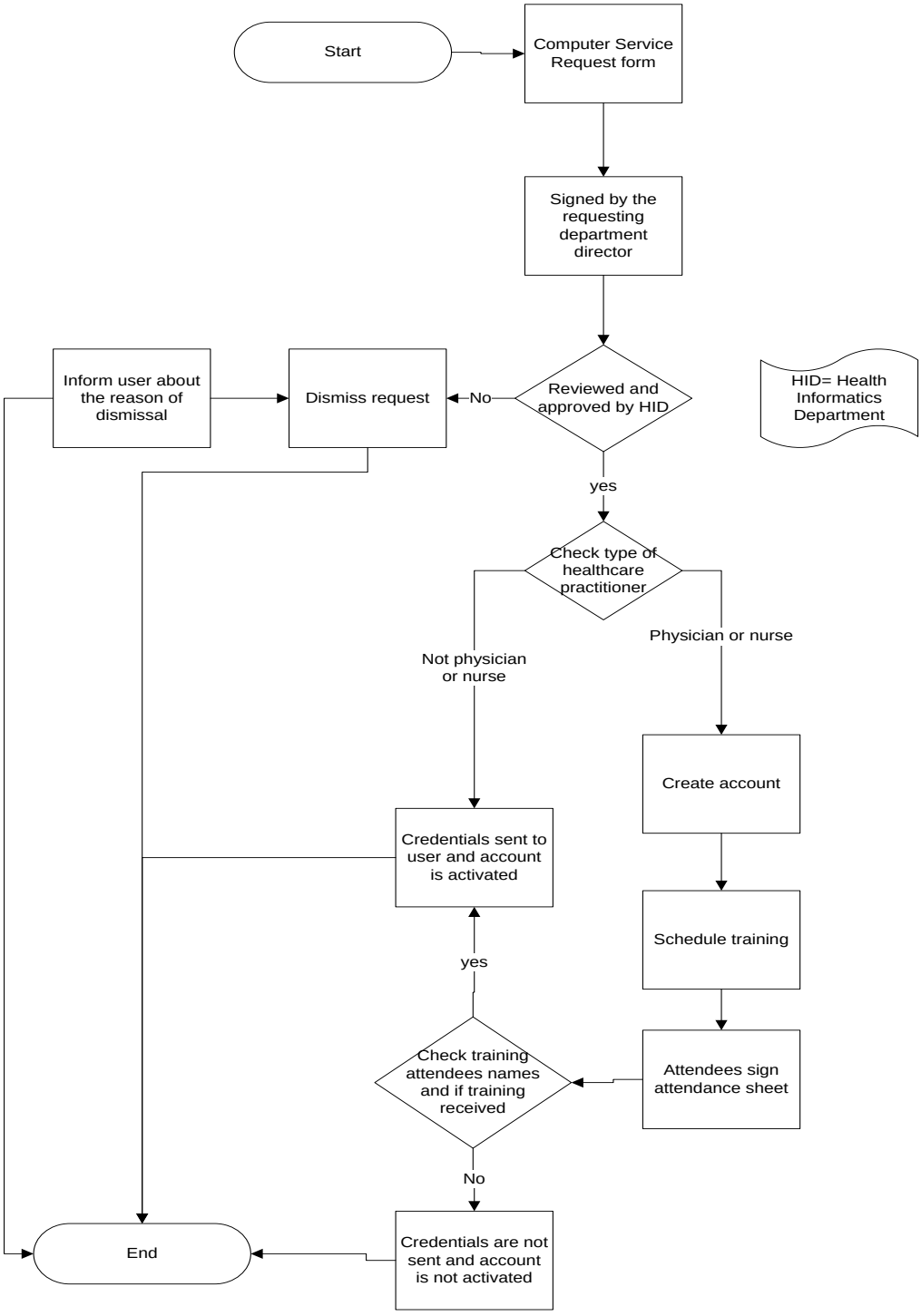


Figure: 4 Granting access to users. Purchasing, upgrading, enhancing, or changing a system or business solution.

Source: Copyright © by KFSHD-ITS-HID-P04

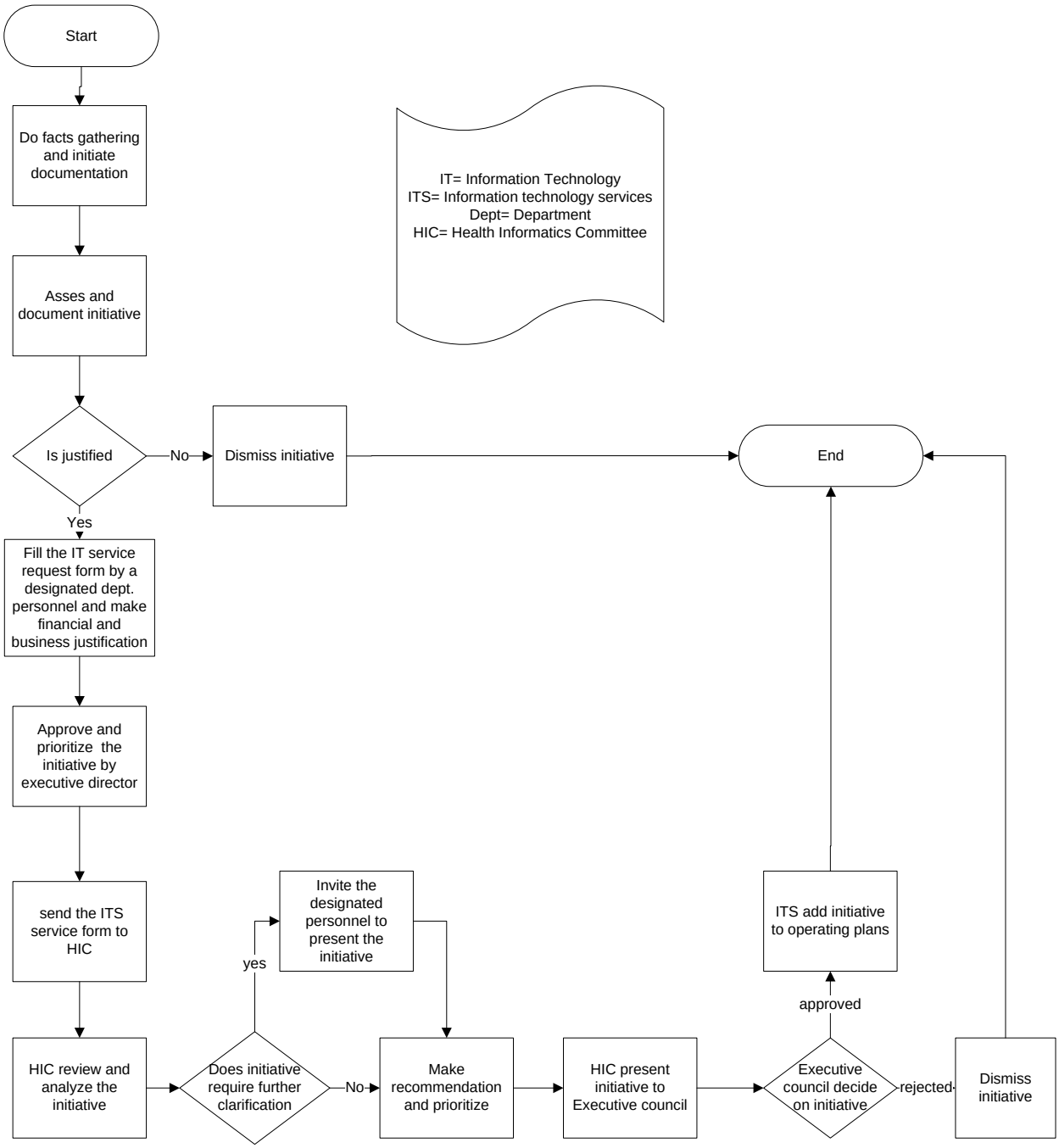


Figure 5: Project team Gantt chart. Source: by the author.

	Task Name	Duration	Start	Finish	Resource Names
1	**RFP**	**11 days?**	**Sat 02/06/12**	**Wed 13/06/12**	
2	Looking for health information system background	2 days?	Sat 02/06/12	Mon 04/06/12	Arij
3	Search for similar EMR requirements	4 days?	Sat 02/06/12	Wed 06/06/12	All group
4	Requirements analysis	4 days?	Sun 10/06/12	Wed 13/06/12	All group
5	Meeting	1 day	Wed 13/06/12	Wed 13/06/12	All group
6	**Determine system goals and current problems**	**11 days?**	**Sat 23/06/12**	**Wed 04/07/12**	**Malek**
7	Meeting with Director of health informatics	1 day	Sat 23/06/12	Sat 23/06/12	Malek
8	Meeting with quality & atrategic planning administration (QSPA) department	1 day?	Sun 24/06/12	Sun 24/06/12	Malek
9	Meeting with quality & atrategic planning administration (QSPA) department	1 day?	Tue 26/06/12	Tue 26/06/12	Malek
10	Meeting with health information management department	1 day?	Mon 02/07/12	Mon 02/07/12	Malek
11	Meeting with registration management department	1 day?	Tue 03/07/12	Tue 03/07/12	Malek
12	Meeting with medical report department	1 day?	Wed 04/07/12	Wed 04/07/12	
13	**RFP (Health Information Management)**	**9 days?**	**Sun 10/06/12**	**Wed 20/06/12**	
14	Liberation of the proposed requirements	4 days?	Sun 10/06/12	Wed 13/06/12	Maha
15	Looking for additional requirements	4 days?	Sun 10/06/12	Wed 13/06/12	Malek
16	Meeting	1 day?	Wed 13/06/12	Wed 13/06/12	Malek and Maha
17	Meeting with health information management department	1 day?	Wed 20/06/12	Wed 20/06/12	All group
18	**RFP (Scheduling)**	**38 days?**	**Sat 02/06/12**	**Tue 17/07/12**	
19	Liberation of the proposed requirements	8 days?	Sat 23/06/12	Sat 30/06/12	Arij
20	Looking for additional requirements	8 days?	Wed 20/06/12	Wed 27/06/12	Malek
21	Meeting	1 day?	Sat 30/06/12	Sat 30/06/12	All group
22	Meeting with scheduling department	1 day?	Sat 02/06/12	Sat 02/06/12	All group
23	Meeting with scheduling department	1 day?	Tue 10/07/12	Tue 10/07/12	Aseel and Malek
24	Editing and formatting	6 days?	Tue 10/07/12	Tue 17/07/12	Aseel
25	**RFP (Registration Management)**	**23 days?**	**Sat 02/06/12**	**Wed 27/06/12**	
26	Liberation of the proposed requirements	5 days?	Sat 23/06/12	Wed 27/06	Arij
27	Looking for additional requirements	4 days?	Sat 23/06/12	Tue 26/06/12	Malek
28	Meeting	1 day?	Wed 27/06/12	Wed 27/06/12	All group
29	Meeting with registration managemen department	0 days	Sat 02/06/12	Sat 02/06/12	All group
30	**RFP (Eligibility)**	**11 days?**	**Sat 02/06/12**	**Wed 13/06/12**	
31	Liberation of the proposed requirements	4 days?	Sun 10/06/12	Wed 13/06/12	Maha
32	Looking for additional requirements	4 days?	Sun 10/06/12	Wed 13/06/12	Malek
33	Meeting	1 day?	Wed 13/06/12	Wed 13/06/12	Malek and Maha
34	Meeting with eligibility department	0 days	Sat 02/06/12	Sat 02/06/12	All group
35	**RFP (Billing)**	**11 days?**	**Sat 02/06/12**	**Wed 13/06/12**	
36	Liberation of the proposed requirements	8 days?	Wed 06/06/12	Wed 13/06/12	Malek
37	Looking for additional requirements	8 days?	Wed 06/06/12	Wed 13/06/12	Malek
38	Meeting	1 day?	Wed 13/06/12	Wed 13/06/12	All group
39	Meeting with billing department	0 days	Sat 02/06/12	Sat 02/06/12	All group
40	**The last stage**	**57 days?**	**Thu 16/08/12**	**Thu 01/11/12**	
41	Review requirements after the meeting with diff. departments	23 days?	Thu 16/08/12	Sat 15/09/12	All group
42	Send requirements to director of health informatics for reviewing	22 days?	Sat 15/09/12	Mon 15/10/12	Arij
43	Obtain final approval	1 day?	Thu 01/11/12	Thu 01/11/12	All group

Appendix B

In the following are the problems that related to the current system and workflow process for different departments such as: Eligibility, Scheduling, OPD, Registration Management, Medical record, Coding, Medical report, and Billing.

1. Eligibility

1.1 Workflow process

In the current workflow process, the eligibility staff receives referrals from other hospitals or from patients, manually or by fax. When the staff receives a referral, they give it a reference number based on the account system "MedicaPlus", and then save the information on an Excel sheet. The eligibility staffs, in consultation with medical staff, then determines whether the referrals meet the hospital's administrative criteria and whether the medical assistance is available or not.

There are two types of referrals: 1) Incomplete referrals, where medical eligibility is not available and/or the inquiry does not meet the administrative criteria. In this case, the staff will reject the case or put it in a pending list to complete it, for no more than 3 months. 2) Complete referrals, where medical eligible is available and the inquiry meets the administrative criteria. In this situation, the staff will accept the patient, after which the eligibility staff will book an appointment and inform the patient to visit the Outpatient Clinic Department. For admission referrals, the eligibility staff will then coordinate with the Registration and Admission Departments to secure a bed and inform the patient to attend the appointment. (See Appendix B, Figure 1 for more details.)

1.2 Problems

1. Wasted time because the referrals process lacks electronic communication with other hospitals. In order to solve this problem, the Eligibility Department needs to open more channels to contact with other hospitals electronically.
2. All transactions are done manually and all documents are hard copies.
3. The Eligibility Department often receives referrals from patients as well, which causes accuracy issues. As the hospital provides tertiary care for the region, it should receive referrals from the second level of care only.
4. After the Eligibility Department accepts a case, the Admission Office will open a file, commence case management, and order a bed. However, if there is no bed available, the case will put on a waiting list. This process taking a long time because it is lack of electronic communication.
5. A patient can also obtain medical eligibility from a specialist by visiting the Emergency Department in an urgent situation. The problem with this situation is that the Eligibility Department will receive the case as data-based only, without being able to study it, because the Eligibility Department does not work 24/7.
6. The current system does not support Ad-hoc and statics reports, and the department is using Excel sheets to manage the cases. Problems arise if one of the users forgets to enter the case.
7. All transactions between different departments are made by paper only, which causes a lack of accuracy. The users use “MedicaPlus” system only to give a reference number to referrals.

2. Scheduling

2.1 Workflow process

When a patient arrives at the hospital, the receptionist will direct him/her to the Registration and Admission Office for who has first visit. The receptionist will then check the schedule to confirm the patent's appointment or book a new appointment. There are two possible situations in this scenario: 1) If the patient does not have an appointment, he/she will be directed to the Patient Affairs or Registration Office. 2) If the patient has an appointment, he/she will be directed to an examination room and then to the clinic for treatment (See Appendix B, Figure 1for more details.)

2.2 Scheduling problems:

1. Generally, the system does not support flexibility.
2. The current system does not have the ability to alert the user when there are duplicates, conflicts, or changes in scheduled appointments.
3. Users face difficulty in rescheduling appointments and changing schedules appointments.
4. The current system does not provide a solution for overbooking problems.
5. There is no limitation for walk-in patients and add-on, which causes heightened pressures on the duty physicians as well as treatment delays.
6. The system does not support an outpatient white board that allows clinic managers to view, monitor, and record information about the patients.
7. Sometimes the system hanging, for example, automated search for nearest appointment, which cause a wasting time for both users and patient.
8. The current calendar displays weekly bookings only, and does not show other categories such as monthly bookings.

9. The system does not support electronic communication with regards to issues such as eligibility for booking appointments and for consultations.
10. The users cannot track whether patients have received a short message service (SMS) notification about appointments or not.
11. The system does not alert users when, for instance, a physician has gone on vacation and is not available.
12. According to hospital policy, a patient's treatment will be suspended if he/she misses three appointments. However, the current system does not support this policy. (See Appendix B, Figure 1).

2.3 OPD problems:

1. According to hospital policy, if a patient does not show up for three appointments without having a valid excuse, the system should discharge the patient. However, the system does not support this policy, as staff members have to enter the information manually and "no-shows" are not always recorded.
2. The physician gives the patient a paper slip in order to make an apportionment. This cause overbooking problems and hand writing errors.
3. The current system allows for the user to overbook and to add patient visits outside of working hours.
4. Consultation is an important step in knowing the background of each patient. Nevertheless, physicians sometimes make an appointment before doing a consultation. Because the appointment is based on paper, confusion and delays in providing treatment can result.

3. Registration Management

3.1 Workflow process

The receptionist will register the patient as long as he or she has medical eligibility approval. The receptionist will fill out the registration form, which contains demographic information and a confidential agreement, and will then register the patient on the system. Finally, the receptionist will request the Medical Record Department to open a paper file for the patient. The receptionist will review the admission request for the physician for the inpatient visit and book a bed. Finally, the receptionist will direct the patient to the ward with his or her file. (See Figure Appendix B, 1 for more details.)

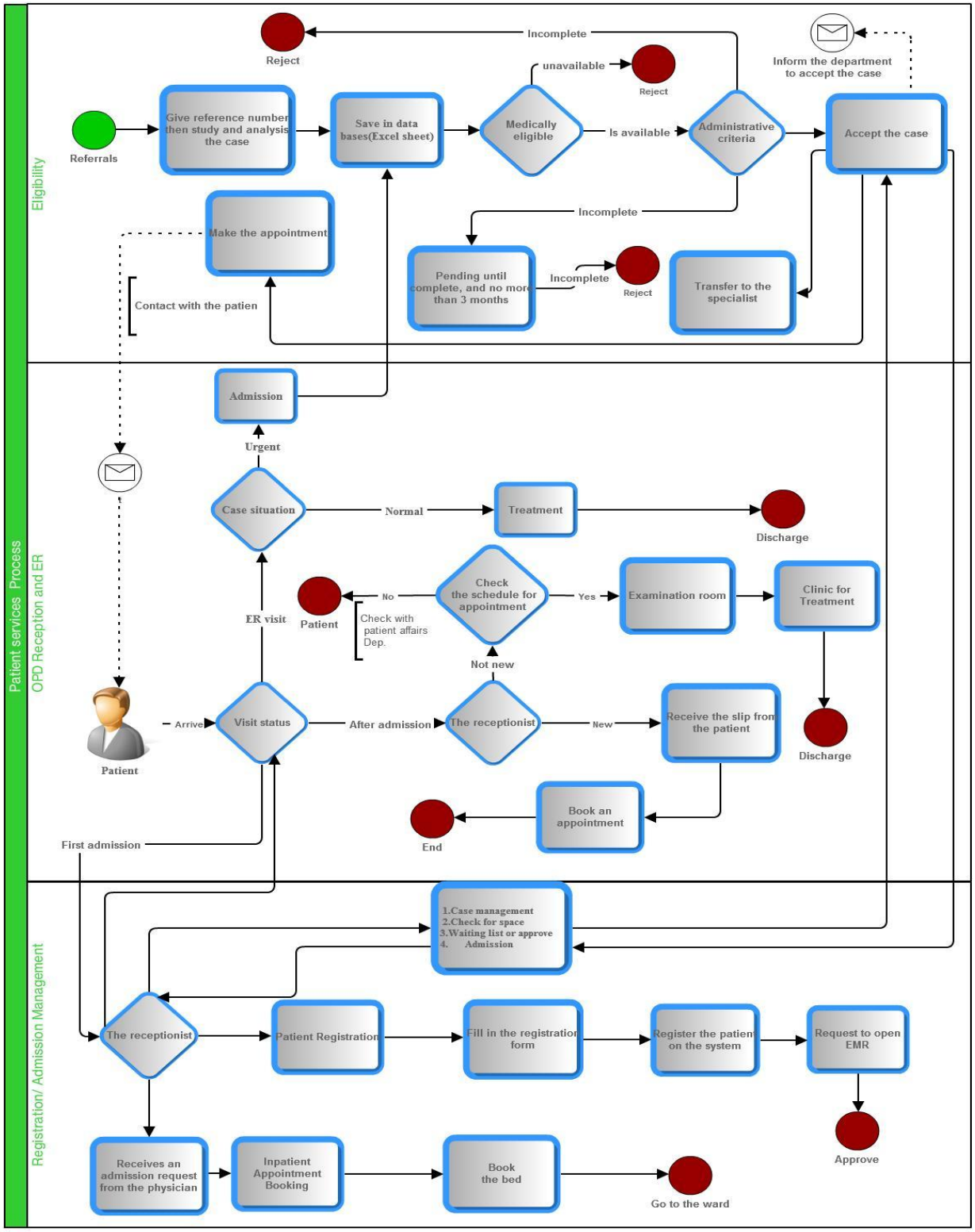
3.2 Problems

1. Because the current medical record is on paper, there is a delay in receiving the file from other departments, such as the Medical Eligibility and Medical Record Departments.
2. Recently, the hospital added a new service providing medical treatment for specific patients paid for by specific companies. This new service has not been added to the current electronic system.
3. Sometimes, it is difficult to identify from the system whether the patient has already opened a medical record file or not, which causes delays in providing treatment.
4. The difference between Arabic and English sometimes causes a duplicate in a patient's name on the system because there is no clear electronic dictionary or standard for specific spellings.
5. The system still lacks basic rules and can, for instance, give the age of a patient by a minus sign, which indicates a future date of birth.

6. There is no clear restriction or authorization to activate a file on the system. For example, the sheet for editing dimorphic patient data is included in the activation file icon, whereas it should be separate. Moreover, the system does not support activation restricted to specific clinics, which means it makes activations general for all clinics.
7. When the patient has been discharged from the clinic, the system does not prevent the discharge from other clinics, too. Therefore, the patient has to go in person to solve the problem with the Registration Office. This adds to the general confusion and increases the workload as well.
8. The current system does not support following statics regarding admissions and registration work, such as the number of admissions by date and user.
9. The current system of SMS is not accurate. For example, sometimes the system sends just one message without confirming that it is "waiting for the eligibility coordinator". As a result, the patient might have to wait a long time, or he/she might have to call the Registration Office to inquire on his/her status.
10. Regarding patient time management, there is no alert if a patient extends the length of his/her stay. On the other hand, some patients who are already discharged may still exist on the system. As a result, this will cause an increase in wait times and lower the number of patient admissions.
11. There is no tracking of any changes to future appointments.
12. The system does not accept more than one appointment per patient. Therefore, if the patient has an appointment with another department, the first appointment will automatically deleted from the system.
13. The current system does not support viewing of Admission requests for end users.

14. In order to print an appointment slip after booking a patient, a clerk has to go through many steps, as the current system does not support automated printing.
15. The function for booking of admission appointments is similar to the function for admitting, which causes confusion for the staff.
16. Some patients cannot be discharged from the system because their medication order has not yet been cleared from the pharmacy, even if the patient has already received his/her medicine.
17. Patient discharge will be delayed if a nurse forgets to release it, as there is no alert message in the nursing system to remind the nurses. Similarly, in the admission system, there is no alert that the patient is still an inpatient.

Figure 1: Patient service processes at KFSH-D. Source: By the author.



4. Health Information Management

4.1 Medical record

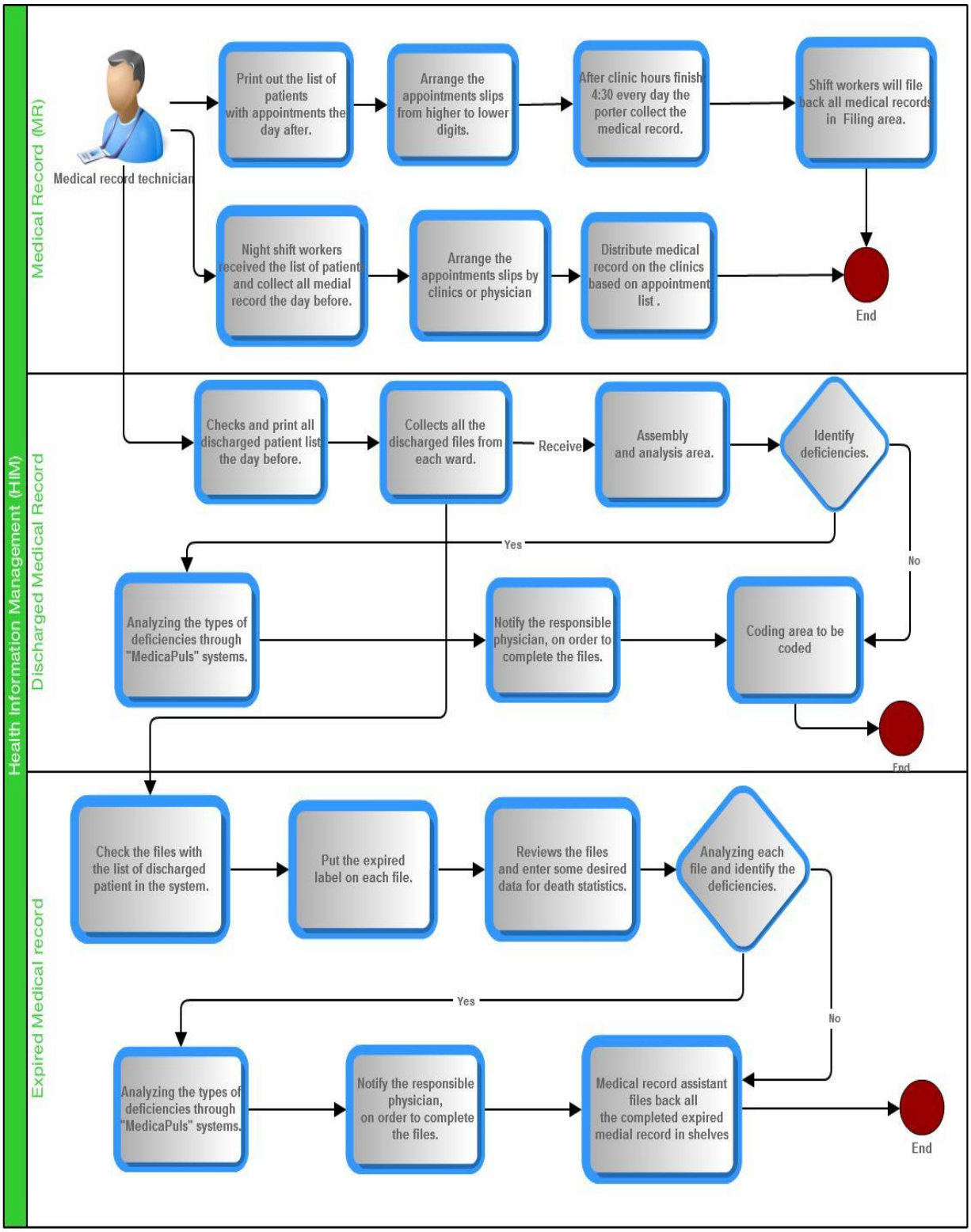
4.1.1 Workflow process

The medical record technician opens a patient file after receiving approval from the Registration Office. The night shift workers receive the appointment list and collect all medical records the day before, arranging the appointment slips by clinics or physicians. Finally, the porter will distribute all medical record files and then recollect the medical record files from the clinics every day at 4:30 p.m. The porter will depend on the appointments' ranked list (printed the day after by shift workers), after which a shift worker will file the medical records files in the filing area. (See Appendix B, Figure 2 for more details.)

Regarding discharge, the medical record technician will check and print all discharge lists the day before. After the porter collects the discharge files from each ward, the medical record technician will study and analyse the files in the assembly area. The medical record technician will then send the discharge files to the coding area, if there are no deficiencies; however, if there are deficiencies, the medical record technician will analyze the type of deficiencies though "MedicaPlus", and the technician will notify the responsible physician to complete the files. This last step might take 10 days or more, based on the physician's response. After the files have been completed by the physicians, the technician will send the files to the coding area (see Appendix B, Figure 2).

Expired files will have the same work flow as discharge files, with the following two exceptions: 1) The technician or medical record assistant will review the files and enter some desired data for death statistics before identifying the deficiencies. 2) The expired files have specific shelving areas (see Appendix B, Figure 2).

Figure 2: Health Information Management-1 (HIM) at KFSH-D. Source: By the author.



When there are missing medical records files, shift worker will receive a list from the night shift worker and will start a search for possible medical record file locations. There are two options: 1) The files will be located and sent directly to the ward or clinic. 2) The files will not be found, in which case a temporary file will be opened and sent to the ward or clinic (see Appendix B, Figure 3).

4.1.2 Problems

The current system does not support electronic transactions, and all medical records are paper files, which makes it challenging for the staff to manage health information properly. The following are the most important challenges:

1. There is no tracking system for medical files, which makes it difficult to locate them and causes wasted time.
2. The current system does not support the automatic assembly of medical statics records.
3. In order to rectify the deficiencies, the staff sends three memo reminders within 10 days until the physician responds. This process is done manually, which causes an increase in the work load and wastes staff time.
4. Sometimes the staff is unable to locate the consulting staff or physician on the system.
5. The system is not updated by the workflow.
6. The current system does not yet support bar code technology.
7. The medical file can be opened by the Emergency, Eligibility, and HIM Departments, which might cause file duplication if more than one department opens a file about the same case.

4.2 Coding

4.2.1 Workflow process

In the coding area, the coder technician will receive all discharge and complete files within one to two months. The coder technician will pull out all of the medical record files and will code them using 3M code finder and the ICD 10 Australian model. Finally, the porter will file all medical record files in the filing area (see Appendix B, Figure 3).

4.2.2 Problems

The hospital relies on the ICD 10 Australian model to code medical files. However, this reliance brings the following challenges and issues related to coding process and system:

1. There is no an appropriate way to retrieve the data from the system.
2. Because the data is stored on the system according to date of coding, not date of patient discharge, it is difficult to retrieve the data for research or decision support purposes.
3. There is a connection between medical records and coding; therefore, any delay in completing medical files will cause a subsequent delay in coding as well. As a result, the coding is not up-to-date.
4. Hand writing can also cause a challenge to staff if it is not clear.
5. Generally, the current system does not support the automatic coding of medical discharge files.

4.3 Medical report

4.3.1 Workflow process

When the patient arrives at the medical report reception, the receptionist will ask the patient whether he or she/ needs Arabic or English. If the patient requests an English report case,

the medical report coordinator will request a medical report from the physician. The physician will dictate the report by phone and through software, and an outsource staff will transcribe the report. Next, the medical report coordinator will inform the physician that the data has been entered into data based. The physician will then make an E-sign, and the medical report coordinator will print it and attach any other requests such as lab test results or x-ray images. All of this will be submitted to the patient.

If a patient requests Arabic, the medical report coordinator will receive a letter from a governmental entity and will ask the physician to write the report. The transcriptionist will type the report and send it to the physician. The physician will print and sign the report, and send it to the medical report coordinator. Finally, the medical report coordinator will submit the report to the receptionist than to the patient. The patient can also make an online request for a medical report (see Appendix B, Figure 3).

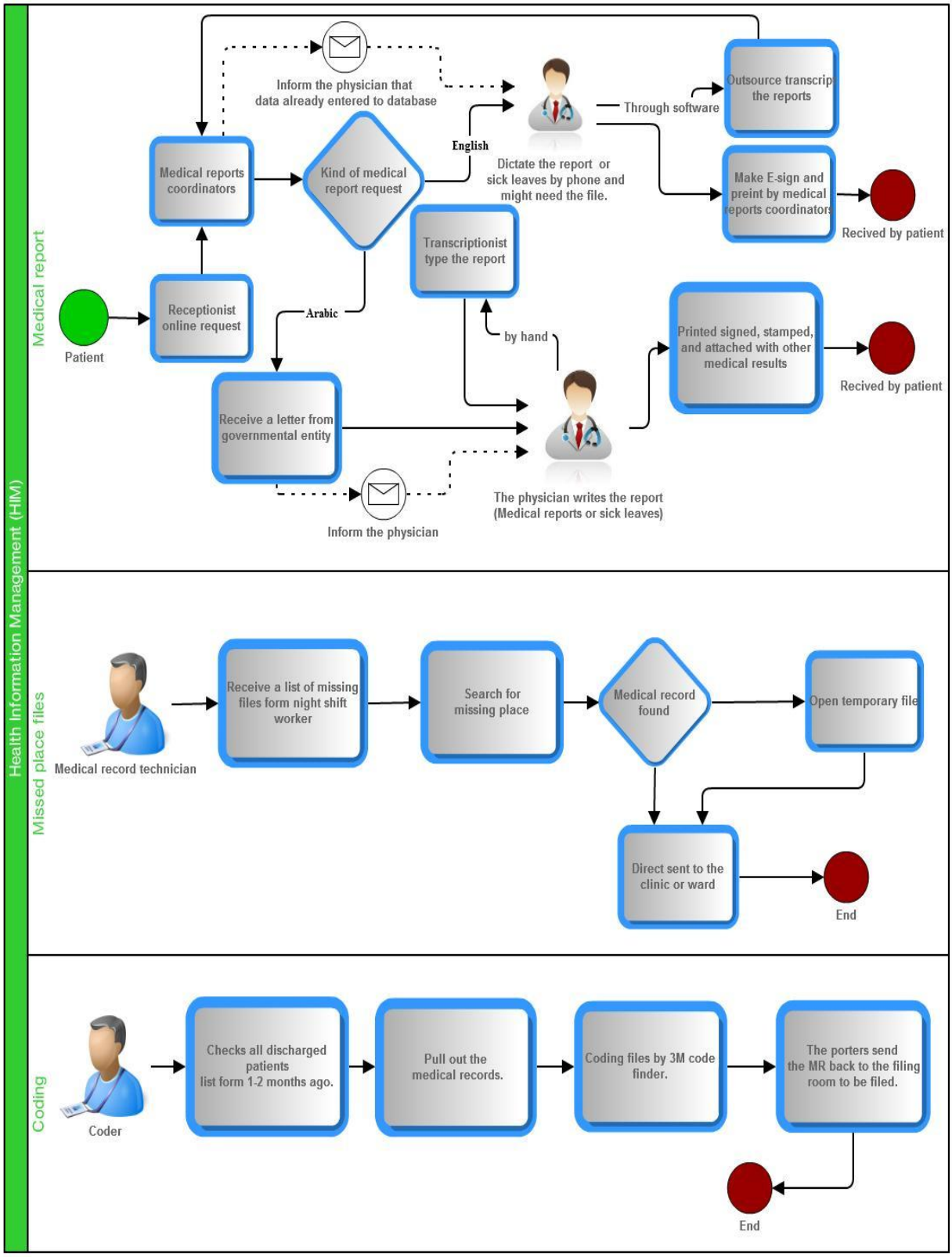
4.3.2 Problems

1- The physician might need the files. However, because the current files are not electronic, the physician has to attend at medical report area, causing service disruption and delays.
2- The transitions among staff regarding requests for Arabic medical report made manually. This causes a waste of time for the staff and delays in service delivery.
3- Difficulty in locating files.
4- Difficulty in retrieving past medical reports.
5- The current dictation system (“VIA”) is not integrated with the current system “MedicaPlus”.

5. Billing

The hospital provides free treatment for all citizens as long as they have medical eligibility supported by the Ministry of Health. The current system does not support patient billing; however, there is another finance system to calculate the cost of expenses. Recently, the hospital added a new service, which is providing medical treatment for patients paid by specific companies, but this new service has not yet been updated on the current system. The hospital needs to add patient billing in the medical record system even if the current treatment is free because there is a tendency from the government to apply medical insurance to all citizens. Moreover, there is a tendency by the hospital to make some treatments paid.

Figure 3: Health Information Management-2 (HIM) at KFSH-D. Source: By the author.



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