

Analysis and Implementation of Barcode Tracking System

by

Amal AL-Saffar

B00563775

am825911@dal.ca

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King Fahad Specialist Hospital-Dammam, Saudi Arabia

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This is to also declare that this report was written by the author and has not received any previous credit at this institution or any other.



Amal Al-Saffar

Executive Summary

Health data is an essential part of health information management because it constitutes the building blocks of information. Once data is analyzed and processed appropriately, meaningful and valuable information can be obtained that enables healthcare professionals and administrators to make informed decisions. These can be made on a clinician level (healthcare plan, treatment options, and outcomes) or on an organizational level (statistical reports, strategic planning, and implementation).

As the quality of health data and information is vital to decision-making activities, healthcare organizations need to adopt up-to-date Information Management regulations and information technology innovations to ensure the quality of data and medical records handling. One of the main issues in handling records is tracking the files as they are transported from one department to the other, which could impose a huge risk for loss, damage, or misplacement. To overcome these issues, most healthcare organizations today implement IT solutions such as Barcode Tracking Technology.

King Fahad Specialist Hospital in Dammam, Saudi Arabia, is one of the largest hospitals in the country. It is currently facing numerous problems in the Medical Records Department, as records are continuously being misplaced and no track of records is being established. This impacts the accessibility and availability of records at the point of care.

The Barcode Tracking System, which is a module in the original hospital information system MedicaPlus, is presently being implemented. It aims to establish an effective tracking cycle to improve workflows and business processes, reduce misplacement incidents, reduce spent time and cost and ensure quality of information and record handling.

One problem that was detected during the formation of the implementation plan was the labeling module that does not support the required label printing method. The key solution to overcome the problem was applying Crystal Reports software to the labels in MedicaPlus in order to allow the required labeling range and commence record labeling as soon as possible.

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1 Introduction

Healthcare data is one of the most essential resources of any healthcare organization, as it frames the building blocks of information (CHIMA, 2009, p.57). Once collected, the data (whether clinical, demographic, coded or aggregate) is processed, analyzed, and put in context to form meaningful and valuable information. The health information helps healthcare professionals and administrators make effective and informed decisions regarding the type of services provided and their corresponding outcomes. The information also helps to improve the organization's strategic planning, communications, and day-to-day operations (CHIMA, 2009, p. 60).

Due to the monumental part health data plays at the point of care and the point of decision-making, data quality is crucial (WHO, 2003). Moreover, health data and proper data collection is vital for authorities at all levels of the healthcare system for generating statistical reports that will ultimately play part in resource-allocation and cost-reduction strategies (WHO, 2003). Additionally, gathering incomplete or inaccurate data will have a direct impact on the quality of the services provided, the mechanisms in which tasks are carried out and, eventually, the outcomes of care. Statistics Canada developed a Quality Assurance Framework that identifies six dimensions of quality: accuracy, relevance, accessibility, coherence, timeliness, and interoperability (CHIMA, 2009, p. 64). Adhering to such a framework would ensure the credibility of data, analysis, and reporting, which can positively influence the success of organizational planning and implementation activities.

Since healthcare data is very sensitive and confidential, all patient care-related data and information are documented and systematically organized in a medical record that is identified with a unique medical record number and undergoes periodic record audits to ensure ease of access, accuracy of data and safe delivery of care (WHO, 2003). This also serves to maintain the privacy and confidentiality of patients and their information. In each hospital, the Health Information Management Department (HIM) is responsible for handling patient records.

According to CHIMA (2009), information management is the "acquisition, organization, analysis, storage, retrieval and dissemination of information to support decision-making activities" (p. 62). Information management professionals follow laws and policies to ensure secure access and handling of information as they facilitate the availability of the

right information to the right person at the right time (AHIMA, n.d., para 1). Given the increasingly growing importance of health data and its use along with rapidly changing information management guidelines, in addition to the rise in healthcare costs and public expectations and needs, the need for incorporating information technology is evident and imperative, especially in light of emerging technological advancements (MEDPAC, 2004).

Information technology (IT) plays a major role in warranting the safety, security, accessibility, and availability of data and medical records, both paper and electronic. This is accomplished through the implementation of IT standards and protocols, database design and management, information and decision support systems employment and interoperability standards (MEDPAC, 2004). Taking into consideration that hospitals usually serve thousands of patients for multiple visits, this means that HIM departments store, manage, and secure thousands of records. As a result, there is a huge risk for loss, damage, or misplacement of files, in addition to delays during retrieval or mobilization of the records as well as legal liabilities (Health Informatics, 2008).

Under normal circumstances, there is no efficient active way of tracing the records once they exit the Medical Records Department or the patient units. Hospitals usually use logbooks to document MRN and the date and time the files are received; however, logbooks can be lost or misplaced, or staff members may forget to document the information. Based on the literature findings, there are several IT solutions for tracking medical records, that aim at disposing of manual tracking, one of which is the Barcode Tracking Technology (Torres, 2012).

Barcode technology in healthcare is primarily applied for tracking inventory assets, pharmacy medications, patient tracking and laboratory specimens (Torres, 2012). However, it has also been used for tracking medical records. Implementing this technology can significantly increase the efficiency in tracking file locations, finding misplaced files, tracking the date, time, and user ID, and improving HIM workflows (SMEAD, n.d., para 2,3).

Based on research findings and other hospitals' experiences, King Fahad Specialist Hospital in Dammam (KFSH-D), Saudi Arabia, decided to implement a Barcode Tracking System in order to reduce the chance of error, enhance workflows, and optimize the management of medical records and health information.

2 Organization Description

The healthcare system in Saudi Arabia has grown exponentially over the past few decades. In response, informatics solutions have been implemented in the larger hospitals to improve the delivery of healthcare services across the country. Even as it constantly expands, KFSH is moving towards providing the best care possible using the latest technologies.

2.1 King Fahad Specialist Hospital

The King Fahad Specialist Hospital was established in 2005 and has been increasing its bed capacity ever since. It is a referral-based hospital where cases requiring tertiary care are referred from other government and private healthcare facilities. The services include oncology, urology, general and specialized surgery, and nuclear medicine among others (Annual Report, 2011). Research and education are top priorities for hospital management, as the hospital aims at improving specialized care delivery and recruiting the most qualified professionals to ensure the delivery of quality patient care. KFSH-D follows the Joint Commission of International Accreditation (JCIA) standards along with the College of American Pathologists (CAP), adhering to the highest standards and policies of healthcare delivery (About KFSH-D, n.d. ,para 2).

2.2 The Health Informatics Department

The Health Informatics Department (HID) is one of several Information Technology Services at the hospital. HID is responsible for implementing health informatics and information technology solutions through constant collaboration with the Health Information Management Department, IT services, Training and Education Department, hospital management, and healthcare professionals. The department's role is to implement information systems, add new functionalities or modules and apply 3M coding (Departments, n.d.).

3 Project Description

Due to ongoing time-consuming and labor-intensive issues with handling medical records, limitations of the current information system (MedicaPlus), and bottlenecks hindering information management workflows, the HID proposed implementing the

Barcode Tracking System.

In the middle of 2012, the project team, in coordination with HIM, held several meetings to determine the system requirements (hardware and software) and specifications, the tracking cycle and the departments that will be affected by the change.

The project plan was set to unfold over various stages, which were as follows:

- Needs assessment
- System development
- Hardware purchasing, including printers, labels and barcode readers
- System installation
- Testing
- Label printing
- Records labeling
- Training plan

In view of the delay issues with the hardware suppliers, the team decided to seek other vendors, which unfortunately caused further delays. Eventually, the hardware items were received on June 24th, 2013.

4 Work Done

4.1 Orientation

The author was assigned a two-week orientation that involved rotating within the HIM department in order to understand the department sections, roles and tasks, and current tracking cycle. The orientation helped in forming a thorough understanding of the current handling and tracking of patients' records as well as identifying issues with business processes and workflows. Also, the orientation allowed the author to establish work relations with staff and communicate with other members that are involved in the project.

4.2 Job Description and tasks performed

The author was responsible for:

- Monitoring and analyzing current workflow
- Reviewing previously completed tasks and understanding system requirements
- Participating in the allocation and testing of printers and barcode scanners plan

- Communicating with other professionals involved in the project to ensure compliance with deadlines and progress of the project
- Identifying opportunities for improvement regarding the business processes
- Utilizing acquired knowledge and skills to participate and assist in implementing the Barcode Tracking System
- Developing the current phase project plan and staff training plan while utilizing project timelines
- Developing a new solution to facilitate the label-printing process in coordination with the project manager and HIM head
- Reviewing the proposed tracking cycle and identifying deficits
- Offering feedback and recommendations for improvement at the end of training

The main two tasks that were performed by the author were system analysis and implementation plan development. Analyzing current and new tracking cycles was the first part of the project. Analysis was performed and discussed with the supervisor. The details are explained in the Analysis section of the report.

Several meetings were held with Maha Al-Jasser (Project Manager) and Ihab AbuHamdeh (HIM head, supervisor) to review previous phases of the project, discuss the following steps, and formulate the implementation plan.

- Implementation:
 - Solutions for managing inactive files in coordination with Medical Records (MR) team were identified. The Logistics Department issued a memo ordering the transfer of inactive files (records of patients who have no activity in the hospital since 2008) to free up storage space for the active files, especially since the hospital is expanding. The plan came in simultaneously with the Barcode Tracking System implementation plan, causing the project to be put on hold until this issue is solved.
 - Developed the implementation plan
 - Printing and labeling phase: The Project Manager and author worked on changing the label printing procedure, as the printing method conflicted with the filing system used in the MR department.

5 Relation to Health Informatics Program

The project was an ideal opportunity to apply the skills and knowledge the author had acquired from the MHI program's courses and projects. The author's formal MHI training effectively aided in the successful completion of this project and in understanding the role of a health informatics specialist.

IT Project Management (HINF 6300) was useful for allowing the author to practice management skills, utilize the understanding of IT project concepts, and merge them into practice. Additionally, learning about a project's lifecycle and the impact of teamwork and task distribution helped the author to understand this particular project's plan and improve communication and cooperation skills.

Health Information Flow and Use (HINF 6101) was a rich resource for grasping knowledge regarding information systems. It also facilitated the author's ability to relate health informatics and IT to healthcare services.

Health Information Flow and Standards (HINF 6102) provided the author with the necessary skills required to design, interpret, and update data flows and business processes and relate them to HL7 standards.

Information Systems and Systems Issues (HINF 6110) provided a clear and thorough understanding of information systems and how to perform a system analysis. It also increased the author's ability to identify key issues and bottlenecks throughout a system's lifecycle, make recommendations, and propose alternative solutions.

Networks and Web (HINF 6220) helped the author to understand system integration, databases, and the use of wireless technologies.

Managing Change in Healthcare Organizations (HESA 5315) helped the author to be more conscious of the implications of introducing change in a healthcare setting in order to make an equitable transition that is acceptable to staff. The course also helped in formulating the staff-training plan and obtaining feedback for effective management, implementation, and administrative decision-making.

6 System Analysis

6.1 Current System Analysis

In the Health Information Management Department, the record goes into a cycle that begins and ends in the Medical Records Department. The business process model (Figure 1) illustrates this cycle.

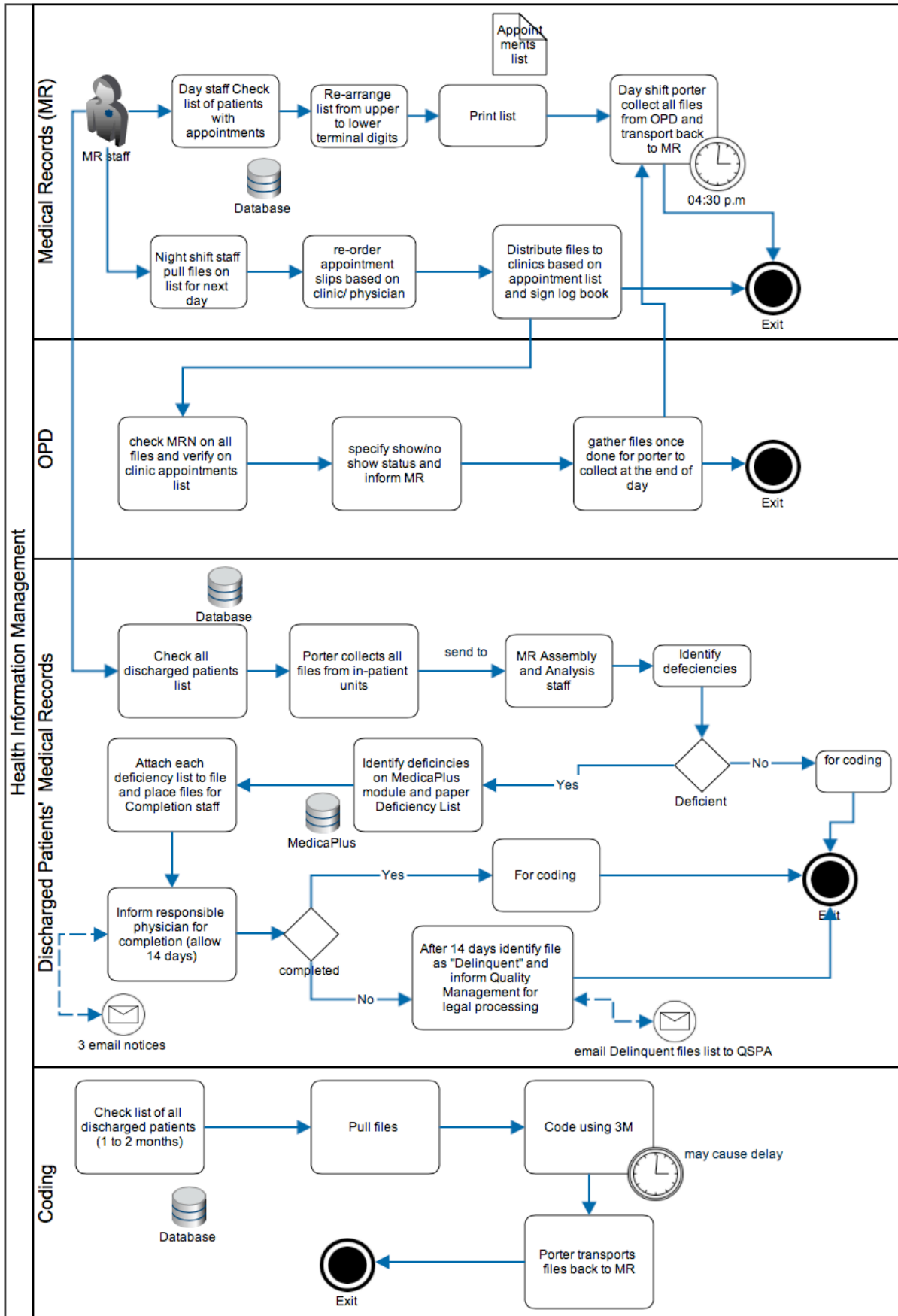


Figure 1: Current HIM Process

For recurring patients, the MR specialist checks the list of all scheduled admissions and appointments in Out-Patient Departments (OPD) for the following day and prints the list, after which the night staff pulls and prepares all of the files to be collected. Then, early in the morning, the MR porter transports the requested files to the in-patient units and OPD, based on the list. For those with appointments, the night MR staff rearranges the appointment slips based on clinic/physician.

In the units and clinics, there are logbooks for the MR staff to sign once files are delivered. Unfortunately, the staff members do not always comply with this procedure or the logbooks get lost or misplaced. Consequently, there is often no way to confirm the receipt of files and no tracking record of the files. The risk is thus high for losing or misplacing files, which is the main reason why the HID is implementing the Barcode Tracking System.

At the end of the day, day staff porters collect all discharges files from patient units and OPD clinics and return them to the MR department. Once there, the file goes through a data quality assurance process, as follows:

Assembly

When the patient file is received from inpatient departments after discharge, the documents must be ordered based on specific guidelines set by the information department. The admission and discharge dates must be verified on MedicaPlus. The workload is very heavy, especially when there is only one assembly specialist checking and re-organizing a large number of files per day.

Analysis

Once the file is assembled, it is sent for analysis. Specifically, the file is checked for discrepancies and misplacement of documents. In the system, the file is tracked using the MRN of the patient via the Deficiencies Management interface. For discrepancies, special stickers are attached to each page containing errors or missing information, such as dates and signatures, indicating the type of discrepancy. A green sticker and a printed deficiency list are attached to the file, which is then placed on the Completion trolley. On MedicaPlus, the deficiency list module is used to enter MRN of deficient files, followed by the type of deficiencies identified, as shown in figure 2. At the end of the day, completed/incomplete files statistics are manually entered using the Deficiency Statistics interface shown in figure

3. The overall statistics are generated biweekly and are submitted to the HIM's head.

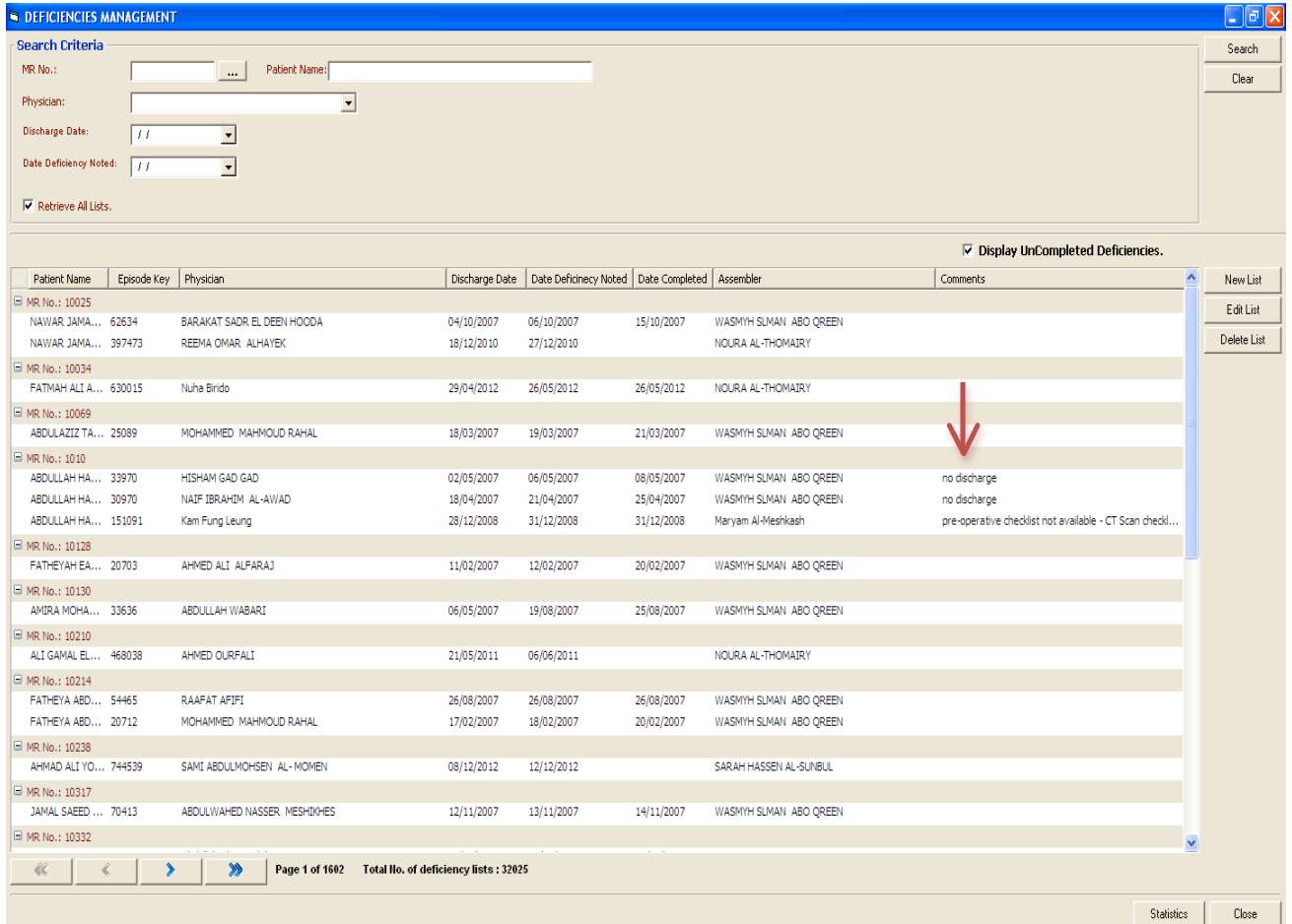


Figure 2: Deficiencies Management Interface

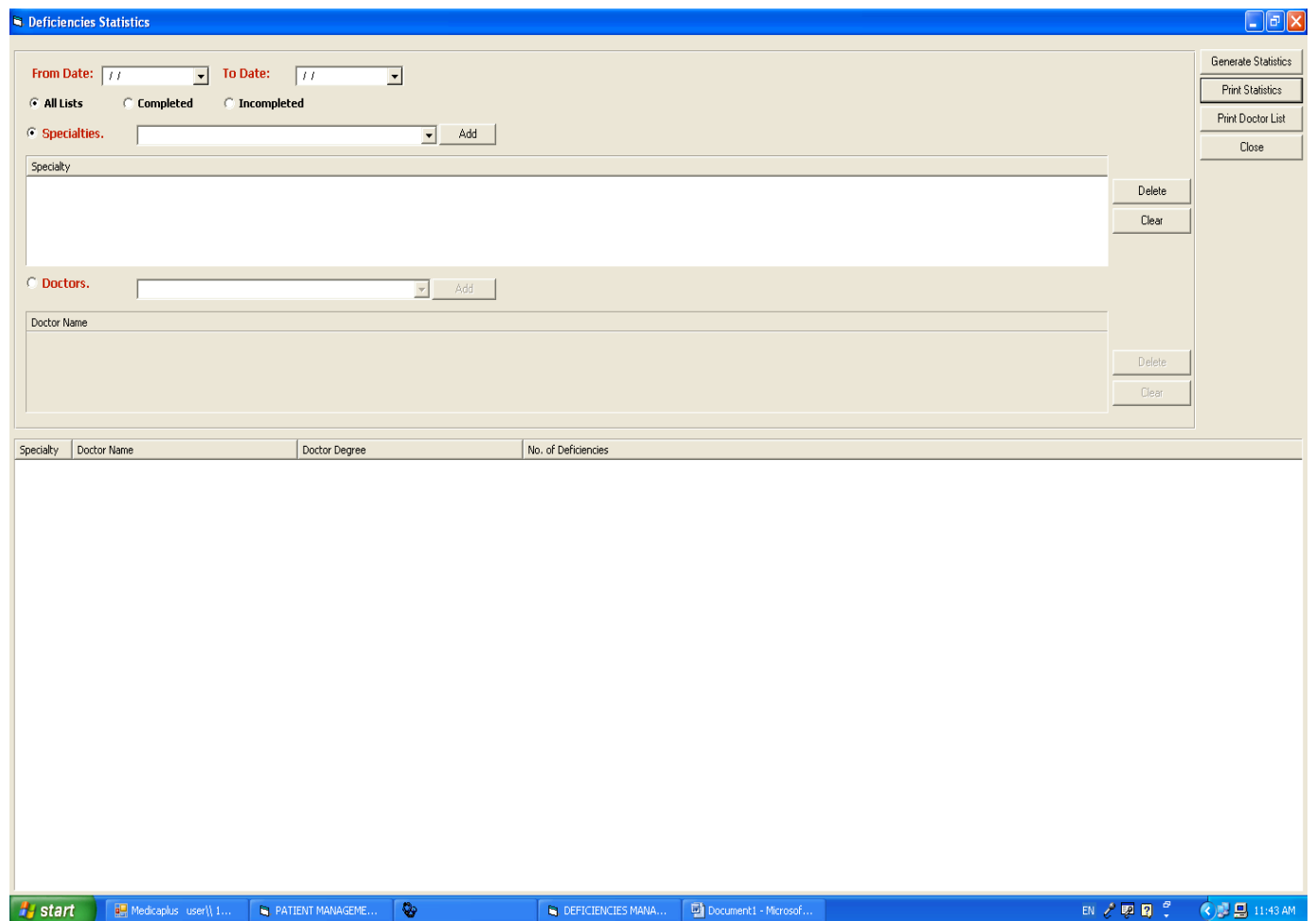


Figure 3: Deficiencies Statistics Interface

Completion

On average, 36-75 files a day are received for completion. A period of 14 days is allowed for completing the files. Employees check files for green stickers and deficiency lists to verify need for completion. Additionally, they check that the patient is on the MedicaPlus deficiency list. Files are categorized based on the terminal digit numerical system; however, for ease of access and workflow, employees categorize files based on department [General Surgery/ Organ Transplant, Orthopedics, Internal Medicine, Pediatrics, Neurology and Neurosurgery, Urology and Oncology]. They then schedule appointments via phone or email for treating physicians to fix their discrepancies. As dictated by policy, on the date of discharge, the first notice is forwarded by email to the treating physician and a CC to the HI Department Head and his assistant, as well as to the Medical Department Director and his assistant. The physician is given 7 days from the issue of the first notice to complete the file. If the file is not completed within 7 days, a second notice is emailed and a CC sent to Medical Director. The second notice is valid for 3 days. If the file is not completed within that time period, a third and final 3-day notice is emailed, along with a CC to the Chief Executive Director. If the file is not completed at that point, it is classified as "Delinquent", which has legal implications handled by the Quality and Strategic Planning Administration (QSPA). On MedicaPlus, if the file is completed, the completion date will be entered manually; otherwise, it will be marked as "Delinquent".

Coding

Once the file is completed or has no deficiencies, coders check lists of discharged patients dating back one to two months. The porter collects the files and begins the coding process using the 3M coding software. Once coding is completed, the porter returns the files to the filing area in the MR Department.

Filing

Completed files are placed on a single trolley and the Filing Department is contacted for pick-up. The files in the filing area follow the designated terminal digit filing system. The area currently stores both active and inactive files. A portion of the active files is transferred to the assigned storage area decided by the Logistics Department.

Quality and Strategic Planning Administration (QSPA) Involvement

The HI Department suffers from chronic understaffing, and so the quality department

relieves some of the pressure and workload on the Medical Records staff. As agreed on by the department's head, the quality department formed a committee that is responsible for making floor rounds for the purpose of checking discharged patients files at the inpatient department so that discrepancies can be fixed in a timely manner before sending them to medical records.

As for a newly referred patient, the Admission Office informs the MR of the new referral, after confirming through the Eligibility Department that the patient is eligible and meets the referral criteria. The MR specialist opens a file and attaches the requested original referral and admission forms, once they are delivered by the Admissions Office. When the patient is discharged, the file is returned to MR and the process shown in the business model begins.

Throughout this cycle, major problems were identified:

- **Broken cycle:** There is no record of sending or receiving files nor the ID of requestors and receivers; therefore, the only way to know the location of a file is via MedicaPlus by checking the patients' status, each MRN entered individually.
- **Workflow:** In the patient units or OPDs, multiple causes of delay take place. For example, the physicians might not discharge patients on time due to their heavy workload, or not write discharge prescriptions before the patients leave. Moreover, as a result of the chronic understaffing along with the multiple processes a file goes through, there is a great delay in delivering files to the intended areas and back to MR. Moreover, the files are checked and processed by many staff members in the HIM department, therefore, it takes a long time to locate a file. If the file is slated for completion or coding, it gets even more difficult since both processes require time to be done, in addition to the fact that the coding area is far from the rest of the department.

Also, the current system (MedicaPlus) does not support automated notifications, thus, the files remain in the completion area for a long time till the responsible physician comes in to fix the errors or fill in missing data. Due to the system inadequacies, the statistical data always lacks validity and credibility as the system fails to accurately capture and assemble data. According to WHO (2003), statistical reports are means of communication and serve as decision-making tools. Various

data and indicators are assembled and analyzed on daily, monthly and yearly basis and are then presented in meaningful graphs and tables that are useful to hospital management based on the purpose of these reports (WHO, 2003). However, given the limitations of MedicaPlus, statistical reports are generated manually using Excel sheets, as directed by the QSPA.

- **Data Quality:** In the assembly and analysis process, numerous deficiencies emerge such as missing documents, lack of dates or signatures, missing clinical data, redundant documentation, and misplaced documents. Poor documentation means poor data gathering, which, as explained previously, negatively impacts record handling, coding and decision-making activities. Additionally, it is time-consuming as the HIM staff and quality managers struggle to ensure that all the identified errors are corrected.

The implications of the issues identified above are overwhelming to all involved departments, hence, there are very few improvement opportunities to point out in comparison to the risks that are dealt with on daily basis. Through observation and analysis, the current cycle is evidently ineffective.

6.2 New System Analysis

The Barcode Tracking System is a module that is included in the current hospital information system (MedicaPlus), but it was not implemented before due to technical, budgetary, and administrative issues. However, due to the pressing workflow and data quality matters, the decision to implement the proposed system was approved by the hospital management. The Barcode Tracking System consists of multiple system components that are necessary to achieve an accurate, efficient and consistent tracking process (BarcodesInc, n.d.) These components include the following:

- ❖ Barcode Label-Printing software

The module is integrated in MedicaPlus and the process of converting the MRNs to barcodes was done when the hardware arrived.

- ❖ Thermal printers

These printers were purchased as they meet the specifications of the department.

- ❖ Ribbon labels

The material these labels are made of is specifically designed to tolerate unstable storage environment for a long period of time. The label contains three attributes, which are patient's name, MRN and the barcode.

- ❖ Barcode scanners

Wireless barcode readers were purchased as they are easy to use, easy to mobilize as they do not require physical connection to the other devices and require minimal maintenance.

For the purpose of allocating the hardware, several meetings were conducted with the HIM head, IT team and affected department heads. Determining the locations was based on floor designs and where the scanners are needed. The involved departments include OPD stations, Admission office, ER and Radiology (17 in total). The OPD clinics are categorized as zones since each three clinics share one reception station. The barcode readers distribution plan is shown in Appendix A.

The tracking cycle begins when the daytime MR staff check all patients for appointments on MedicaPlus the day before and print the list. The night staff pull files and organize them based on clinic/physician. The following day, the day staff scans the barcodes on the selected files. The scanned barcodes should match those shown in the "Requests Worklist" window (see figure 4). Once they are all scanned, the MR staff sends a "Transfer Request" to OPD clinics. All MRNs of the selected files will be shown the "Transfer Out Medical Records" panel below. If there is a newly scheduled appointment that was not in the list printed the day before, the MR staff will click "Refresh" at the bottom of the panel then select "New Transfer" .

At the clinic, a nurse verifies appointments and scans all files, which will then appear in the "Accepted Requests" panel. Next, the nurse clicks "Accept Request". Once done, the nurse clicks "Send back Request" to Medical Records. The MR porter collects the files by 04:30 p.m. and returns them to MR, where the staff verifies receipt of all transferred files and ensures that there are no missing files. The files are then sent to Assembly and Analysis, and so on. If a file MRN does not match anyone on the requests or receive lists when all the barcodes are scanned, the request is then rejected and the file is considered missing. The MR staff will follow up and investigate by reviewing the transfer out-back

cycle in order to determine the location of the file then inform the porter to collect it (Business Process in Appendix B).

Figure 4: Requests Worklist

The new cycle is far more effective in tracking records because the records are scanned and users can immediately confirm file locations. Within the interface, the status of the file and requests is coded using a color-shape system. For instance, an accepted request is green with a check mark, a rejected request is yellow with an X mark and a pending request is a white circle, as shown in figure 4. Also, the workflow is more dynamic, which improves the accessibility, availability, and handling of records. Furthermore, each sender/requester's ID is shown in the requests panel under "Requested by".

One issue was detected, however, which involves a case where a patient has more than one appointment. For example, if a patient has an appointment in the Oncology clinic followed by an appointment in the Urology clinic, the nurse in the Oncology clinic does not have the option of sending a "Transfer Request" to the Urology clinic or view the other appointment as the system itself does not allow it due to restrictions of access. The only option is to send it back to MR, because the nurse can only view the appointment list in

that particular clinic. The barcode scanning process is shown in Appendix C.

7 Implementation Plan

The implementation plan was developed by the author and reviewed by the supervisor and project manager. The main challenge during the implementation plan was sorting out the most efficient label-printing method and the manpower required for the files labeling process. In collaboration with the HIM head and labeling team, the latter issue was resolved by identifying the number of MR personnel who will be responsible for labeling and their schedule. Volunteering overtime was one of the options that the staff were willing to accept in order to start the labeling phase as planned and finish prior to the deadline (which was set as a maximum of 4 months).

The last phase of the implementation plan is the staff training. Based on the hospital's policy, any training involving the information system must be done by the Training and Education Department. A meeting was conducted with department heads of the areas included in the implementation plan to discuss the training plan. The plan was designed over two phases: phase one for MR staff and Admission Office, and phase two for OPD, ER, and Radiology. The department heads were required to introduce the new change to their staff as a preparation step for the implementation to be a successful experience. A PowerPoint seminar will be scheduled in a later date for the project manager to discuss the purpose of the project, identified goals, how the workflow and admission and discharge activities will be affected and the desired outcomes. Several presentations will be scheduled afterwards to illuminate how the system works and the practical training will commence shortly after by the Training and Education specialists. The complete plan is illustrated in Appendix D.

8 Health Informatics Challenge

8.1 The Problem

The most difficult problem to manage was the label printing method. The filing system is based on terminal digits, which means the files are organized and retrieved based on the last two digits of the MRN. For example, on the shelves, all records ending with "07" are

arranged systematically on the first and second shelves. When an MR staff looks for a file, he or she will look directly in the “07” section. Initially, the HIM head demanded that the label-printing method should be in accordance with the terminal digit filing system. The printing software does not take this into account and the printing is basically serialized. For instance, in the label-printing interface, there are two ways of printing. Labels can be printed either one-by-one by entering the targeted MRN or in a series by entering a printing range (e.g., 00006 to 02006). This sample range will include the first 20 records stored in the database. For logistic reasons, the priority for the department is to label the active files first; hence, the current range could include several inactive files and only a few active ones. As a result, the printing phase will be very time-consuming and the labeling process will be further postponed. As a result, the HIM head requested a new solution to be developed.

8.2 The Solution

MedicaPlus is a very limited and inflexible system and does not allow any alterations in the labeling module. Therefore, the author recommended using tables in order to allow the requested printing range. This will only include the active files by segregating the active patients MRNs from the inactive ones in a separate table from the database. A meeting with IT specialists and database administrators was arranged by the project manager where plausible solutions were explored. The IT team decided to go with one of the most effective solution allows the extraction of active files labels in a separate file that gets linked to the labeling software.

The original extension of the labels file in MedicaPlus is .RBT, which is a file extension associated with LEGO MINDSTORMS NXT applications that can be run by Microsoft Windows or Mac-based systems “.RBT File Extension” (Beare, n.d.). This file extension is embedded in MedicaPlus; thus, the filtration of active and inactive files took place and the labels were pulled and re-ordered based on terminal digit using Crystal Reports software. Crystal Reports is a type of application that enables creating, running or reformatting data in the database (Taylor, n.d.). A new file is now generated as a “report”, which is linked to the label-printing interface. Consequently, the files were separated both physically and electronically. Similarly, the labels can now be printed, in terminal digit sequence,

separately to optimize efficiency in the labeling process and not exceed the enumerated time period in the project plan. The barcode label-printing module and interface are shown in figures 5 and 6, respectively. The label-printing process is illustrated in Appendix E.



Figure 5: Label-Printing Module

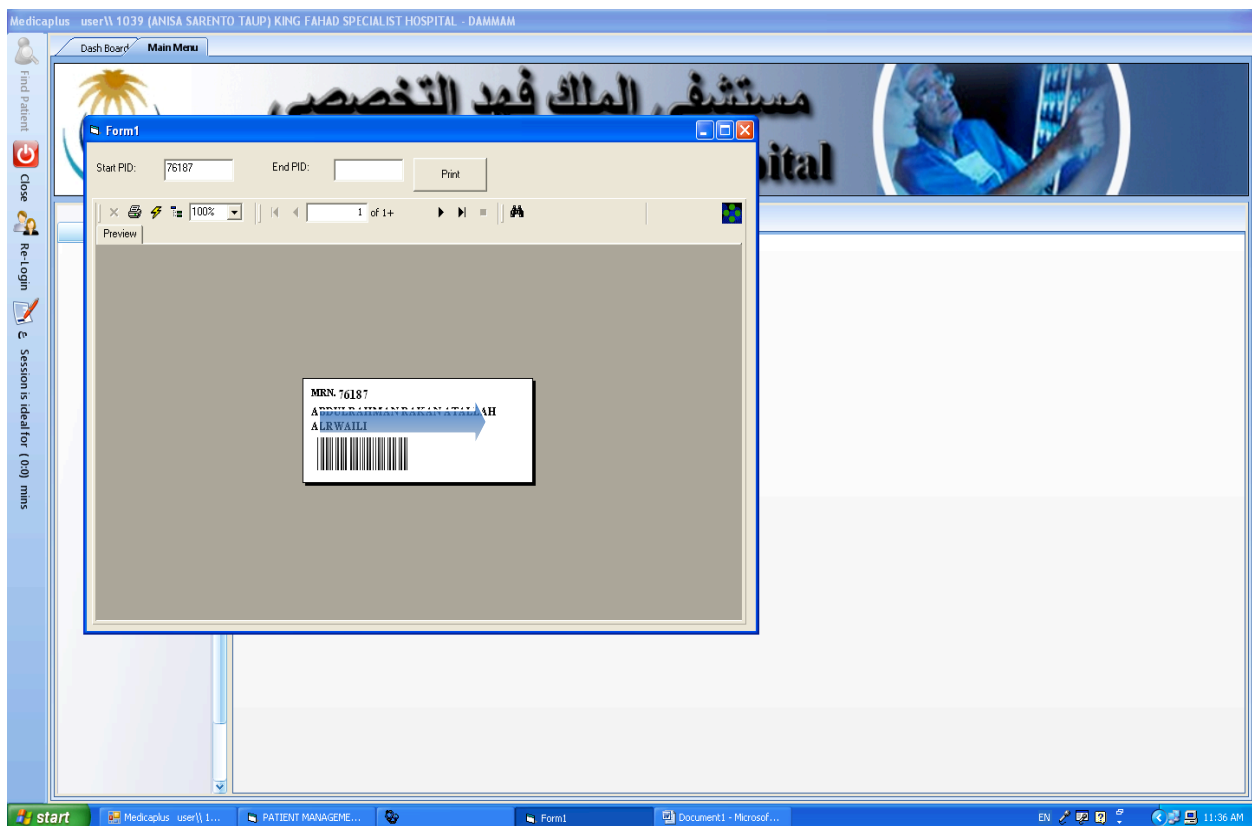


Figure 6: Barcode Label Interface

9 Conclusions

The Barcode Tracking System is a crucial tool for effective Information Management, as it ensures successful tracking of patient records. The current and new system analysis was performed and completed for the purpose of identifying problems and suggesting appropriate solutions in order to improve business processes and information flow, in addition to the efficiency of record-handling and maintaining data quality.

The main issue in implementing the Barcode Tracking System was the labeling process. By applying Crystal Reports application to the labels file in MedicaPlus, the problem was resolved. The labeling process has begun and is estimated to be completed in four months. The staff education plan was discussed and completed ahead of time in order to begin staff training in accordance with the project plan in preparation for the Go-Live phase in 2014.

10 Recommendations

Throughout the internship and project implementation, several recommendations were made by the author regarding further improvements to ensure adequate and timely handling of health information. Workflow-related solutions were suggested and a few functionality-related ones were added to improve the use of MedicaPlus, as follows:

- Add automated notification for responsible physicians needed for completion.
- Add "Send Transfer Request" to other units/clinics functionality for patients with multiple appointments/procedures.
- Develop a data SharePoint solution between various HIM sub-departments for the time being to improve file locating and, enhance communications and share lists.
- Generate statistics and reports for better decision-making at the management level.
- Ensure effective intradepartmental communications.
- Develop policy and procedures for the Barcode Tracking System to ensure staff compliance with the tracking process, improve their understanding of their roles and responsibilities in handling patient files and what to do in case of misplaced/lost files.
- Perform periodic system maintenance to avoid system shutdown and develop an alternative plan should a shutdown actually occurs.

- Re-assess workflow for problem detection and improvement.
- Develop an evaluation plan to determine the success of the project, short-term and long-term goals.
- Create new lines for recruitment, as the department is extremely understaffed.

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Appendices

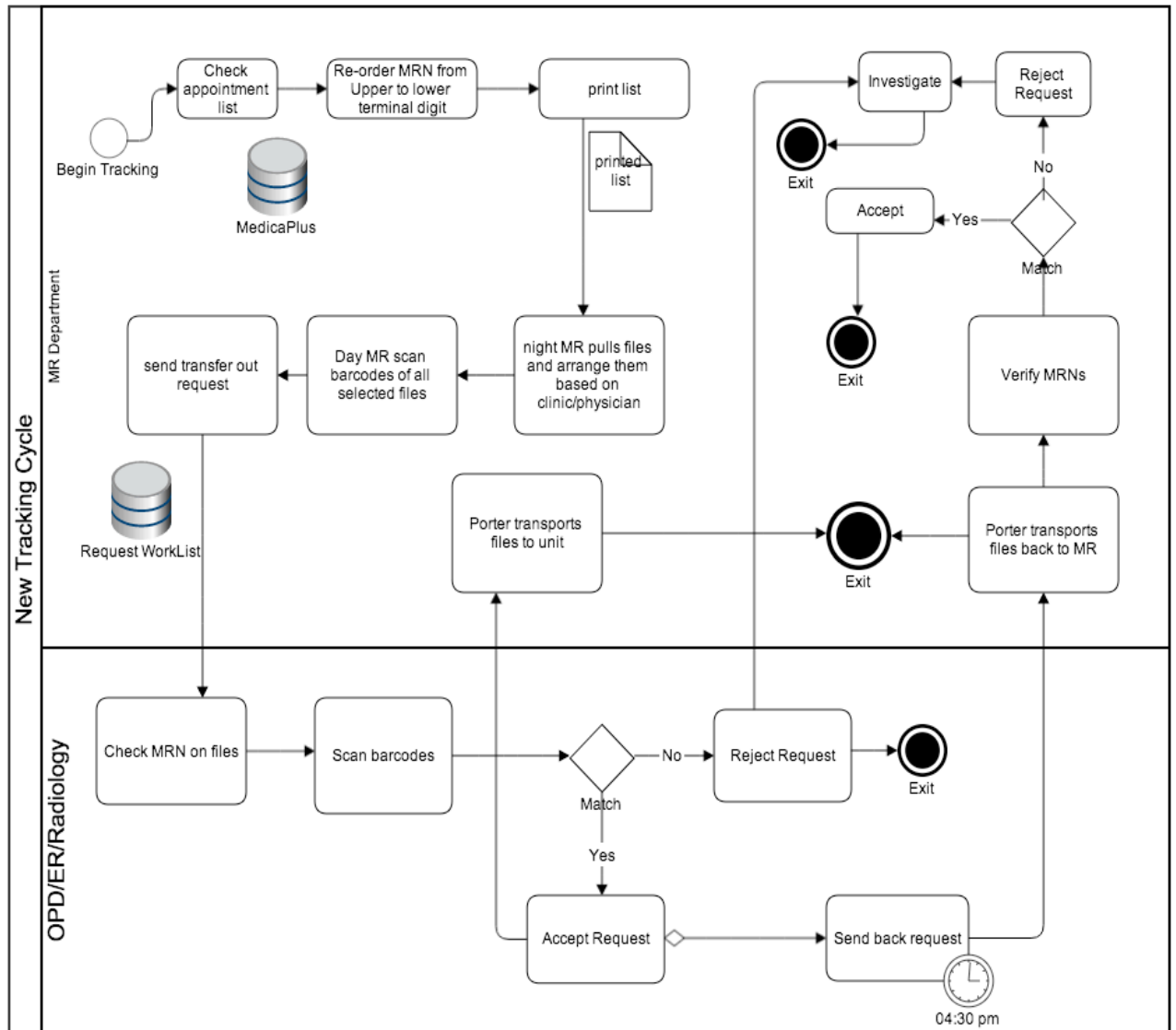
Appendix A: Barcode Readers Distribution Plan

By Project Manager

Area	Number of devices
OPD Zone1	
1- Cardiology	1
2-Rehabilitation	
3- Mental Health	
OPD Zone2	
1-Neuroscience	1
2- Transplant	
3-Oncology	
OPD Zone3	
Main OPD	1
OPD Zone4	
Family medicine	1
OPD Zone5	
1-Oncology Center	1
2-Onc Emergency	1
3-Dental Clinic	1
Admission Office	
Reception	1
Medical Records	
1-Filing area	4
2-Medical information	1
ER	2
Radiology	2
Total	17

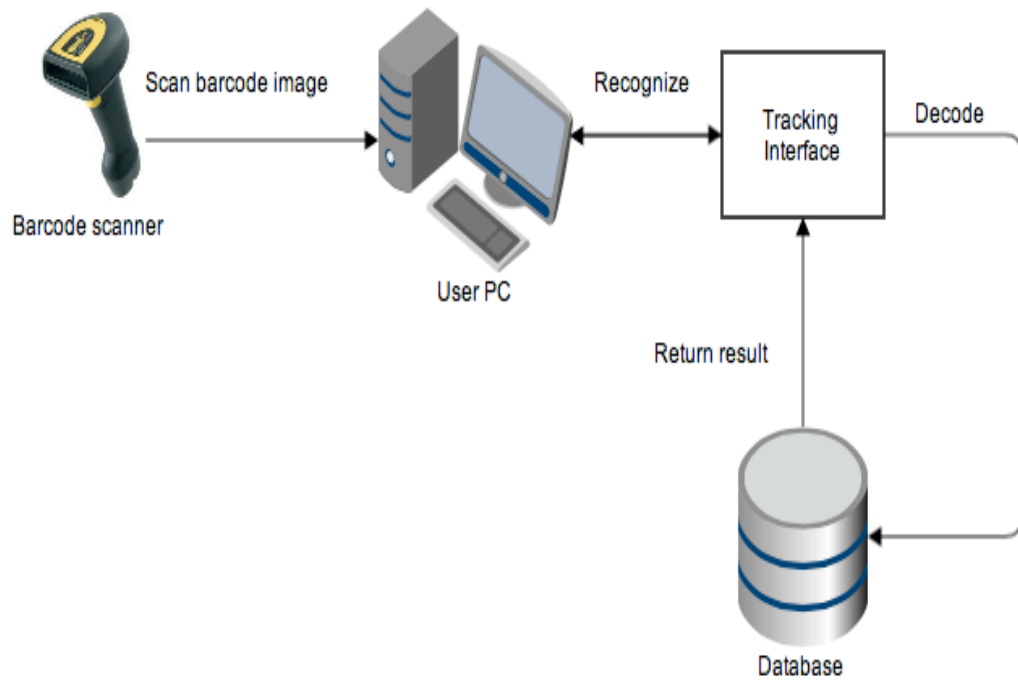
Appendix B: New Tracking Cycle Business Process

By Author



Appendix C: Barcode Scanning Process

By Author



Appendix D: Project Implementation Plan

By Author

Task Name	Start Date	End Date	Assigned To	Q3			Q4			Q1					
				Jul 2013	Aug 2013	Sep 2013	Oct 2013	Nov 2013	Dec 2013	Jan 2014	Feb 2014	Mar 2014	Apr 2014		
Section 1 -Preparation	07/08/13	10/17/13		Section 1 -Preparation											
Meet with HI management and IT Heads	07/08/13	07/08/13	All team	Meet with HI management and IT Heads											
Allocate printers and barcode readers	07/10/13	07/10/13	Maha	Allocate printers and barcode readers											
Set up printers and readers	10/14/13	10/15/13	IT	Set up printers and readers											
Prepare printers' ribbons	10/15/13	10/16/13	IT	Prepare printers' ribbons											
Testing	10/17/13	10/17/13	IT	Testing											
Implementation	09/02/13	03/07/14		Implementation											
Phase 1:Re-design label printing process	09/09/13	09/27/13	Amal & Mah	Phase 1:Re-design label printing process											
Design label printing plan	09/02/13	09/26/13	Ihab	Design label printing plan											
printing labels	09/16/13	10/04/13	MR	printing labels											
Start Labelling files	10/07/13	03/07/14	MR	Start Labelling files											
Design preliminary process flow	09/10/13	09/10/13	HI team	Design preliminary process flow											
Meet with Nurse managers	09/25/13	09/25/13	Hi team	Meet with Nurse managers											
Distribute barcode readers to allocated stations	01/06/14	01/08/14	IT	Distribute barcode readers to allocated stations											
Testing	01/08/14	01/08/14	IT	Testing											
Phase 2.Set up clear process flow	11/07/13	11/07/13	HI Team	Phase 2:Set up clear process flow											
Tracking system seminar	01/22/14	01/22/14	Maha	Tracking system seminar											
Staff Training	10/01/13	04/08/14		Staff Training											
Meet with Staff Training and Education Department team	10/01/13	10/01/13	HI team	Meet with Staff Training and Education Department team											
Meet with Departments Managers	10/02/13	10/02/13	HI team	Meet with Departments Managers											
Set up staff training plan	10/02/13	10/15/13	Amal & Mah	Set up staff training plan											
Revise Training Plan	02/04/14	02/05/14		Revise Training Plan											
Medical record staff training	TBA		Training Dep												
others training	TBA		Training Dep												
Go-Live	04/07/14	04/08/14		Go-Live											
go-live medical records staff	04/07/14	04/07/14	All	go-live											
go-live Other units	04/08/14	04/08/14	All	go-live											

Appendix E: Label-Printing Process

By Author

