



Our Lady of Lourdes Hospital

Executive Summary

Student Consultant, Radford Shiozaki & Rintaro Sato
Community Partner, Dr. Abundio Palencia Jr.

I. About the Organization

Our Lady of Lourdes Hospital (OLLH) is a private, non-profit, 50-bed tertiary hospital in Daet, Camarines Norte, Philippines. The hospital provides essential medical services to the residents of the entire Bicol region. The late Dr. Abundio Palencia Sr. founded OLLH in 1965. Today, Dr. Palencia's sons and daughter direct a majority of the hospital's clinical and administrative roles.

Official Vision

To establish the hospital as one of the very best in the entire southern Luzon area that takes care of the sick as well as the healthy person in all of his dimension.

Official Mission

To serve the community in all of its health related needs. Recognizing that the person is the sum of all that he is, the hospital is geared towards the care and well being of all the parts of the person -- physical, emotional, mental, and spiritual. We will work to contribute to the attainment of a happy and healthy community.

II. Improving Internal Communication and Information Management by Implementing a Framework for an EMR System

One of the top priorities identified by the hospital staff was to create an easy way to retrieve medical data. Currently, patient charts are paper-based and stored in a room in the back of the hospital. The room is running out of physical space to store all the charts and some of the paper charts are getting damaged from mold and insects. The paper charts are also in danger of getting damaged from floods or fires. Furthermore, each time a patient is admitted, a new chart is created even if the patient has been admitted before. This results in redundant data. The process to find old cases is difficult for the records officer because it is time consuming. Lastly, the Philippine national health insurance company (PhilHealth) is pushing hospitals to switch to electronic records to integrate electronic claims.

We decided to address these problems by introducing an electronic medical record (EMR) system. The electronic medical record will significantly reduce the time required to find old cases and will also reduce the threat of data loss. Due to the time constraints and the limited technology infrastructure and support, we have decided to focus on computerizing the admissions and records

process. We found and implemented an open source electronic medical record system called OpenClinic GA. We then customized the code using AGILE methods in order to fit the admissions and records officer's needs. As we worked with the officers, we also trained the users and created training manuals for them.

We were able to successfully implement both the admissions officer and records officer functionalities for the system. They are both trained and are beginning to input real patient data in the system. In order for the system to be sustainable, the system administrator, Mr. Von Eric must be proactive and continue to customize and grow the system in order to add functionalities. We recommend that he work on customizing the system to fit the hospital's pharmacy, radiology, and laboratory needs after we leave.

III. Additional Recommendations

The hospital should also create a website to improve external communication with the public and increase visibility. Currently the hospital does not have a website and the only way people find out about the hospital is through word of mouth. We provided a basic process to create a website for the hospital.

We also created a basic technology infrastructure improvement plan. This is a basic budget sheet that lists additional hardware and software that will be necessary when integrating other hospital departments to OpenClinic GA.

Consulting Partner

Dr. Abundio Palencia Jr.

Tel: (054) 721-2664

Our Lady of Lourdes Hospital
Vinzons Ave, Lag-On Daet, Camarines Norte

About the Consultants

Radford Shiozaki
radford@cmu.edu

Radford is a master's student studying IT in
Carnegie Mellon University Australia.

Rintaro Sato
rintaros@andrew.cmu.edu

Rintaro is a senior studying Information Systems
and International Relations and Politics at
Carnegie Mellon University.



Our Lady of Lourdes Hospital

Final Consulting Report

Student Consultant, Radford Shiozaki & Rintaro Sato
Community Partner, Dr. Abundio Palencia Jr.

I. About the Organization

Organization

Our Lady of Lourdes Hospital (OLLH) is a private, non-profit, 50-bed tertiary hospital in Daet, Camarines Norte, Philippines. The hospital provides essential medical services to the residents of the entire Bicol region. The late Dr. Abundio Palencia Sr. founded OLLH in 1965. Today Dr. Abundio Palencia's sons and daughter direct a majority of the hospital's clinical and administrative roles.

Official Vision

To establish the hospital as one of the very best in the entire southern Luzon area that takes care of the sick as well as the healthy person in all of his dimension.

Official Mission

To serve the community in all of its health related needs. Recognizing that the person is the sum of all that he is, the hospital is geared towards the care and well being of all the parts of the person -- physical, emotional, mental, and spiritual. We will work to contribute to the attainment of a happy and healthy community.

Facilities

OLLH is located in a three-story building. The first and second floors are used for the hospital and the third floor is used as the physician's residences. In addition to the main building, there is another building behind the hospital. This building is used as a dormitory and a cafeteria. An additional annex is currently under construction that will increase the hospital's capacity to at least 100 beds.

All facilities are constructed primarily of concrete. According to the IT technician, this has made it difficult to install Ethernet cabling. Since most administrative and ancillary departments are located on the first floor, all computers are currently located on the first floor.

Patient areas on the first floor include 10 multi-bed patient rooms managed by a single nursing station, an emergency room, an x-ray and CT scanning rooms, an ICU room; a pharmacy; and a laboratory. Patient areas on the second floor include 11 private/semi-private patient rooms managed by a single nursing station, labor and delivery rooms, a NICU room; an operating room, an OB-GYN ward, a surgical ward, a medical ward, and a pediatrics ward.

Administrative areas are located on the first floor. These areas include the accounting office, cashier, nursing office, HR office, claims preparation office, and records office. Administrative areas are more limited regarding available space. This is partially caused by dedicating a significant amount of space to storing documents and records. Most administrative areas are adequately lit and air-conditioned. Administrative areas also have adequate access to electrical outlets.

Technology related problems include occasional blackouts and flooding during the monsoon season, and inconsistent Wi-Fi signal strength (probably related to the thick concrete walls).

Originally Ethernet cabling was used for networking, but there were problems with rats chewing through the cables.

The hospital employs armed security guards for 24-hour protection. One guard is stationed in the front entrance, one is stationed at the dormitory and another one is stationed near the annex.

Programs

General Services

24/7 Emergency Care

Medical Examinations

24/7 Pharmacy

Specialized Services

Otolaryngology (ENT)

Orthopedics

Physical Therapy and
Rehabilitation Medicine

General Surgery

Pediatrics

Urology

Internal Medicine

Obstetrics and Gynecology

Ophthalmology

- Ultra Sound with Color Doppler Velocimetry

Diabetology

Gastroenterology

Pulmonology

Cardiology

Nephrology

- Stress Testing
- 2D Echo Heart Monitoring

Ancillary Services

Nutrition/ Dietician

Clinical Laboratory

Dental Services

- Histopathology
- Cytology
- Newborn Screening

General Radiology

Pathology

- CT Scan
- X-Ray

The hospital is the first tertiary hospital in Daet and provides a variety of specialized services. The hospital houses the only CT scanner in the entire Camarines Norte province and the Center for

Diabetes Care of Camarines Norte is headquartered at this hospital. The hospital is also currently negotiating to have the first dialysis machine in the city.

Most of the services offered here do not require computers and are paper based. The only department that heavily relies on computers is the radiology department, which uses a computer to view the images from the CT scanner and to send the images to a hospital in Manila for diagnosis.

Staff

Management

Abundio “Bong” Palencia Jr., M.D., Medical Director

As the medical director, Dr. Bong directs the administrative and technical activities of the hospital. He will be involved in the decision making process related to our consulting work and will be a key stakeholder and contact person for this project. His decision-making authority related to this project will significantly impact the outcome of the project. It will be important to work closely with Dr. Bong to identify requirements and gather resources.

Raul Palencia, M.D., Hospital Administrator

As the hospital administrator, Dr. Raul plans, directs and supervises the administrative services of the hospital under the direction of the medical director. Dr. Raul’s responsibilities are more related to the functional operations of the hospital, as opposed to the clinical operations. These responsibilities include directing and supervising clerical services, property control, building maintenance, central recording, payroll keeping, personnel records keeping and discipline, budget preparation, security, and reporting.

Eloisa Clidoro, RN, DNE, MAN; Chief Nurse

Eloisa carries full administrative responsibility and authority for the nursing department. She has a thorough understanding of the clinical operations of the organization and is very familiar with the organizational structure of the hospital, making her a good liaison for establishing communication with other departments.

Clinical

Physicians

The principle physicians of OLLH are the Palencia brothers (Dr. Raul: general surgery, Dr. Paul: internal medicine, Dr. Phillip: orthopedics, and Dr. Abundio Jr.: rehabilitative medicine) and their wives (Dr. Rosan: OB-GYNE, Dr. Lirio: pediatrics, Dr. Liza: internal medicine, and Dr. Elizabeth: OB-GYNE). In addition to their clinical duties, each brother is as a member of the hospital’s board of directors. The physicians document clinical notes in the patients’ paper-based medical files. Computers do not play a significant role in the physicians’ day-to-day clinical activities.

Nurses

There are 32 people on the nursing staff. The staff includes nurses, midwives and health aides. The nursing staff works at the nursing stations, the ER, the outpatient department, and the OR/delivery room. The nursing stations are not equipped with computers and the nurses do not use computers to perform their regular duties.

The nurses are in charge of carrying out the doctor's orders. When the doctor does their daily rounds of the patients, the nurses will hand each respective chart to the doctor. The doctor will then fill out the doctor order sheet and hand it back to the nurse. When the rounds are finished, the nurse will bring the completed charts back to the nurse station. The nurses will look over each doctor order sheet and carry out the doctor's orders by obtaining the medicine needed by the patient from the pharmacy.

When surgery is required, the nurse first gives the proper paperwork to the patient including the consent form and the surgery checklist form. After the patient signs the forms, the nurse will put the forms in the patient's chart.

Rose Ann V. Dela Torre, ICU Nurse

The ICU has two beds and two vital monitors that are connected to one computer. The software used to record the patient and the vitals is called BMCentral. The computer uses Windows XP.

When a patient is admitted to the ICU, the nurse creates a new patient record using the case number as the patient ID and uses the information on the patient chart. For this reason, there are duplicate patient accounts. The monitors are not connected to an uninterrupted power source so when there is a brown out, the computer and monitors shut down momentarily, and when that happens the patient record is not saved so they have to create a new patient record.

Ancillary

Jose Rasco & Henry Ilan, Senior Radiologic & CT Scan Technicians

Jose and Henry both perform X-Ray and CT scans. Responsibilities also include documenting patients and procedures in a patient logbook, transmitting scans to Manila (CT) or Naga (X-ray) to be read by a radiologist, maintaining equipment and supplies, and storing records. The CT scan process is completely reliant on technology and the technicians use a computer program called Osirix to perform and record CT scans. The images are in JPEG format. When the technicians want to send the images to the radiologist in Manila, they compress the JPEG files and email the compressed folder to the doctor. The Radiology department has a dedicated Internet connection to transmit CT scans. All CT records are stored locally on the hard drive for a very limited amount of time, but DVD backups are created and stored for a minimum of two years (DHS requirement).

X-ray scanning is an independent process that does not utilize computers. X-ray films and reports are identified and stored for a minimum of six years (DHS requirement) using a year and case number system that is independent from the patient admission case number that the hospital uses.

All systems used by the X-ray/CT department are completely independent from the systems that are used by other departments.

Pharmacy

The pharmacy is open 24/7 but the pharmacist is usually present every other week. When the pharmacist is not present, a pharmacy aide or the supply officer staffs the pharmacy. There are various procedures for dispensing medication. If the patient does not have insurance coverage, the cashier must first be paid and then the receipt must be presented to the pharmacy before medication is dispensed. If the patient has insurance coverage, a paper request will be submitted directly to the pharmacy and the medication is immediately dispensed. The pharmacy submits a paper record of each medication dispensed to the accounting department for billing purposes. The supply officer is responsible for updating an inventory logbook every day. This logbook is used to place monthly

inventory orders. There is a computer located in the pharmacy, but it is not being used to perform any pharmacy duties.

Vivian L. Usman, Lab Technician

The lab is open 24/7 and is in charge of urinalysis, fecalysis, and blood work. When a patient needs lab work, a nurse fills out a lab request form and gives it to the lab technician. The patient then goes to the cashier to pay for the lab fees. Afterwards, the patient brings the receipt to the lab technician, who records the receipt number in the patient's lab request form. When the lab technician confirms that the test has been paid for, they do their lab tests. The lab technician keeps a log of the patient's name, results, doctor in charge, date, and any other required information in a bound logbook. When the lab results come in, they write the result in a result form or use a typewriter to type it. They give the result form to the department the patient is residing in. Then they record that the patient has received the results in a separate logbook.

Administrative

Christina "Tina" Encinas, Human Resource Director

The HR director manages the employees of the hospital. Duties of the HR director include recruitment and orientation of employees, disciplinary action, and monitoring leaves of absences.

Currently the director has a hard copy of all the employees and their information but would like to have it computerized. Also, the director would like to keep track of employees' leaves of absences online and keep track of whom the director sent disciplinary memorandums to. Ms. Tina has also expressed a desire to implement an online application process as well as online competency exams for potential employees.

Rosalia "Lia" Tababa, Records Officer

The records officer is responsible for managing all patient medical records following patient discharge and completion of the billing process. Each chart is checked for completeness and then stored in the records room. Ms. Lia works with a student that comes in on the weekend sometimes to create a Microsoft Excel file of the patient logbook that contains information on patient visits from approximately 2010-2012. This information includes case number, patient name, date of birth, address, gender, admission date & time, admitting diagnosis, attending physician, discharge date and time, and discharge position (improved, expired, etc.). Digitizing this information is a redundant process, since it is just transferring the information from the admissions logbook to a spreadsheet. In addition to managing medical records, Ms. Lia also processes birth and death records. This is done on the billing computer from accounting using a program called PhilCRIS.

This system is a good way of managing these records in an orderly manner. Ms. Lia also keeps a hard copy of general birth and death certificate information to maintain a record of certificate distribution.

Kem Syrel Samante, Admitting Officer

The admitting officer is in charge of keeping track of inpatients admissions. When an inpatient is admitted, Ms. Kem first speaks with the patient or the patient's relative to get basic patient information. She writes the information down on a blank index card sized piece of paper and then goes back to the accounting room. Then she starts recording the information in a big red logbook.

In addition to the information gathered from the patient or patient's relative, the admitting officer will copy the information from the ER logbook into the big red logbook. A large responsibility of the admitting officer is to ensure all PhilHealth documentation requirements are met for patient

eligibility. Using a checklist attached to Claim Form 1 (CF1), the admitting officer will verify that all PhilHealth document requirements are met and then complete CF1. At discharge, the admitting officer looks at the patient chart and adds more information in the big red logbook, such as final diagnosis, discharge position, etc. Technology is not used to fulfill the responsibilities of this position. All documentation is performed using paper files.

Accounting

The accounting department has many functions related to billing, claims and accounts receivable. An itemized bill is created for each patient, regardless of PhilHealth coverage. The biller collects medication and equipment usage from paper slips given by the pharmacy. Other billing information is collected from the patient chart and inputted into a Microsoft Excel form to create an itemized bill. Using this bill, the claims officer inputs the same information into a different Excel file that will be printed on an official PhilHealth claim form (CF2). Lastly, the claims submitter will print the official diagnosis code on the form and create a claims submission cover sheet. At this point the claim will be ready for submission. In addition to claims processing, the accounting department also handles accounts receivables. These records are kept using Excel.

Technical Environment

All the computers are located on the first floor. The accounting room has five computers and is used for Internet research, payroll, billing, claims submission, OB/GYNE ultrasound printing, and accounts receivables. The laboratory has one computer, the records and supply officer share one computer, the radiology department has three computers, the HR officer has one computer and the claims preparers have two computers. Most of the computers are around five years old, use Windows XP, have at least 2 GHz processors, and almost all have less than 512 MB of RAM. See table for detailed specifications. One computer in the accounting room has Windows 7. The computers have the basic Microsoft office suite installed. The radiology department has one Macintosh desktop computer. There are two Internet routers, one in accounting and one in radiology. There is currently no electricity back up in place for any of the computers. For critical systems, it may be beneficial to install uninterruptible power supplies. This would be essential if servers are used for a new EMR system.

As mentioned earlier, the network technician tried to have wired Internet connection in the hospital but the rats chewed the wiring so they switched to Wi-Fi. However, because of the concrete walls, the Wi-Fi does not effectively reach outside of the accounting room. All network connections, aside from radiology, are established through a Linksys 802.11n router that is located in the accounting room. Internet service is provided by Bayan Telecommunications via DSL.

<u>Computer</u>	<u>Processor</u>	<u>Memory</u>	<u>Storage</u>	<u>Comp ID</u>	<u>Notes</u>
Billing	P4 2.66 GHz	1 GB	9.89 GB (6.47 GB free)	“Comp3”	Has PhilCRIS software
Payroll & Internet	P4 2.53 GHz	512 MB	32.2 GB (5.03 GB free)	“server”	
Bookkeeping & Receivables	P4 2.53 GHz	128 MB	38.2 GB (32 GB free)	“OLLHMOTHER”	
Claims Submission	P4 3.0 GHz	512 MB	149 GB (114 GB free)	“ollh-PC”	

OB-GYNE	P4 2.6 GHz	512 MB	37.2 GB (23.5 GB free)	“drrosan”	Located in acct. office. Mainly used for printing ultrasounds
Claims prep 1	P4 3.2 GHz	480 MB	76.6 GB (64.5 GB free)	“ph”	Located on right side
Claims prep 2	P4 2.8 GHz	512 MB	38 GB (22 GB free)	“computer2”	Located on left side
HR	P4 2.6 GHz	256 MB	37 GB (29 GB free)	“pc18”	
Lab	P4 3.00 GHz	512 MB	37.2 GB (4.5 GB free)	“laboratory”	Needs printer
Nursing Office	2.8 GHz	512 MB	37.2 GB (24.1 GB free)		No network connection
Supply	P4 3.0 GHz	512 MB	37.2 GB (25.7 GB free)	“computer1”	Shared by supply & records officers
ICU	Dual core 2.00 GHz	1 GB	74.5 GB (10.3 GB free)	“icu-e6ad1317d17”	No network connection. Connects to vital sign monitoring equipment.

Technical Management

Mr. Edmar Norte manages most of the technology at the hospital. He is a full time technician at Our Lady of Lourdes College Foundation and goes to the hospital once a week to maintain the technology and troubleshoot. If additional software or hardware is needed, he works with the hospital’s supply officer, Ms. Vivian Ibasco, to purchase additional supplies. Mr. Edmar can be called in on other days if system problems occur. Documentation is not kept for reporting or resolving problems. There is currently no policy or process established for updating software or virus definitions.

Technology Planning

Dr. Bong directs the technology planning of the organization. This is not a formal process and there is not an official technology plan in place. Problems exist in information management, communications management, and operations management, which could be improved if a coordinated technology plan was developed.

Internal Communication

The medical records are entirely paper based. The nurses and doctors communicate through the “face sheet” and the doctor’s order sheet. The face sheet includes all the diagnostic information about the patient. The doctor’s order sheet is written by the doctor to tell the nurses what treatments to administer to the patient.

Paper request forms are used extensively to communicate between departments. These forms are used when patients need to receive service from ancillary departments, such as pharmacy, lab, radiology, etc.

Usually, a new patient chart is created every time the patient enters the hospital. However, occasionally (once or twice a month) the doctor will request to see the patient's old charts. When that happens, he asks the records officer to retrieve the old charts. The administrative department keeps a hand written record of all the patient cases in chronological order in a big red book. To find the old file, the nurse asks the patient when their last visit was. If the patient does not remember, then the nurse asks the patient for the best estimate. Then the nurse tells the records officer the date of the patient's last visit. The records officer then goes through the big red book to find the patient's case number. Then the records officer goes to the records room, which contains shelves with stacks of patient charts ordered by date and case number. The records officer then finds the chart and gives it to the nurse.

There are no technologies being utilized to facilitate communication between departments. For example, there are no corporate email accounts and data from Excel files is shared by printing Excel sheet.

The hospital also has a board of trustees consisting of the Palencia family to make executive decisions for the hospital.

External Communication

People come to this hospital based on its good reputation spread by word of mouth. When patients come in, they communicate directly with the nurses and doctors and hospital staff face to face. When the hospital staff communicates with the insurance, they create a Microsoft Excel sheet for each patient and use direct mail to communicate for their insurance claims. This causes the reimbursement process to be quite long, usually taking 6 to 8 weeks following discharge.

Information Management

Currently the hospital records are not integrated so each department has their own system to keep track of the patients. Most of the systems are paper-based. Currently, billing, radiology, and the ICU unit keep some form of electronic record of patients. Billing creates a Microsoft Excel page for each patient to record the costs to send to the insurance companies. The Radiology department keeps track of their CT scan patients by saving CT images in a DVD. The ICU unit creates a new patient record for each case and stores vitals information for each patient.

As we mentioned earlier, usually, a new chart is created every time a patient walks in, even if they have a chart of the patient from an earlier date. Also the record number is reset after every year. The charts are then stored in the back records room on rows and rows of shelves. The case number, patient name, address, insurance, admission date, admitting diagnosis, final diagnosis, attending physician, discharge position, and discharge date is also recorded separately in the big red logbook. This information was transferred to an excel file for cases from 2010-2012, however this process was discontinued when the temporary medical transcriptionist left the organization.

Given the current process, there is a significant amount of data duplication and redundant recording being performed. By implementing a unified system of information management data could be better consolidated, data entry errors could be reduced, and better communication between departments could be achieved.

II. Improving Internal Communication and Information Management by Implementing a Framework for an EMR System

Motivation

One of the top priorities identified by the hospital staff was creating an easy way to retrieve medical data. Currently, patient charts are paper based and stored in a room in the back of the hospital. The room is running out of physical space to store all the charts and some of the paper charts are damaged from mold and insects. The paper charts are also in danger of getting damaged from floods or fires.

Furthermore, each time a patient is admitted, a new chart is created even if the patient has been admitted before, which results in redundant data. When past patient charts are requested, the records officer has to first look in the red logbook to see the case number. Then the officer has to locate which stack of charts the individual chart is in. When the officer finds the stack, she has to look through the stack to find the chart she is looking for. The process is difficult for the records officer because it is time consuming and some of the files are too high up for the records officer to reach. Lastly, the Philippine national health insurance company (PhilHealth) is pushing hospitals to switch to electronic records to integrate electronic claims.

We decided to address these problems by introducing an electronic medical record system. However, due to the time constraints and the limited technology infrastructure and support, we have decided to focus only on computerizing the admissions and records process.

Outcomes

Overview of our outcomes

1. Created our scope of work
2. Researched which system is right for the hospital
3. Researched what hardware is required to support the system
4. Customized the software to fit the admissions and records officers needs using AGILE methods
5. Trained the users
6. Set up the hardware
7. Set up the network

Creating our scope of work

After gathering information from the hospital and prioritizing the problems and opportunities to address, we created our scope of work for this summer. For our scope of work we outlined exactly what we would be accomplishing by this summer. We defined our measurable outcomes and our system concept. We also outlined the design of the system and what hardware and software would be necessary to complete our task. After we created our scope of work we discussed this with our stakeholders to clarify what they should expect and what we expect from this project.

Creating a scope of work was an important outcome because it put everybody on the same page.

The complete scope of work can be found in the appendix.

Researching which system is right for the hospital

We looked online to find the best solution to fit the needs of the hospital. When we were looking for the right system, we looked for four things:

1. Is it open source?
2. Does it have an active online community?
3. Does it provide good documentation?
4. Does it have the right functionalities?

We decided to look for open source software to minimize costs. We also looked for software with an active online community and good documentation because we needed additional technical support to learn how to use the software and customize it to fit the hospital. Lastly but most importantly, we looked for software that was capable of not only fulfilling our scope of work but to fulfill the needs of the hospital in the long run.

In order to identify what functionalities would be required by the hospital, we identified the primary stakeholders, created the stakeholder requirements, and identified the stakeholder’s quality attribute requirements. This can be found in the appendix. To see if the system can deliver the functionalities we downloaded and demoed software if it was available.

In order to find how active the online community was we used a website called ohloh.net. This site allows users to see how many developers are active in the project and when their last update was. In addition we went on the software’s website to see how active the community was and how much documentation was included. The full list of software we looked at can be found in the appendix.

While doing our research, we narrowed our choices down to three main systems: OpenMRS, OpenEMR, and OpenClinic GA. All three of the software had their pros and cons so we discussed each system and demoed them to our end users and the stakeholders.

	<u>Open Source</u>	<u>Active Online Community</u>	<u>Documentation</u>	<u>Functionality</u>
OpenMRS	Yes	Yes	Lots of technical but lacking in end user docs	Will require lots of customization
OpenEMR	Yes	Yes	Yes	Not made for hospitals
OpenClinic GA	Yes	Only one developer is active	Lacking overall	Mostly yes

After discussing and demoing, the majority of the end users and stakeholders felt that OpenClinic GA was the best fit for the hospital. We were still concerned with the lack of the online community and the documentation so we emailed the main developer, Dr. Frank Verbeke and he agreed to help us. Also we decided to try to foster the online community by creating a wiki for OpenClinic GA and adding our own documentation.

Researching what hardware is required to support the system

In order for the hospital to support the system, hardware was needed. We needed several types of hardware:

- A server with 2 hard drives
- External back up
- Uninterrupted power supply

We recommended purchasing a physical server instead of storing the data in the cloud because of security and reliability reasons. For the hospital, we recommended purchasing a tower server because it is less costly and it is easier to monitor and maintain. The list of servers we found can be found in the appendix. When we proposed the idea to purchase a server, we were given a Dell XPS 720 to use as the server. The Dell XPS 720 only had one hard drive disk so we requested another one in order to set up RAID 1. We decided to set up RAID 1 to increase data security.

We also recommended purchasing an uninterrupted power supply (UPS) due to the frequent brown outs. We needed a UPS that could keep the server running for around 15-20 minutes without power. Although the hospital has a back up generator, during a brown out, the electricity may be cut for up to 5 minutes. Furthermore, we experienced multiple brown outs during the day so we needed a UPS that could handle several brown outs before needing to recharge.

We recommended purchasing external hard drives to use as back up upon Mr. Ruben's recommendation to keep backup in an off site location. This is so that even if the hospital is flooded and the server is destroyed, there will be back up to restore the data. We were given 2 new 500GB external hard drives.

Customizing the software to fit the admissions and records officers needs using AGILE methods

In order to customize OpenClinic GA, we first downloaded it on a virtual machine. Then we began testing the current application to see what needs to be added and what needed to be removed or changed. We identified what needed to be customized and ranked them according to how necessary it was. The list can be found in the appendix. After we learned how to customize, and completed the customizations on the list, we let the end users test the software. After testing the software, they gave us suggestions on how to improve the software more. We did this several times until the end users were comfortable and satisfied with using the software.

What problems still exist:

- System doesn't work on Linux machines
- There is a bug to add files (external documents) to a patient health record
- Don't know how to create new forms
- Don't have a testing suite for the code
- Don't know how to change or reset the record ID number

- Don't know how to change the search bar to take out city/municipality (which has Belgium cities)
- Don't know how to add another form option for encounter to add a final diagnosis table
- Don't know how to make drop down menus
- Don't know where to put the regular expressions to prevent errors
- Don't know how to let anyone besides system admin upload files
- System admin has the ability to upload files but it does not work
- Don't know how to delete patients
- Don't know how to limit the view of specific aspects for a user ie: for admissions,
- For past encounters it doesn't show administrator or departments
- Getting some problems when using Google chrome maybe stick with Mozilla.
 - Cant create new password for new user
 - Permissions don't update correctly

Training the users

Training the admissions officer

- Trained Kem by working closely with her during and after customization. We sat down with her during the customization process to show her what the system looks like and what she would like to see. We walked her through the basic processes and she told us what she wanted customized. After we listened to her and customized, we showed her again and repeated that until she was satisfied.
- After that we sat down with her and taught her how to use it by creating a user guide and showing her how to do it and letting her do it.
- We used actual data from the big red log book to simulate what she will be doing

Training the records officer

- Same way as admissions officer

Training the system administrator

- We had Edmar and von come work with us everyday so they could watch what we are doing
- We also created a user manual for the system administrator and we worked with Edmar and von and had them simulate actions the system administrator may be doing

Training the network administrator

- Worked closely with Edmar everyday and worked with him to set up the network and the back up and the server

We decided to keep the storage method in the records room by case number instead of switching to by patient for several reasons

- Simplicity - they don't have to change their current way
- They only need to look at the old files once or twice a month
- Not necessary to change the process because the computer will track the cases for each patient so even though the cases are not physically grouped by patient number, it will still be easy to locate and retrieve the files
- If a new filing system were to be put in place, a lot of space will have to be devoted at once to separate the different filing systems

Setting up the hardware

Setting up back up

Encryption

Export MySQL from virtual and import to the real one – had problems with a table that showed in the description but when we exported it gave us an error saying 1146 table doesn't exist for several tables – we created those tables then dropped them and it works now but when doing it again with the new server it will happen again.

- Created back up of Windows 2008 R2 virtual machine
- Obtained Windows 2008 R2 (using Radford's personal license that he never used before)
- Installed Windows 2008 in the Dell XPS 720
- Restored the virtual server into the physical server
- Attempted to set up RAID 1
 - Failed. We think it failed because the sector sizes of the HDD is different
- Set up backup and backup policy of the hardware and database
- Purchased backup software to easily restore from one computer to another
- Purchased antivirus?
- Created test server on campus with OpenClinic GA and MySQL workbench and test data.
- Secured the server
 - Made sure firewall was good
 - Limited internet access
 - Taught the system admins how to properly use and maintain a server
 - Restricted the USB ports by disabling auto run

Setting up the network

- Put the server in its permanent location
- Obtain the computer that the admissions officer and records officer will be using
- Wire the computer to the server

Recommendations

Continue customization of software to add functionalities

Motivation

Due to the time constraints, we were not able to fully implement all of the capabilities of the software. The software has the capability to computerize and integrate pharmacy, radiology, laboratory, billing, cashier, as well as a variety of other functionalities to a patient file. By adding more functionality to the software, more patient information can be centralized. This will make finding data easier for a patient. It will also reduce the amount of paper records.

Process

Hire full-time IT staff to manage and sustain the project

In order to sustain the software and continue to add functionality we recommend having at least one full-time staff member that will be in charge of the IT in the hospital. This person will be in charge of the general maintenance of the software and hardware, troubleshooting, and adding functionalities to the hospital computer system. We recommend Von Eric to be the system administrator for this project since he is the most familiar with the software. We recommend Edmar to be the network administrator for this project since he is the most familiar with the network side of the project. However, both Von Eric and Edmar should work together closely since they are both familiar with the software.

Furthermore, we recommend the IT staff as well as Edmar and Von to receive more IT training to learn more about java, java server applets, and how to maintain and troubleshoot a server.

For more java training we recommend that they speak with the Our Lady of Lourdes College Foundation java instructor.

Online Java training and tutorial:

- <http://www.oracle.com/technetwork/java/index-jsp-135888.html>

This online tutorial and training guide was created by Oracle, the company that owns Java. It is free and provides a comprehensive overview of the Java programming language.

Online JSP tutorials:

- <http://www.jsptut.com/>

This free online tutorial provides an overview of JSP in 15 chapters.

- <http://www.tutorialspoint.com/jsp/>

This free online tutorial was created by tutorialspoint and provides an overview of JSP and how to create web applications with it. This tutorial has 34 chapters.

Add pharmacy, radiology, laboratory functionality

Based on discussions with staff and evaluation of the needs of the hospital, we recommend that pharmacy, radiology, and laboratory functionalities be implemented in that order. We recommend that customization be carried out using the following generalized methods:

1. Learn how the current process works in the departments that will utilize the new functionality
 - a. Interview the department staff to understand what they need to be able to do on the system
 - b. Figure out how the system can improve the current process
 - c. Create and rank use cases for the department
2. Learn how the current code works for that department or functionality
 - a. On the test server, study the related JSP code located in the C:\projects\openclinic\tomcat6\webapps\openclinic directory and subdirectories
 - b. Study the way the database interacts with the related code using MySQL Workbench on the test server
3. Customize using AGILE methods
 - a. Make small changes to the code and demonstrate the changes to the end user and the stakeholders on a weekly basis
 - b. Keep the stakeholders involved throughout the customization process
 - c. Document any changes you have made, especially to the translations, system settings, and customized code

For assistance with this process contact Ruben D. Canlas Jr. at rubencanlas@gmail.com

Mr. Ruben Canlas Jr. was one of our professional advisors for this project. He is an IT consultant in Manila as well as a MBA professor at Ateneo Graduate School of Business. He has many years of experience with IT projects and using agile methods.

Online tutorials can be found here:

- <http://net.tutsplus.com/articles/general/the-principles-of-agile-development/>

This article provides an overview of 12 points to focus on when doing agile development.

- <http://www.scis.ulster.ac.uk/~zumao/teaching/com905/Agile%20Tutorial.pdf>

This PDF file contains a tutorial of agile software development written by four authors with significant experience with agile development.

- <http://www.cb nuggets.com/it-training-videos/series/agile-development-project-management>

This is a paid tutorial contains 30 videos on agile development and the process.

Classes can be found here:

- <http://orangeandbronze.com/agile-training>

This is a two-day training course held in Makati City. The training program is part of O & B University. It costs 15,100.46 pesos. This university also has training programs for Java.

4. Test
 - a. Make sure the customization works as intended and doesn't produce any errors by testing it on the test server.
 - b. Make sure the customization hasn't affected any other areas of the software by testing it on the test server.
5. Prepare for implementation
 - a. Create user accounts for the end users of the department to be implemented
 - b. Consult with stakeholders and leadership to determine the appropriate permissions levels for new users
 - c. Assign appropriate permissions profiles for new users. If appropriate permissions profiles do not exist, create new permissions profiles
6. Train
 - a. Create a training guide for the end user
 - b. Train the end users
7. Implement
 - a. Transfer the customized code to the production server's
C:\projects\openclinic\tomcat6\webapps\openclinic\projects\ph\ directory
 - b. Input any changes to translations on the production server

While completing the customization for the other departments, we also recommend finding a solution on how to store external documents.

We think the problem has to do with the JavaScript from lines 36-55 in the documentsEdit.jsp file.

The file is in: C:\projects\openclinic\tomcat6\webapps\openclinic\healthrecord

Add cashier and billing functionality

After the radiology and other departments are added we recommend customizing and integrating cashier and billing functionality. The ideal goal would be to do direct e-claims with PhilHealth but we believe that it will require professional assistance.

We recommend first contacting Mr. Ruben for a recommendation for an IT consultant because he has worked with PhilHealth in the past.

III. Additional Recommendations

Create a hospital website to improve external communication

Motivation

Originally, one of the tasks assigned to us was to create a website. However, after speaking with the stakeholders, we decided to focus all of our time on the EMR system because that was a higher priority. Currently, the hospital does not have a website and the main way people find out about this hospital is through word of mouth. However, external communication with the public can be increased by creating a website. The hospital can spread information more quickly through the website. Furthermore, it will create more visibility. The hospital has several specialties that other hospitals do not have in the Camarines Norte area. By creating a website, visibility will increase and more patients will be able to find and receive specialized care that is found nowhere else in the region. Eventually the website may also serve as a portal for the patients so the patients can schedule appointments online through the website or check and update their personal information online or upload important documents.

Process

Create wireframes

In order to understand the content and basic layout of the website, we recommend creating wireframes of the website.

A basic tutorial for creating wireframes can be found here:

- <http://webdesign.tutsplus.com/tutorials/workflow-tutorials/a-beginners-guide-to-wireframing/>
- <http://graphicdesign.about.com/od/effectivewebsites/ss/wireframes.htm>

The wireframes can be done on paper and pencil or online using free wireframing tools such as the ones listed on this website:

- <http://mashable.com/2010/07/15/wireframing-tools/>

We also recommend using moqups to create a more high fidelity wireframes:

- <https://moqups.com/>

Choose a theme

The wireframes should provide the basic layout and content of the site. The theme of the site will be how the site will actually look. We recommend looking at other hospital websites to get inspiration on what the OLLH website should look like.

Here are some hospital websites to look at:

- <http://www.stlukesmedicalcenter.com.ph/home>
- <http://azcc.arizona.edu/>
- <http://www.pamf.org/>
- <http://www.scripps.org/>

Set up domain and hosting

After creating a wireframe and deciding on the theme of the site, a domain name and hosting should be purchased. The domain is like the street address of your website and the hosting is like house that stores all of the code to run the site. We are not sure where the school purchased their domain name but we know that the school website is currently being hosted by Bluehost. We recommend first checking to see if the hosting plan will allow for more than one domain hosting. If so, then another hosting service does not need to be purchased.

As of now these domain names are available:

- ourladyoflourdeshospital.org
- lourdeshospital.net
- ladyoflourdeshospital.org

You can check the availability of the domain by searching here:

- <http://whois.net/>

A lot more options are available if you decide to add a dot ph. To find available domains with a .ph, search here:

- <https://www.dot.ph/whois>

A guide to purchase domain names in the Philippines can be found here:

- http://www.ehow.com/how_4777551_buy-domain-philippines.html

There are many hosting services around the world. Here is a list of the top hosting companies in the Philippines by market share:

- <http://www.bennixville.net/2010/12/top-15-webhosting-companies-in.html>

The article below lists the top three US hosting companies for Philippines sites:

- <http://www.prweb.com/releases/top-philippine-web-hosts/best-philippines-hosting/prweb10949010.htm>

Decide on a way to create the site

Since Mr. Shindo has created the Calaguas Eco-Tour website with straight HTML/CSS, one option would be to ask Mr. Shindo to make the website. Another option would be to use a content management system (CMS) like WordPress or Joomla so people with no HTML/CSS background can create and sustain the site. The school website was created using a CMS.

An article listing the top CMS can be found here:

- <http://net.tutsplus.com/articles/web-roundups/top-10-most-usable-content-management-systems/>

Create the site

The final step would be to create the actual site and get it hosted.

Once the site is created, someone must be put in charge to regularly maintain and update the site. If the hospital wants to further expand their visibility and external communication, they can also look into using social media.

IT infrastructure improvement plan

More IT hardware and software will be necessary as OpenClinic GA is customized for different departments. We have created a list of the departments and what additional IT infrastructure is needed. The table on the next page provides a list of additional hardware and software that will be needed when other departments get integrated to the system. We have also included a general estimate of the costs.

Department	Item	Cost in PHP*
Pharmacy	Wired network connection (10m**)	600

	20-port 1000BASE-TX Ethernet switch	13,000
	Firefox	0
Radiology	Wired network connection (use 100m CAT-6 to support the long distance)	5,000
	Firefox	0
Laboratory	Wired network connection to the computer (use 25m CAT-6 to support the long distance)	1,200
	Firefox	0
Cashier	1 computer (preferably with windows XP or greater, at least 512MB RAM)	25,000
	Wired network (10m)	600
	Firefox	0
Billing	Firefox	0
ER admissions	1 computer (preferably with windows XP or greater, at least 512MB RAM)	25,000
	Wired network (use 25m CAT-6 to support the long distance)	1,200
	Firefox	0
Nursing Station 1	1 computer (preferably with windows XP or greater, at least 512MB RAM)	25,000
	Wired network (use 10m CAT -6)	600
	Firefox	0
Nursing Station 2	1 computer (preferably with windows XP or greater, at least 512MB RAM)	25,000
	Wired network (use ~25m CAT-6 if they can wire through the ceiling)	1,200
	Firefox	0
Total		PHP ~123,400.00

*These figures are just estimates.

**We recommend actually measuring out the amount of wiring that will be needed to figure out how much length of wiring is needed.

For pharmacy, we included the 20-port 1000BASE-TX Ethernet switch because currently the hospital only has a four-port Ethernet switch. All four ports are being used and more ports will be needed to wire the other departments.

We recommend purchasing category-6 cables (CAT-6) because it is able to provide faster wired network access even across long distances.

About the Consultant

Rintaro Sato is a senior studying Information Systems and International Relations and Politics at Carnegie Mellon University. He will be graduating in May 2014. After graduating he plans to become more proficient in Japanese so he can obtain a job where he can use his English and Japanese skills to help other people.

Radford Shiozaki is a second year master's student studying Information Technology at Carnegie Mellon University's Heinz College. He will be graduating in 2014. After graduation he plans on establishing a career as an IT consultant.

Appendix A. Scope of Work

Measureable Outcomes

- Create a framework for an electronic medical record system (phase 1)
 - Storing basic patient information by patient instead of by case
 - Have a fully implemented software by July 26, 2013
- Create a technology plan for the future (future phases)
 - Outline the next phases of the entire technology plan for the hospital
 - Recommendations

System Concept

Phase 1 of the hospital's technology implementation plan will support and improve the current process of record keeping, instead of replacing it. At the completion of phase 1, doctors will continue to document patient notes in the traditional paper files. However, the software we implement will store basic patient information in a local database by patients instead of by visits. In the new system there should only be a single patient record for each unique patient. This patient record will be directly linked with all their case records. The software should replace the need to hand write the information in the big red logbook. The complete description of the system will be contained in the scope document.

Scope Document

Design and Development

Phase 1 will implement basic functionality of an open source electronic medical record system. The development in phase 1 will be based on open source software that will best support the addition of future functionalities. Phase 1 will include a limited dataset.

This will include:

- Storing and retrieving patient records
 - Retrieving patient record by searching any combination of:
 - First name
 - Last name
 - Date of birth
 - Case number
 - Patient record ID
 - Storing required info including:
 - Patient Record ID
 - First name
 - Last name
 - Date of birth
 - Address
 - Sex
 - Civil Status
 - Storing optional Info including:
 - Occupation

- Citizenship
 - Religion
 - Insurance information
- Storing and retrieving case records
 - Storing information including:
 - Case number
 - Date and time of admission
 - Patient ID
 - Admitting diagnosis
 - Final diagnosis
 - Attending physician
 - Discharge position
 - Date and time of discharge
 - Retrieving case records by searching:
 - Case number
 - Patient ID

Implementation

The admissions officer and the records officer will use the new software.

Hardware and Software

Hardware

The project will require a purchase of at least:

- 1 server with an uninterruptible power supply

In addition we highly recommend purchasing:

- A computer for ER admissions
- A printer for the laboratory (an order was placed a month ago)
- Uninterruptible power supply for ICU heart monitor and computer

Software

- Open source EMR system
- We recommend the server be running on a Linux based operating system
- Open source web and database server software

Appendix B. Stakeholder Requirements

Primary Stakeholders

- Patient
- Doctor
- Nurse
- Records Officer
- Admissions Officer
- Billings Officer
- Claims Officer
- Laboratory Technician
- Radiologist Technician
- Pharmacy
- Human Resources Officer

Stakeholder Requirements

All staff

- As a staff member, I want to be able to log in and out of the system
- As a staff member, I want to be able to reset my password
- As a staff member, I want to be able to access the system 24/7

Admissions Officer

- As an AO, I want to be able to create a new patient
- As an AO, I want a way to uniquely identify a patient
- As an AO, I want the system to automatically give a unique patient ID number
- As an AO, I want the system to automatically give a unique case ID number
- As an AO, I want to edit information about the patient's face sheet
- As an AO, I want to search whether a patient has come here before by the patient's name
- As an AO, I want to see what documents are required for their insurance
- As an AO, I want to complete Claim Form 1 online
- As an AO, I want to see if the patient has any outstanding bills to be paid
- As an AO, I want to see what type of insurance the patient has

Records Officer

- As a RO, I want to view the case numbers of a particular patient
- As a RO, I want to search a patient by their name
- As a RO, I want to be able to delete a patient
- As an RO, I want to see if the billing is complete for the patient
- As an RO, I want to see if all the required information is filled out in the patient chart
- As an RO, I want to edit a patient chart if there are any missing areas or errors
- As an RO, I want to request portions of the chart to be filled out by the doctor

Doctor

- As a doctor, I want to be able to edit any information on the patient's chart
- As a doctor, I want to see which patients I am in charge of
- As a doctor, I want to request lab services
- As a doctor, I want to request radiology services

- As a doctor, I want certain patient information to be seen by only me and no one else due to the patient-doctor relationship

Nurse

- As a nurse, I want to view a patient's chart
- As a nurse, I want to see which doc order sheets I completed and which I still need to do
- As a nurse, I want to edit a patient's chart
- As a nurse, I want to see what medications the patient is on
- As a nurse, I want to see if the patient filled out the right paperwork
- As a nurse, I want to know what paperwork is required for a certain procedure
- As a nurse, I want to a checklist for what the patient needs to do before a certain procedure

Billing Officer

- As a BO, I want to see what medications and treatments were used on a particular patient
- As a BO, I want to create a bill electronically
- As a BO, I want to store the bill with the patient's chart
- As a BO, I want to find the cost of a treatment or medication easily

Claims Officer

- As a CO, I want to send a claim to PhilHealth online

Patient

- As a patient, I want to be able to see my chart online

Laboratory Technician

- As a LT, I want to record in lab results on the chart
- As a LT, I want to record their receipt number on the chart
- As a LT, I want to see which doctor ordered the lab test
- As a LT, I want to see the date of the lab test
- As a LT, I want to see what lab analysis is required for a particular patient
- As a LT, I want to see whether the patient paid or not
- As a LT, I want to be able to print out the results
- As a LT, I want to see which patients have lab requests
- As a LT, I want to see what paperwork is required before doing a lab test
- As a LT, I want to see if the paperwork is all filled out before doing a lab test

Radiologic Technician

- As a RT, I want to see what type of examination is required by the patient
- As a RT, I want to see whether the patient paid for the examination
- As a RT, I want to be able to upload the images of the results on the patient chart
- As a RT, I want to view the examination results for a particular patient
- As a RT, I want to store the information for at least 2 years for CT and 6 years for x ray
- As a RT, I want to be able to print out the results
- As a RT, I want to keep a log of all the patients and their procedures
- As a RT, I want to email images to other doctors

Pharmacy

- As a P, I want to record what medication was prescribed to what patient
- As a P, I want to see past medication the patient took

- As a P, I want to know when a certain medication should not be taken with a medication the patient is currently taking
- As a P, I want to be able to know which meds are in stock and which are not.

ICU

- As an ICU, I want to accurately measure the patient's vital signs
- As an ICU, I want to monitor the patient's vital signs
- As an ICU, I want to review the history of a patient's vital signs
- As an ICU, I want to document a patient's vital signs in the patient's record

HR

- As an HR, I want to see all the current employees of the hospital
- As an HR, I want to see all the past employees of the hospital
- As an HR, I want to see how many rest days a current employee has
- As an HR, I want to edit information for employees
- As an HR, I want to create a new employee
- As an HR, I want to delete an employee
- As an HR, I want to record memorandums and who I sent them to
- As an HR, I want to have an online application process
- As an HR, I want to have an online testing for applicants

Stakeholder's Quality Attribute Requirements

(For our scope of work only)

Functionality

- The software shall be accessible on Microsoft XP and Macintosh operating systems
- The software shall be accessible on 8 version of Internet Explorer

Usability

- The software should be easy to log in and out. Logging in and Logging out should be simple and quick. Login should last for the staff's entire session when applicable. Logout should be obvious so that the staff remembers to log out of any shared devices.
- The software should prevent errors when creating and editing patient information. (The software shall prevent duplicate patients from being created)
- The staff shall be able to create a new patient within at least 3 clicks after logging in
- The software shall be able to recognize if a patient is new or not

Security

- Patient information shall be stored securely so private patient information is not compromised.
- Accessibility and usability shall be restricted according to staff role.
- Unauthorized people shall not be able to access the system.

Performance

- Staff that have access to patient data shall be able to see changes made or new patients 30 seconds after anybody in the network including them has edited or created a patient

Reliability

- The hardware and software shall be able to handle and store at least 1000 unique patient data.
- The hardware and software shall be able to handle at least 10 people using the system at once.

- The hardware and software shall be securely backed up and data shall be able to be easily recovered if data is compromised.
- The hardware shall be able to run even if there is a brown out for at least 30 minutes until the back-up generator starts running.
- The system should have very minimal downtime. If there is downtime, fixes shall be resolvable quickly.

Scalability

- The hardware and software shall be able to easily increase the amount of data storage

Appendix C. List of Open Source EMR Software

<u>Name</u>	<u>Open source?</u>	<u>Cost</u>	<u>Current Contributors</u>	<u>Last Commit</u>	<u>Database Used</u>	<u>Language</u>	<u>Web Based?</u>	<u>Web Server</u>	<u>Pros</u>	<u>Cons</u>
OpenMRS	Yes	Free	49	3 months ago	MySQL	Java	Yes		Lots of activity and is free. Layout and UI looks ok	Requires customization
OpenEMR	Yes	Free	31	8 days ago	MySQL	PHP	Yes	Apache	ICD-10 codes can be imported, accurate patient search functionality,	Functionality is not designed for hospital use; no lab, x-ray, OR integration
OpenClinic GA	Yes	Free	N/A	N/A	MySQL	Java and JSP	Yes	Tomcat	Good functionality	Lacks the community and documentation
HelloHealth	No	Free	N/A	N/A	N/A	N/A	N/A	N/A	Free and looks like it has a good UI	Not able to get a demo because they don't send demos to the Philippines
GNU Health	Yes	Free	4	7 days ago	PostgreSQL	Python	No	N/A	Good functionality for labs and	Interface is difficult to customize. Functionality of dr. notes is insufficient. Data relationships don't seem to be stable
FreeMED	Yes	Free	0	1 year	MySQL	PHP	Yes	Apache	It works	UI is not intuitive, looks old
GNUmed	Yes	Free	1	1 year	PostgreSQL	Python	N/A	N/A		No demo doesn't look too active
HospitalOS	Yes	Free	N/A	N/A						
HOSxP	Yes	Free	0	2 years	Many different	Pascal	N/A	N/A		Cant read it b/c it is in Thai
Mediboard	Yes	Free	7	4 days	N/A	PHP	Yes	N/A		Only in French
Open Hospital	Yes	Free	4	7 months	N/A	N/A	N/A	N/A		Italian, no support documentation, poor community support
Oscar McMaster	Yes	Free	0	0	MySQL	JSP	Yes	N/A	Seems like it has the right stuff	Not sure how to obtain it. UI is kind of messy
ZEPRS	Yes	Free	N/A	N/A	MySQL	N/A	N/A	N/A	Looks ok and fits most of the reqs.	Not sure how to customize it
ClearHealth	Yes	Free	1	5 months ago	MySQL	PHP	Yes	Apache	Has good security	Forum is disabled

Data taken on June 2013. The N/A means we could not find the data.

Appendix D. List of servers we looked at

<u>Type</u>	<u>GHz</u>	<u>Processor</u>	<u>RAM</u>	<u>HDD</u>	<u>RAID</u>	<u>OS</u>	<u>Cost</u>	<u>Link</u>
Dell PowerEdge T310	2.4	Quad	4GB	500GB	0,1	DOS	79,900	http://www.asianic.com.ph/product/dell-t310
Across Prima 92010	2.4	Quad	4GB	640GB	0,1	None	54,995	http://www.asianic.com.ph/product/Across-Prima-92010
HP ProLiant ML110 G5	2.33	Duo	2GB	320GB	0,1	Windows 2008	69,995	http://www.asianic.com.ph/product/hp-ml110-g5-ms-server08
Acer AT 110 F2 XE-1220	3.1	Quad	2GB	500GB	0,1	No	43,500	http://www.asianic.com.ph/product/acer-at110-f2-381kdp
HP ProLiant ML110 G7	3.1	Quad	2GB	250GB	0,1	no	45,500	http://www.asianic.com.ph/product/hp-ml110-g7-e3-1220-cpu
Dell PowerEdge T110	2.4	Quad	2GB	500GB	1	DOS	49,900	http://www.asianic.com.ph/product/dell-t110
HP ProLiant ML110 G5	2.33	Duo	2GB	160GB	0,1	No	44,995	http://www.asianic.com.ph/product/hp-proliant-ml110-g5

Data taken from asianic.com.ph in June 2013

Appendix E. Ranked list of what needed to be customized

Overall

A level

- Take out the initial warning sign and user info on the very first page
- Take out frank Verbeke's access
- Create custom type: Admissions and adjust their permissions
- Create custom type: Records and adjust their permissions
- Make it so the system works even without Internet connection

B level

- Change 'name' to 'Family name' for less confusion
- Change 'Firstname' to 'First name'
- Change health facility personnel category list

C level

- Update department list (FOR THE BEDS ASK LEIA)
 - System - configuration - department administration -
 - Change description of TECHNICAL AND PARACLINICAL SERVICES to ANCILLARY SERVICES
 - Change description of SURGERY to GENERAL SURGERY
 - Delete HIV/AIDS department
 - Add ENT
 - Add dialectology, gastroenterology, pulmonary to internal med
 - Add orthopedics, physical therapy, urology, ophthalmology
 - Add 2d echo and stress test to ancillary for now
 - Add CT scan and x ray to radiology
- City/municipality on top part is still drop down menu with Belgium cities
- Customize to OLLH in system
- Change logo to OLLH
- Change the logo on the ID card to OLLH
- New patient language should default to English
- Country for patient should default to Philippines
- Change icons to better icons
- Cannot create new users on my mac

Admissions

A level

Patient

Administration page / new patient page

Current personal data tab

- Person ID blank and cant add anything - just remove from the forms - it is the same number as record number (left it so it doesn't screw up the database)
- Record number - just remove b/c it auto adds (left it so they have the option to input their own record number)
- Archive code - also cant add - just remove from forms
- National registry number- change name
- CSLS-ARCAD ID- remove don't know what it is
- Record marked for export - remove - just make it automatically say yes

Private tab

- Cell - remove or change to work number
- Change province to Philippines provinces- include an 'other' option for non-Philippine addresses
- Change municipality, province to free-form or drop down

Health facility personnel tab

- Hide this tab for admissions and records

Create archive code

- Hide entirely from admissions

Medical Summary

- Need Someplace to put Final Diagnosis after each encounter
- Need someplace to put condition on discharge after each encounter

Nursing

- Hide entirely from admissions

Applications

Planning

- Hide for now

Anesthesia

- Hide

Prescription

- Hide

Emergencies

- Hide for now

Pharmacy

- Hide

Financial

- Set to view only (hid entirely for now)

Insurer payment

- Change EUR to PHP

Cash desk

- Hide

Technical examinations

- Hide

ADT

- Modify permissions so emergencies is hidden
- Modify permissions so encounter management - admissions can CRUD
- Modify permissions so history - admissions can CR

Diagnosis

- Hide

Statistics

- Hide

Data center

- Hide

Executives

- Hide

Print labels

Mini-stats

System

Information about the health facility

- Hide

Configuration

- Hide

Permission

- Hide

Lmmo

- Hide

Info

Help

- Modify so it shows our how to document

Global health barometer

- Hide

B level

- Default native country to Philippines
- Change private tab to something else like contact info
- In private tab- regular express the zip code, email, phone, cell phone
- When inputting insurance
 - Tariff category
 - There is nothing in 'extra insurance'

Records

What is records allowed to see

- Medical summary
- Applications
 - Print labels
 - Mini-stats
- System
 - My profile
 - Merge patient records
- Info
 - Help

A level

- Doctors need to be added
- Departments need to be added and customized
- Beds need to be added (you can't add departments to admission if the department doesn't have assigned beds)

B level

- Need to find a clearer way to distinguish admitting diagnosis ("Reason for Active Encounter") and diagnosis at discharge ("Diagnosis")