



Philippine Orthopedic Center Hospital Information System

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Abstract: Currently, there are plans to privatize public hospitals here in the Philippines because of poor management and lack of financial resources to provide quality healthcare services. On one note, privatization can solve the lack of finances as private institutions will invest in it. However, it will merely become businesses as these hospitals increase cost of services which delineates itself from the main objective of the establishment of public hospitals. One of these hospitals lined up for privatization is the Philippine Orthopedic Center.

POC is the main public hospital catering to orthopedic cases. Its role in providing healthcare services is crucial. However, it experiences delay in transmission of both request slips and charge slips which facilitate interdepartmental communication. In some cases, these slips even get lost. These pose great problems because charge slips dictate financial revenue while request slips dictate the ability to accomplish its services.

To address these, a hospital information system will be developed in which the interplay of departments is highlighted. Hence, modules of the system will cover from the registration of a patient to its diagnosis (inpatient or outpatient), and the different specialty departments which offer specialized medical services such as pharmacy, laboratory, and radiology. All these will terminate in the billing module and medical records.

After series of intricate design and development, the HIS built is able to capture all incoming patient information and facilitate the flow of data as patients go through transactions inside the hospital. After which, the system is also able to generate an accurate patient statement of account as compared to before wherein manual calculation was done. It also generates reports based on patient records and transactions as inputs to decision making. In present, the system is still undergoing minor fixes brought by system testing and will be for initial release mid-2015.

Key Words: Information System; Hospital Information System; Billing

1. Research Background

1.1 Domain Background

In 1945, American Army organized Philippine Orthopedic Center (POC) as the Philippine Civil Affairs Unit (PCAU) No. 1 in Mandaluyong. This was established to provide health services to civilians during the liberation of Manila and its suburbs. The focus of providing their services changed to accident victims and orthopedic cases after the unit was turned over to the Philippine Government. The name was also changed to Mandaluyong Emergency Hospital then to National Orthopedic Hospital.

The hospital was relocated to Quezon City in 1963. The hospital expanded that the authorized bed capacity grew from 200 to 500 then to 700. In 1982, the hospital was renamed National Orthopedic Hospital-Rehabilitation Medical Center (NOH-RMC) and later to Philippine Orthopedic Center in 1989 by virtue of Batas Pambansa No. 301 and Republic Act 6786.

Vision: To become the premier center of excellence in the art and science of orthopedic surgery and rehabilitation medicine responsive to needs of the nation and the international community.

Mission: We exist to provide comprehensive orthopedic care and rehabilitation, training and research utilizing world-class technology and expertise.

Core Values: Integrity - We are committed to serve with honesty. Excellence - We provide the highest quality medical care, training and education. Compassion - We empathize with our patients at all times.

1.2 Problem Statement

Daily, there are 700 patients entering the emergency room. The sheer number of patient everyday suggests that the amount of information in use is large. In order for the hospital to carry out the prime task of ensuring healthcare being delivered to patients, its independent departments must be positioned in such a way that inter-department communication is strong. Hence, the passing of information from one department to another must be timely. Therefore, there should be an integration of how one department receives and passes information from department to another.

The hospital uses request forms to facilitate inter-department requests. In standard, the nursing section, via the instructions given by the doctor, issues request forms to facilitate the request of the doctor for different medical works (e.g. lab tests by

the laboratory department or x-ray by the radiology department). The request forms contain information regarding the patient and the type of medical work to be done. It also contains some relevant information on patient history or accomplished pre-examination requirements. The request forms are then sent to the respective departments for processing. However, there are delays in the processing of the request forms due to bulk requests. Hence, the intended medical work to be done gets delayed or is not processed at all. For the hospital management, this becomes a source of customer complaints due to the delay of processing or inability to deliver the services.

In the case of the different departments, the usual process of delivering services is followed. Once a service to a certain patient is fulfilled, the different departments issue charge slips which contain information regarding the particulars of the transaction. The charge slips will be issued to the billing department for it to be included into the patient accounts. However, there are delays in the processing of the charge slips. In some instances, charge slips get lost due to heavy volume. With this, the billing department will not be able to include the certain transaction into the patient accounts. Internally, when the billing department receives the charge slips, it is then manually segregated into individual folders (patient accounts). Some charge slips are not segregated accordingly. In both instances, when the patient receives the statement of account, the bill is usually undercharged. This is beneficial to patients but is critical to hospital management. If undercharging is rampant, then there are losses or low turnover of profits. This will affect the overall financial capability of the hospital (although some percentage of funding comes from the government, the hospital also uses the financial resources from patient payments to fund various expenses).

1.3 Objectives

The objective of this study is to deploy a hospital information system that will log all patient-related hospital transactions to prevent undercharging of patients.

- To provide an avenue wherein the hospital can handle and process the requests to three specialty departments (laboratory, pharmacy, and radiology)
- To provide an avenue wherein the hospital can easily register and admit patients through automated registration.
- To provide an avenue wherein the hospital can easily generate various reports from

stored data for reporting and decision-making purposes.

2. THEORETICAL FRAMEWORK

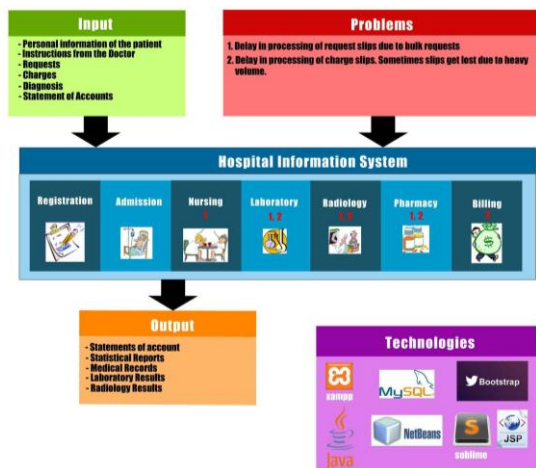


Fig 1. Theoretical Framework

Once a patient enters the hospital (ER department) to avail of healthcare services, initial patient information as well as the explanation of complaint will be logged into the patient registration module. The doctor who will be attending to the patient will be able to view the patient information encoded and complaint filed. The doctor module will facilitate the input of initial diagnosis. As the main tool for diagnosis, the doctor will need x-rays. The request for the x-ray will be facilitated by the nurse and be transmitted to the radiology module in which the staff from the radiology department can view the requests of the doctors. Since this is a case in the emergency room, the radiology department would process the request and place the patient first on line. After the return of the results, the doctor will then determine whether the patient be admitted (in-patient) or not (out-patient).

If the patient is for admission, the personal information will be needed by the admissions module for room assignment. Under the admissions module, the staff from the admissions department would be able to view and manage the different wards and assign patients to specific wards (with the proposition of the patient whether to be placed in the pay ward or charity ward). On the other hand, if the patient is deemed as out-patient, necessary medical procedures will be done and the respective charges of such will be sent to the billing module for the processing of patient bills. The statement of account will be produced and patient will be paying the

amount indicated for discharge. Once completed, the records and treatment summary of the out-patient will be sent to the medical records for archiving.

When the patient is admitted, the admissions module will send the ward information to the nursing / ward module to facilitate the admission of the patient. Once completed, the nursing will be able to view the patient information as well as the doctor instructions and diagnoses. Upon the receipt of an instruction from the doctor (as seen in the nurse module), the nurse in charge will be processing the request (either for medicines or medical examinations). The request will be sent to the respective modules immediately (medication requirements to pharmacy and medical examinations to either radiology or laboratory). This will solve the delay in request slip transmission.

The users of the three modules would be able to view all incoming requests. For the pharmacy module, there will be an inventory of medicines and upon request, pharmacy staff will check for availability. Once available, the medicines will be pulled out from stock and the staff updates inventory. Running out of stock will be rare since medicinal inventory is a primary need in a hospital. However, in such cases, the transaction of medicine with a zero stock level will not be allowed. In turn, the system will prompt the pharmacy department of immediate restocking an item reaches below the safety stock level. In the case of both radiology and laboratory, when a request is transmitted, both will proceed with scheduling of requests. After which, both departments would now push through with actual examinations. In the three modules, the end process (transaction termination) will be the filing of charges and sending it to billing module once transaction is completed. This will solve the issue on delay of charge slips.

The billing module will receive charges and segregate according to patient. Once patient is ready for discharge, the staff will manipulate total charges (from PhilHealth and etc.) if the need arises and produce the statement of account which the patient will use in settling the bill. Once bill is paid, nurses will receive notice for discharge. From the nursing module, all related patient information and treatment summary will be sent to the medical records for processing and archiving by medical records staff. This will ensure that once a patient is visiting again for check-up, the records of the patient will easily be retrievable.

The medical records will be collated and all patient information and transactions will be reflected. Medical records personnel may now use this module to generate statistical reports (such as injury reports, patient treatment reports, medical



examination reports, etc.) which is required of public hospitals to be submitted to the Department of Health for recording of health-related statistics as opposed to readily built systems which only is a form of information repository.

On the management side, the reports generated by patient transactions will be used to predict demand trends of injuries for a certain period. Demand trends will be based on recurring past patient treatment summaries (such as nature of injury of patients for a given period). This will make sure that each department will be able to address patient needs. Hence, the hospital will be ready ahead of time in anticipation of an increase of patients with a particular type of injury. The resources or materials needed for treatment can be prepared ahead of time as well as the health professionals needed to cater to the demand. Through this, the hospital may be able to deliver high quality healthcare (ability to tend to all needs of patients) through enough preparation.

Since the system will be able to collate historical medical records, the system will be able to predict the estimated cost for treating a certain type of injury. Based from the past billings of patients, the system can automatically give a rough estimate to the patient so as the patient can assess whether treatments are payable. Hence, possible losses that stem from inability of patient to pay can be decreased.

In relation to the billing, since the patient transactions are recorded and billed as fulfilled, the patient will be able to view its outstanding balance to keep patients informed through the use of a web system. This will ensure that the patient party will be able to prepare the needed finances ahead of time or whether cost cutting can be done (e.g. procuring medicinal supplies outside rather than with the in-house pharmacy).

3. METHODOLOGY

This project utilized the systems development lifecycle method or more commonly known as the SDLC or the waterfall method (Shelly, Cashman & Rosenblatt, 2007). SDLC is a framework that is followed by developers and systems analysts in performing tasks in software development. SDLC contains the description of the project, how it would be developed, how it would be maintained and how it would be replaced (Shelly, Cashman & Rosenblatt, 2007).

This method encapsulates all methods as to the activities performed in the whole duration of the

project. In addition, the waterfall method is a more traditional way of approach.

3.1 System Planning

The first stepping stone and foremost step in the waterfall method that was done was the planning phase. In this phase, data was gathered and analyzed to find problems in the organization (Shelly et al., 2007). In addition, the facts that were gathered served as the grounds that strengthened the need of an ICT solution. Since the phase entailed that the problems be identified, feasibility studies were also part of this phase. After which, findings were then presented to several advisers for comments and approval of the project.

With information about the process and problem cases at hand, the team was able to identify different problems from both the management level and the operational level. The identification of the existing problems enabled the team to push through with the study.

3.2 System Analysis

After the planning phase has been completed, the systems analysis phase was initiated. Since the facts and recommendations have been seen and approved by several advisers, the project continued anew. The analysis phase enabled the creation of a concrete model of the new system that was built and implemented in place of the old and cumbersome system (Shelly et al., 2007). Further and detailed fact finding was also carried out in this phase.

With both analysis of the existing system and its weak points, this serving as an input, the team modelled a more suitable alternative system that solved the problems encountered. The proposed system including modules for the domain was the output of this phase.

3.3 System Design

The systems design phase immediately followed after the analysis phase. This phase enabled careful designing of the new system (Shelly et al., 2007). This eventually served as the master plan with respect to the next phase of the waterfall method. The intended user interface of the system was designed carefully in this phase. In addition, the necessary inputs and outputs were identified to facilitate the flow of the system. Algorithms that were implemented in the system were also identified in this stage – pseudo code.

Since the input was the planned or proposed system modules, the output for this phase was the



architecture of the proposed system (on how the proposed system will be built), the different specifications of the program, and the program itself.

3.4 System Implementation

The next phase that succeeded the systems design phase was the actual implementation of the system. Based on all the designs that have been made in the previous phases (database, user interface, architecture, etc.) that were conformant and compliant of the requirements of the organization, this phase was the actual construction of the system (Shelly et al., 2007). The system that was produced in the implementation phase was patterned in accordance with how the process flows inside the organization. It was subjected to hardcore testing to eliminate flaws notwithstanding the testing done whilst system coding is in progress. Furthermore, documents were created as part of the outputs required to complete this phase.

The plans and blueprints of the proposed system including the system architecture were used to come up with the tangible system at the end of this phase.

The Philippine Orthopedic Center Hospital Information System was built using the PHP programming language.

PHP is used to interact with HTML forms of the user interface. It connects to a database for data retrieval and manipulation (Valade, 2004). Furthermore, it generates secure web pages in which users are prompted for a username and password before gaining access to the web page (Valade, 2004). It also has options for object orientation making encapsulation and abstraction plausible (Valade, 2004). Most of all, syntax and functions of PHP is easy to learn and implement making it the preferred language for web application development for both beginners and professional developers.

4. SYSTEM MODULES

4.1 Registration

The system will be able to capture the patient registration process. It will store pertinent information regarding the patient which is necessary for the whole duration of the hospitalization. If an existing patient record is not found, the user will be tasked to create one for the new patient. If the patient is a returning patient, the system will retrieve the old records which contain patient information and the patient is able to make changes if necessary. The registration process will also capture the nature of the incident which the patient needs to be treated for. It will be the baseline account

for all additional case logs to be appended into the patient account as the hospitalization process goes on.

4.2 Admission

If the case is severe enough, the patient needs to be admitted into the hospital to receive immediate care. When this happens, the system will be able to manage wards and spaces and look for vacancy to be assigned to a patient bound to be admitted into the hospital. Necessary room and board charges will start upon the admission of a patient and this also will depend on the type of room and boarding chosen by the patient. Once the patient is admitted, the patient will then be discharged from the emergency room and be transferred to the chosen ward type.

4.3 Diagnosis and Treatment

During an emergency case, the doctor will be performing emergency procedures. After the entire procedure, treatment details and case notes will be made available in the system. In addition, all pertinent chargeable items consumed and billable during the emergency procedure (which include but not limited to: supplies used, medicines administered, etc.) will be inputted into the system for proper billing. Once a patient is admitted, nurses will be able to log all diagnosis and treatment notes of a patient into the system for monitoring. The treatment data (e.g. undergone surgery) will serve as primary basis for treatment charges which will cover the entirety of the treatment process from specialty room charges, medicinal costs, supplies cost, medical paraphernalia to professional cost of the doctors involved.

4.4 Nursing Care

Nurses attending to the patient (and hence the nursing station concerned) will have access to the diagnosis and treatment reports to be able to monitor patient conditions. Thus, this aspect will enable users to be able to log case or treatment comments or logs into the system. It will also be able to capture the different vital signs of patients for easy monitoring of both doctors and nurses alike. Upon the orders of the doctor, nurses will be able to send requests for radiologic examinations, laboratory tests (which include services from the blood bank), or even the needed medicines from the in-house pharmacy to aid in the entire patient treatment process. In addition, the supplies that are used or consumed by patients will be recorded by the nurses (as supplies are stored in the nursing station and thus given to



patients care of nurses) and these charges will append into the patient accounts. Nurses will also be able to request for physical therapy for a patient.

4.5 Radiology

The system will be able to receive and collate all radiology requests of different patients in the hospital which was requested by the doctors care of the nurses on duty. In addition, the radiology department can schedule the requests for fulfillment as machines are limited. The request status can be updated by the radiology department to give updates to initiators of request such as the doctors and nurses. After the successful delivery of the service (when results are delivered to requesting parties), the transaction that successfully ended will be reflected into patient accounts with corresponding fees and charges for proper billing.

4.6 Laboratory

The system will be able to collate all laboratory requests of different patients in the hospital which was requested by the doctors care of the nurses on duty. In addition, the laboratory department can schedule the requests of extraction for fulfillment. The request status can be updated by the laboratory department to give updates to initiators of request such as the doctors and nurses. After the successful delivery of the service (when results are delivered to requesting parties or services are completed), the transaction that successfully ended will be reflected into patient accounts with corresponding fees and charges for proper billing.

4.7 Pharmacy

The system will be able to collate all requests for medicines of all patients in the hospital which was requested by the doctors care of the nurses on duty. It will be able to log the status of the delivery of the requested medicines. In addition, there will be an inventory of medicines to countercheck availability thus preventing imminent shortage. After the successful delivery medicines, the transaction will be reflected into patient accounts with corresponding fees and charges for proper billing.

4.8 Billing

The system will be able to collate all patient transactions properly and reflect it into individual patient accounts for proper billing. The patient may opt to settle the bill partially in the interim of the treatment process. The billing department will be retrieving the statement to date and paid amounts will just be deducted to the final bill once patient is

ready to be discharged. Once the patient is geared up for discharge, it will already be time to settle the full bill. The billing department would easily be able to obtain the total payable amount for each patient. The system will also be able to factor in cases where in patient parties are unable to settle the bill. In an event of unable to settle bill, a promissory note will be needed. If the patient is a member of the PhilHealth and details have been submitted during registration, the system will automatically calculate the amounts chargeable to PhilHealth (of which the PhilHealth will cover). This automates the once was old process of manually calculating the coverage amounts for each transaction. Further deductions will also apply to the patient bill for cases such as senior citizen benefits and the like. The system will then produce a comprehensive patient statement of account itemizing all patient transactions, the corresponding amounts for each, the amount covered by PhilHealth, the balances that patients need to pay, and other cases for amount deductions. The total amount will be reflected in the statement of account and must be settled accordingly. Once the bill has been settled, the payment will be logged accordingly and the patient will be discharged accordingly.

5. RESULTS, CURRENT STATUS AND CONCLUSION

After series of intricate design and development, the development of the Hospital Information System is primarily complete and functional. It is already able to capture all incoming patient information and facilitate the flow of data as patients go through transactions inside the hospital. After which, the system is also able to generate an accurate patient statement of account as compared to before wherein manual calculation was done. It also generates reports based on patient records and transactions as inputs to decision making. In present, the system is still undergoing minor fixes brought by system testing and will be for initial release mid-2015.

6. REFERENCES

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