Development of a Clinical Rounds Module Under the CAISIS platform

Performed at: Diagnostic Radiology Department in collaboration with the Nova Scotia Breast Screening Program (NSBSP)

By

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Preface

The purpose of this paper is to fulfill the internship requirement for the Master of Health Informatics degree. Working at the Diagnostic Radiology Department CDHA, the author was assigned a project to create a Mammography Rounds module on the CAISIS platform. This paper summarizes the author's findings during the summer internship period from April 20, 2012 to July 31, 2012.

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

I could not have accomplished this research work without the help of NSBSP staff members and the Faculty of the Diagnostic Radiology Department CDHA. I found it to be a great experience working with the team, as the work culture is incredibly inspirational and motivating. I would especially like to thank Professor Mohamed Abdolell for providing me the opportunity to work with the team to tackle this project, for his supervision and feedback throughout the internship, and for his review of this report. I am also very grateful to Ryan Duggan and Kaitlyn Tsuruda for their support and advice.

Author

Executive Summary

This paper presents and documents tasks and research performed during the author's Master of Health Informatics internship at the Diagnostic Radiology Department in collaboration with the Nova Scotia Breast Screening Program (NSBSP) in 2012. The NSBSP aims to reduce female morbidity and mortality from breast cancer. To help accomplish this goal, the NSBSP has adopted a new open-source application to enhance the capturing, storing, and accessing of data. The main objective of this internship was to help the NSBSP facilitate the case review process (Mammography Round) by creating a Round module on a CAISIS platform. Mammography Rounds are conducted regularly to ensure the integrity of the diagnosis prior to treatment. The main objective of the research was achieved within the set schedule.

The author was also assigned to provide an appropriate solution to exchange pathology data between CAISIS and CERNER MILLENNIUM. The author proposed using HL7 and DICOM to facilitate data exchange between CAISIS and the Legacy systems, but the solution was not accepted due to limited funding. The author then proposed a second solution using JAVA, which was accepted, and hence sending pathology data from CAISIS to CERNER MILLENNIUM was achieved.

In this paper, the author provides an in-depth analysis of the strengths, weaknesses, opportunities and threats of the proposed solution via a SWOT analysis.

At the conclusion of the paper, the author provides some recommendations that could be used to improve cancer data capture and exchange. These recommendations include:

- Using HL7 to create interoperability between CAISIS and the Legacy systems.
- Improving the sharing of Pathology images by adapting the use of a PACS system.
- Creating a Pathology synoptic report to increase report quality, reduce typographic errors, and increase productivity and overall cancer data quality.

In this internship, most of the tasks were achieved by applying what the author learned in the Master of Health Informatics courses.

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1. Introduction

Breast cancer is a disease that involves the transformation of normal breast cells into abnormal cells to form a tumor. The leading type of breast cancer is a" *ductal carcinoma" (*Canadian Cancer Society, 2012a*).* According to the World Health Organization (WHO), breast cancer is the leading cancer that affects women around the world. In 2004, 519,000 women died from the disease (World Health Organization, 2012). In Canada, Canadian Cancer Society (CCS) statistics reveal that approximately 22,700 women will have breast cancer in 2012 and that around 23 percent of them will die from it (Canadian Cancer Society, 2012b), while in Nova Scotia, 740 new cases will have breast cancer and that around 22 percent of them will die (Canadian Cancer Society, 2012c).

Due to the high number of cases and mortality rate associated with breast cancer, several provinces in Canada started a breast cancer screening and surveillance program. The Nova Scotia Breast Screening Program (NSBSP) was launched in 1991 and is dedicated to decreasing morbidity and mortality from breast cancer by providing sophisticated services. It is also responsible for encouraging individuals to have regular breast screening tests and, based on the results of those tests, either to book an appointment at the nearest site to start the follow-up and treatment process or to schedule a yearly check-up appointment (Nova Scotia Breast Screening Program, 2012).

However, sometimes test results require an extra review in order to provide an accurate diagnosis prior to starting cancer treatment. In order to ensure accurate differential diagnoses, each breast screening program conducts Mammography Rounds. Mammography Rounds provide a mechanism for reviewing each case and providing a recommendation report (the Mammography Round process will be discussed in detail in the next section). Previously, all this work was done manually, and saved in handwritten format. In the last couple of years, however, the NSBSP has been developing a platform that uses a relational database as well as a user interface to automate and increase accuracy, productivity, and efficiency.

In this paper, the author documents work that was done during the summer internship at the NSBSP under the supervision of Professor Mohamed Abdolell. In the first part of the research, the author provides an overview of the NSBSP as well as a job description and a list of tasks completed during the internship. In the second part, the author describes how the work done in the internship is related to what the author has learned in the Master of Health Informatics

courses. Finally, the author describes a proposed solution and suggests recommendations to improve work at the NSBSP.

1.2 The Goals

The main goal of the internship is to create a round module within the new open-source system. At the project's end, the NSBSP will be able to collect and save, in one system, pathology images and other information required to conduct Mammography rounds. As well, the NSBSP will be able to generate a recommendations report and send it directly to a family doctor. The purpose of automating the Mammography Rounds process is to reduce patient waiting time by reducing the time that is required to prepare the recommendation reports and send them to GPs. Also, automating the Mammography Round process will make it possible to increase data accuracy by reducing the chance of errors in identifying cases and recording rounds results. One more goal would be to integrate the Mammography Rounds module with the teaching module.

2. Mammography Rounds

A Mammography Rounds session is an official meeting that involves radiologists, pathologists, surgeons, residents, and mammography and ultrasound technologists. The responsibility of the participants is to review and evaluate case results, diagnoses, and treatments. A Rounds session is an essential part of patient care, and provides continuing medical education for technologists as well as radiologists. In a Rounds session, clinical issues are introduced with regards to diagnostic breast imaging by focusing on existing or interesting cases. Rounds also serve as a venue to review frequency procedure such as localization or triple reads.

The main goals of a Rounds session are:

- To evaluate and analyze each case to guarantee suitable diagnosis prior to cancer treatment.
- To discuss and review various topics such as breast imaging, pathology and surgical intervention.

- To select and review cases and topics that represent the suitable use of breast imaging technology and improve patient outcome.

2.1 Mammography Rounds workflow

2.1.1 Prior to a Rounds Session

There are two main scenarios where cases are brought to a breast rounds session to be reviewed by the rounds team at Queen Elizabeth (QEII) hospital. The first group involves cases that have had a wire localization procedure. Wire localization is a standard procedure that is done prior to surgery. It is done by using "a thin, hooked wire is guided through the skin to the lesion and the surgeon uses the wire to help guide the excision" (Gray et al., 2001). The second group involves cases that are requested by a hospital or a family doctor.

All cases from the first scenario (wire localization procedure) are identified and selected by using the daily appointment listing from the Mammography Information Systems (MIS). The MIS contains patient demographic information, medical history, as well as medical examination information. A clerk searches the daily appointment listings according to site, and then checks for cases involving the wire localization procedure.

Most of the cases from the second scenario (hospital or doctor requests) come from the IWK. In this process, a clerk receives an email asking for individual cases to be reviewed. This request is filed in order to get another doctor's opinion to ensure the appropriateness of the diagnosis. In some cases, radiologists are requested to check with other radiologists regarding follow-up recommendations.

All information is collected manually. A clerk from radiology department creates an agenda that records the name of the patient being reviewed and whether or not that patient has had breast screening, A Medical Record Number (MRN) is assigned to the patient and the specimen associated with their core biopsy procedure. This information is then sent to a pathologist, who will evaluate and analyze the case and then present it at a Round. At the end, a clerk creates a session for the Brest Rounds and prepares any required pathology or radiology images.

2.1.2 During a Rounds Session

During a Rounds session, a radiation technologist records all patient information about the case. The pathology outcome is likewise recorded, including whether the finding was cancerous or not. If a cancer is found, all information regarding the cancer is recorded, such as type, size, grade, etc. and if there is any change in management. This information is then scanned into the picture archiving and communication system (PACS).

Throughout the process, a clerk keeps the minutes, which includes patient information and recommendations. The clerk will also indicate in the minutes if something needs to be taken into account (e.g., dirty margins necessitating the patient to be brought back for an additional mammogram). This information is then entered into a Microsoft Word document, a copy of which is emailed to all those who attended the Rounds session as well as to all other breast radiologists, surgeons, pathologists and management. If a radiologist mentions verbally that a particular case represents an appropriate teaching case for residents, the clerk must record this in the minutes document, and the radiologist must document on the patient history sheet why this should be considered a good teaching case. This information is kept in the clerk's office until it is requested by residents. Also, if there is any change in case management, the clerk is responsible for creating a coversheet and sending it to the patient's general physician or to a primary physician. The coversheet contains patient demographic information, the reasons for the review, and the changes in the management and treatment plan. Finally, in the patient's file in the Mammography Information System (MIS), the clerk documents that the patient was reviewed and the date of the review.

2.2 NSBSP Information Technology systems

The NSBSP uses three systems to capture patient information. The main system where the demographic information, investigation results and patient history are stored is the Mammography Information System (MIS). This system is restricted for use by clinic staff. The CERNER MELLENUM system is used to store Pathology results and create Pathology reports, which are sent directly to the NSBSP network printer for hardcopy print out. The Picture Archiving and Communication System (PACS) is the third system used by the NSBSP. It stores radiology images, scans paperwork from the Rounds. Sharing and accessing the information stored in these systems is restricted, which some-times requires work duplication.

In order to facilitate better access and management of data, the NSBSP decided to implement a new open-source system called CAISIS. CAISIS is a web-based cancer data application that allows integration of research and patient care (Caisis Foundation, 2012).

The development and customizing of a CAISIS interface as well as the mapping of the data from MIS and other systems to CAISIS was assigned the breast imaging electronic medical record (BIEMR) group within the Radiology Research departments. The BIEMR group is composed of a number of people from Newfoundland who have collaborated on the development of an open-source system for breast screening and surveillance. Its members include radiologists, radiation technologists, academics, and breast screening program managers. This group engaged an external developer and an internship student (the author) to work with them to develop a new breast rounds module and synoptic breast pathology report on the CAISIS platform.

2.2 Open Source software in health care institutions

In this section, the author discusses the strengths and limitations of using open-source software in health care institutions.

Over the past few decades, health information systems have been increasingly viewed as viable solutions for reducing functional budgets in health care institutions (Wang et al., 2003). Nevertheless, the implementation process of health information systems is itself associated with high costs. In response to this issue, the European Union has decided to support the adaptation of open-source software as an appropriate solution to reducing the foundation costs involved in implementing health information systems (Working Group Libre Software, 2000). Murray, Wright, Karopka, Betts, Orel (2009) indicate that the use of open-source software is associated with reducing costs in the long term and also increasing information security. Moreover, by using the systems and having proprietorship of them, health care institutions will have full control of the system along with the ability to expand it and add new components as required.

On the other hand, adopting open-source software in health care institutions could result in problems. According to McDonald et al. (2003), patient information is critical, crucial, and requires a sophisticated system to capture, distribute, and provide this information to medical experts. Nevertheless, open-source software development and implementation starts with a "beta-face", which is a temporary version of the software that is used to capture any problems that could arise and then fixes them. However, this stage is not allowed in health care institutions due to the importance of protecting patient information. Also, open-source software is often built as a small component, after which a new component is implemented by another team, which then requires integration between the various components (Turku School of

Economics and Business Administration and Turku Centre for Computer Sciences, 2004). For instance, in this project the author/intern was required to develop a new component under the CAISIS platform, which is a rounds module. But in order to properly develop the rounds module, the author/intern had to understand the other components and integrate them correctly.
Furthermore, Paré, Wybo and Delannoy (2009) conducted a study to find the main barriers involved in open-source software adaption. The authors indicate that an issue arises when a developer needs to evaluate the open-source software because the information that is available is insufficient or undependable. However, there is no helpdesk that can provide this information, so the cost that is required to evaluate the software and fix problems will increase. The second barrier that is mentioned by the authors is the lack of a responsible third party. They indicate that health care institutions need to take into account that open-source software does not have a third party who can provide maintenance or support or help institutions expand the software by adding new components. Also, the authors indicate that open-source software contains a hidden cost which includes repair, updates, future developing, as well as quality assurance.

Due to all of these barriers, health care institutions need to understand that using open-source software could reduce operational cost, but on the other hand, there are hidden costs that could arise along with various logistic problems.

3. Internship Description

3.1 Job description

The NSBSP is implementing a new open-source Breast Imaging Electronic Medical Record that will replace the MIS in order to improve the existing processes of preparing, recording, reporting, sharing and communicating with other systems such as PACS and CERNER MILLENIUM by utilizing the CAISIS open-source software. This job required a critical analysis of the existing system and the participant-to-software development life cycle, including designing the database table and building the user interface and Rounds recommendation report.

3.2 Role

The author/intern was responsible for creating a Mammography Round module on the CAISIS platform to facilitate the accessing of data as well as reduce patient waiting time and increase data accuracy. In order to achieve these goals, the author/intern had to conduct several meetings with the key players of the Rounds to understand the general principles and how the Rounds are

managed. By determining the current workflow, the bottlenecks could then be identified. It was also necessary to identify the requirements of all Rounds' participants.

Secondly, the author/intern had to find out how to map data from the Legacy system to CAISIS in order to create a business object with appropriate SQL queries and access layer on the CAISIS platform.

During the internship, an additional task was assigned to the author: to provide a solution to make CAISIS communicate with CERNER MILLENIUM in order to send pathology reports from CAISIS directly to CERNER.

4. Internship and Health Informatics

In this internship, the author's role and responsibilities were strongly related to what the author learned in the Master of Health Informatics courses.

The author was involved in every step of the software development lifecycle, which also required advanced project management skills in order to bring the project to completion on schedule. The author applied what he learned in Project Management for Health Information Projects by arranging an initial meeting to understand the objective of the project. From this, a scope document was created that contained the project's requirements, which was circulated among and approved by the Rounds' key players. The author also created a plan and a tasks schedule to manage tasks that were to be done by other developers.

The HI Flow and Use course provided the author with the knowledge to concentrate on the workflow and identify the bottlenecks, which helped the author to figure the areas that needed to be improved the most. As well, the course provided the author with the knowledge to understand the indicators (such as mortality, morbidity and waiting time) and how data accuracy is essential for increasing productivity, efficiency and efficacy. This knowledge helped the author to concentrate on a proposed a solution that would increase data accuracy and reduce duplication.

Additionally, the Fundamentals of Clinical Care for Non-Clinicians course provided the author with the knowledge to understand the basic concepts of clinical care and how it works. In this internship, the author encountered some of these concepts and terms such as at-risk population and patient risk factors.

In this internship, the author encountered the main issues that he learned in the courses "Systems and Issues" and "Flow and Standards", which is heterogeneous between systems. The

author's proposed solution is based on what he learned in the Flow and Standards course. He applied the HL7 solution to provide interpretability between CAISIS and the Legacy systems.

In the Managing Change in Health Systems course, the author learned about medical culture and who are the key players. This course provided the author with the knowledge to work within this culture and how to convince those in power positions to accept change. For instance, in this project, pathologists tended to use CERNER MILLENIUM to enter pathology data. The author applied what he learned to convince them to use the new method.

5. Project Progress and Outcome

5.1 Creating a Mammography Round workflow diagram and scoping document

The first step in building a Mammography Round module was to design a workflow diagram (the current workflow was discussed in detail in the third section). An initial meeting was arranged with the Rounds clerk to highlight the main points and the key players. The first workflow diagram draft was sent to the Rounds clerk for feedback. The author then arranged to attend the next Round to see how the work was done. The final workflow diagram was accepted and the bottlenecks identified (Figure 1).

In order to capture all of the module's requirements, a scoping document was created. The scoping document of the Rounds module was discussed and reviewed with the Rounds key players as well as the author's supervisor (the scoping document is attached to Appendix B).

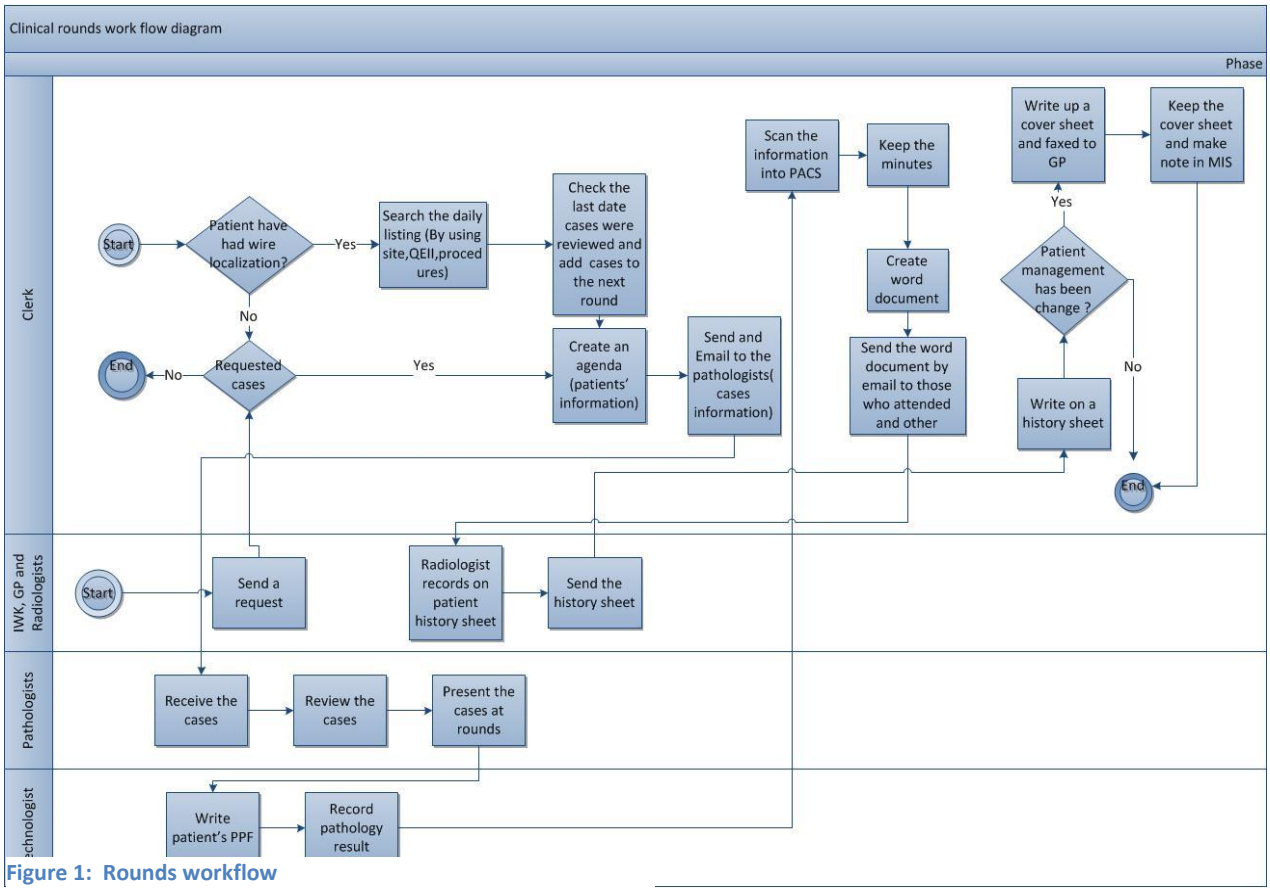

Figure 1: Rounds workflow

5.2 Setting and understanding the CAISIS platform

In order to work on the CAISIS platform, the author had to install the entire system requirements, including Windows server 2008, Visual Studio 2008, and SQL server 2008. The author also had to review the CAISIS data dictionary to understand the data structure.

5.3 Rounds module

To automate and facilitate most of the Round process, a new user interface was created and added to the main tab on the CAISIS platform (Figure 2 & 3). A recommendations report and a minutes report were added to the CAISIS report user interface. New tables were also created and mapped from the Legacy system to the CAISIS database. This was done by using C# language and SQL-queries. To facilitate sending reports to those who attend the Rounds as well as to the patient's GP, the generating and sending of reports are done automatically by using Java script and C#. Secondly, an additional pathology image plug-in is added to the Rounds module based on the pathologists' requirements (Figure 4). This plug-in allows pathologists to save pathology images in JPEG format and to add notes (a recommendation to enhance this plug-in is provided in the Recommendations section).

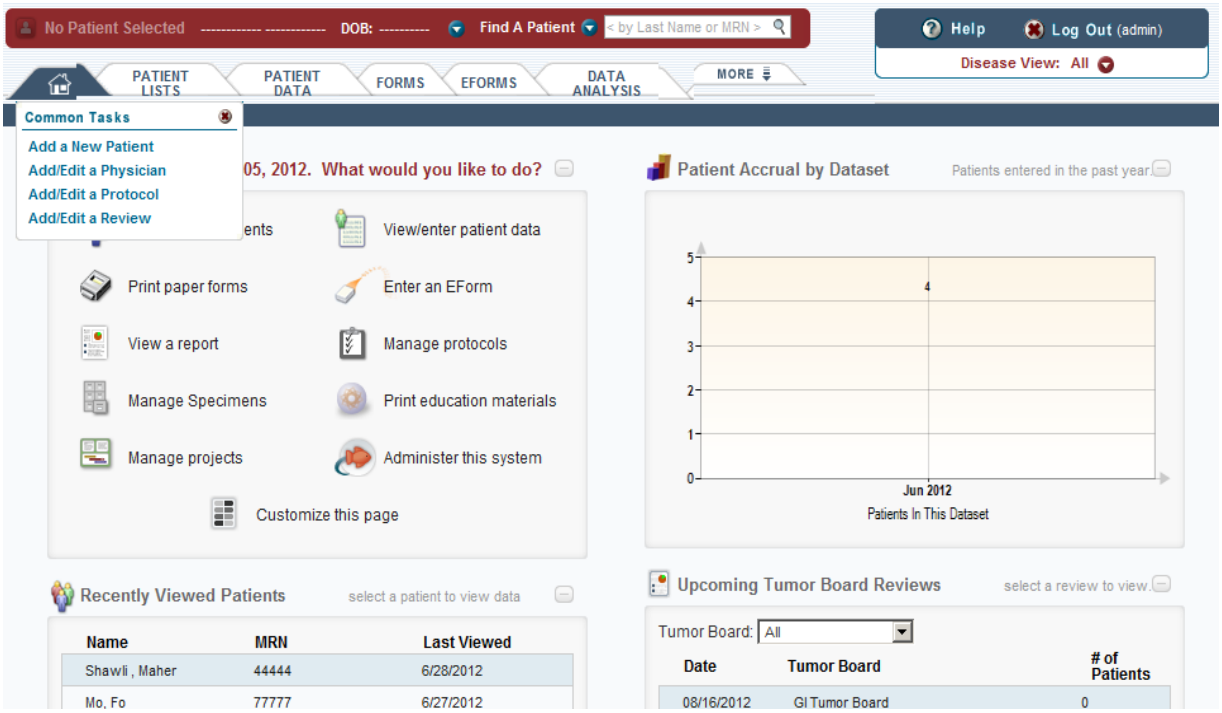

Figure 2: A new Tab was added to the common tasks under CAISIS platform

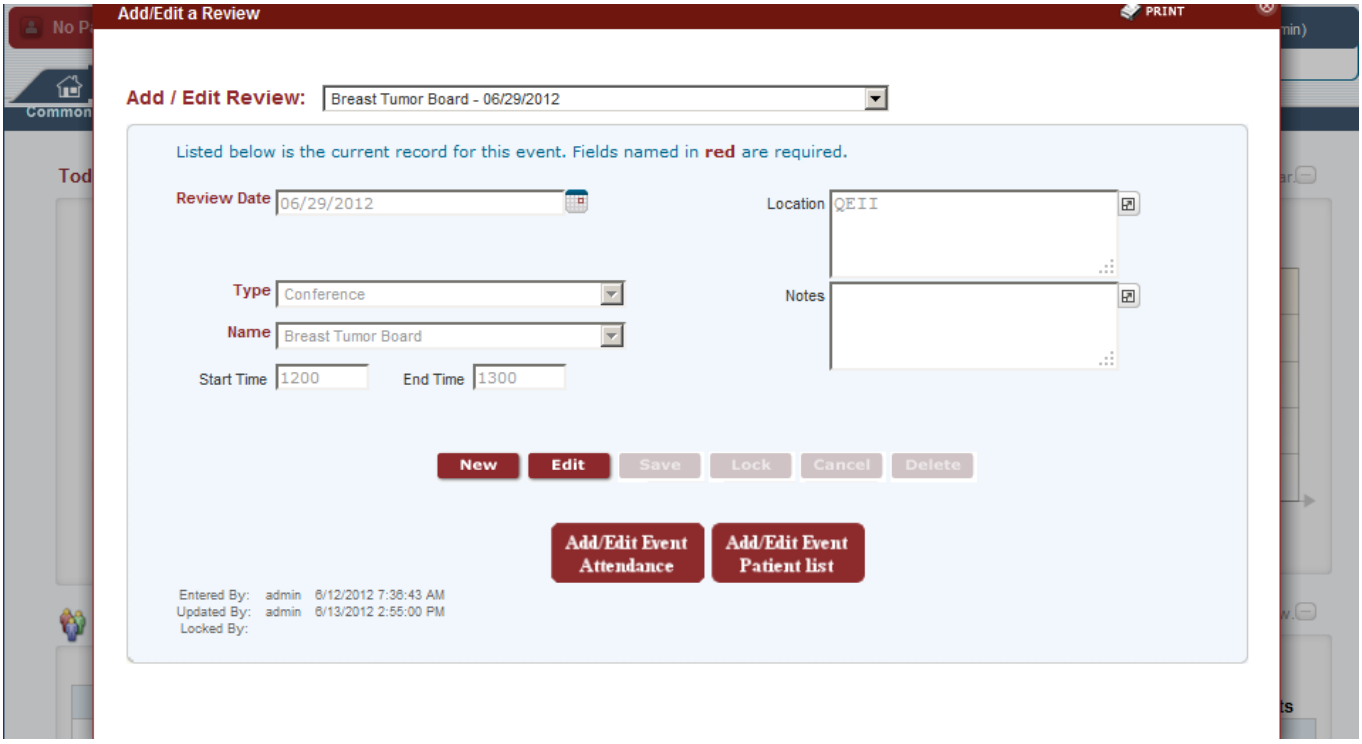

Figure 3: A new Rounds user interface was created under CAISIS platform

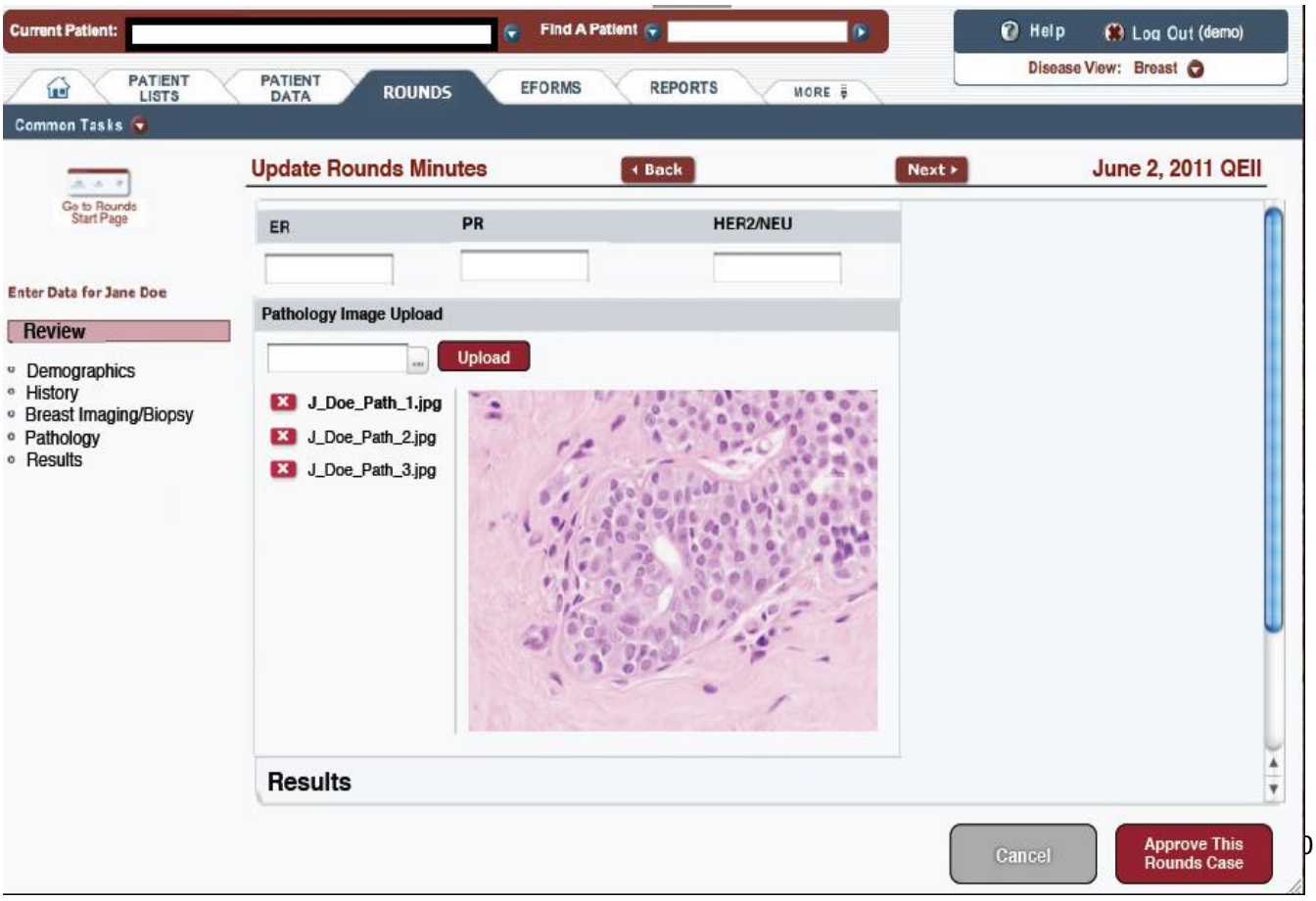

Figure 4: Pathology Image plug-in was added to Rounds user interface

Finally, by clicking just one button, the rounds module user is able to send a particular case that represents an appropriate teaching case for residents and includes the reason for using the teaching module.

5.4 Communicating between CAISIS and other systems

The proposed solution involved creating an HL7 interface between CAISIS and the Legacy systems, but this solution was not accepted due to budgetary constraints (this solution will be discussed in detail in the next section). In this solution, sending pathology reports from CAISIS to MILLENIUM is done by creating an XML file on the CAISIS platform and exporting to MILLENIUM by using JAVA language. With this proposed solution, a user can export reports by clicking just one key.

6. Communicating Between CAISIS and the Legacy Systems

6.1 Exchanging data between CAISIS and the Legacy systems

In recent years, hospitals with Legacy systems are looking to replace them with a new application that can provide more sophisticated services to improve productivity (ManPowerGroup, 2011). However, hospital data is usually stored in various applications such as MILLENIUM, MIS, and PACS that are all supplied by different vendors. In NSBSP, this is the case. NSBSP has three heterogeneous Legacy systems and is looking to implement a new open-source system to integrate those systems.

The current approach to transfer data from CAISIS to the Legacy system is done manually by entering the data twice or entering the data into only to the Legacy system, making an information gap between the two systems. All pathology results are entered into MILLENIUM without transferring or re-entering this information to CAISIS, which creates the information gap.

6.2 The proposed solution

The author proposes a three-step solution, which includes creating a new method to generate reports in an XML format, building an HL7 interface by using Clinical Document Architecture (CDA) between CAISIS and CERNER MILLENIUM, and using Digital Imaging and Communications in Medicine (DICOM) between CAISIS and PACS.

As can be seen in Figure 5, the communication between CAISIS and MIS is done via an HL7 interface that allows a CAISIS user to receive demographic information and sends inquiries for specific pathology results, and vice-versa.

On the other hand, the interface between CAISIS and PACS allows them to send and receives messages, while converting the HL7 message into DICOM format and vice-versa.

The final interface between CAISIS and CERNER MILLENIUM allows for semantic interoperability, which facilitates sending the final pathology report data to CERNER MILLENIUM.

The author proposes to use the open-source HL7 engine "Mirth" to design the HL7 interface in order to reduce costs. Mirth is an open-source application that is used to build HL7 interfaces. It also provides support for those who want extra assistance from experts (Mirth Corporation, 2012). Creating the HL7 interface and generating an XML report will facilitate the integration between CAISIS and the Legacy systems.

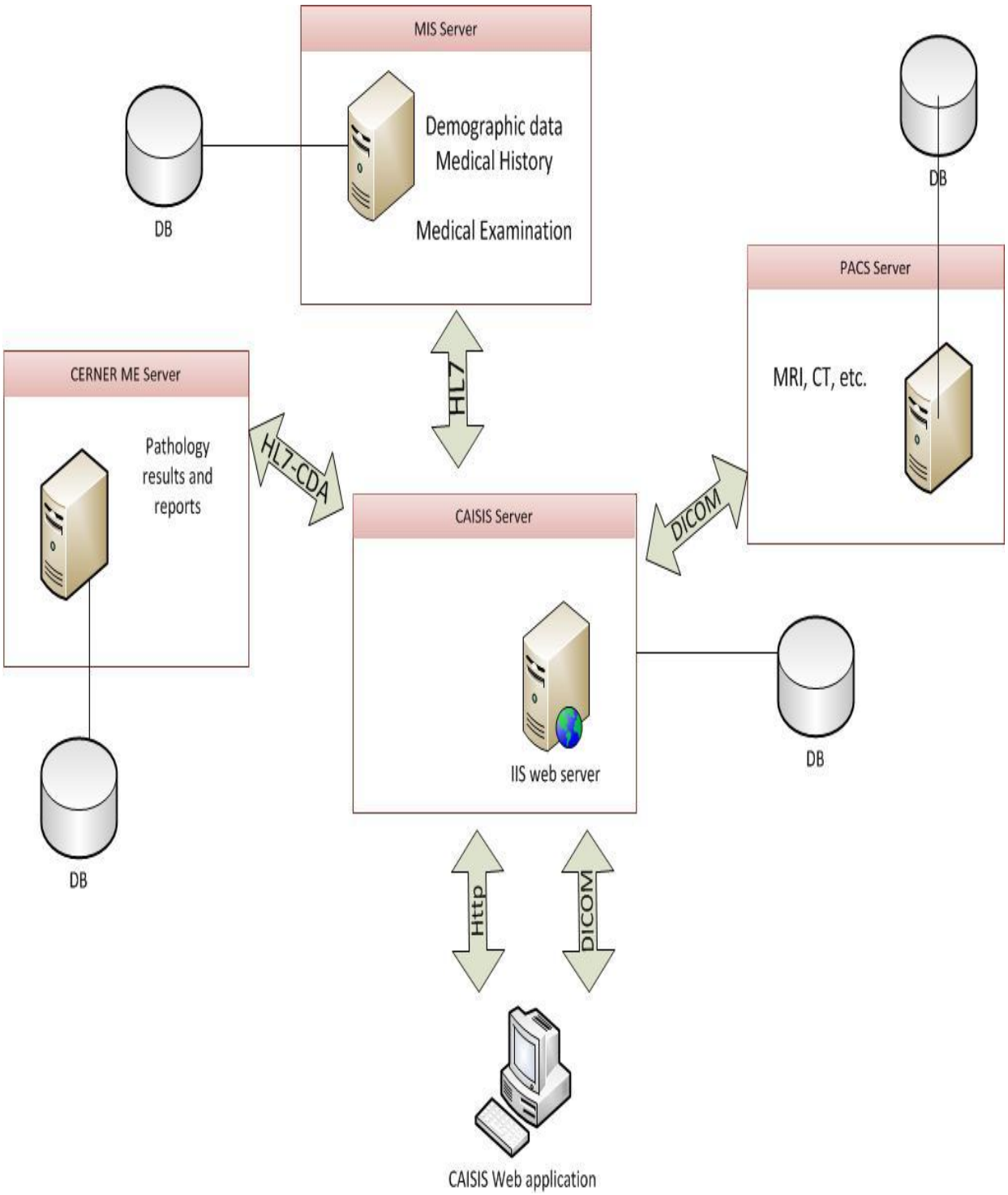

Figure 5: The proposed solution to Integrate CAISIS with the legacy systems

6.3 Overview of HL7

The HL7 standard is used to integrate information that is transmitted, recorded or traded between institutions by creating a common formation that is accepted by participants. The HL7 standard solves the issues of heterogeneous systems and emphasizes administration and medical data such as medical records, medical treatments, medical documents, etc. (Health Level Seven International, 2012).

In order to facilitate communication between systems, HL7 uses a message that contains four parts: segments, fields, components, and sub-components. These messages support all activities.

HL7-CDA is a document that is built based on the XML standard. It facilitates computability between clinical documents and informatics by using an XML and HL7 Reference Information Model (RIM). CDA can be used to send text and multimedia components such as images, sounds, etc. (Beeler, 2012). This makes it suitable for sending pathology reports from CAISIS to the CERNER ME.

DICOM is a standard that is used to display, record, share and distribute medical images such as MRI, CT, etc. ("Digital Imaging and Communications in Medicine," 2011), which makes it suitable for sending and receiving images between CAISIS and PACS .

6.4 The proposed solution's SWOT analysis

In order to ensure the appropriateness of the proposed solution, the author conducted a SWOT analysis. The aim of this analysis was to identify the internal and external key elements that can be used to achieve the objective. The analysis also aimed to understand the proposal's weaknesses and threats.

6.4.1Strengths

- Instead of totally replacing the Legacy systems, integrating them with CAISIS will enhance the ability to capture, store, access and evaluate information.

- Integrating CAISIS with the Legacy system will increase productivity by eliminating duplicate data entry.

- HL7 is widely accepted across Canada and internationally (e.g., in the USA and in more than 15 European countries) (Health Level Seven International, 2011).

- Using HL7-CDA allows semantic interoperability between various systems that are developed by different vendors to communicate with each other.

- Using an open-source engine to build an HL7 interface at the CAISIS site will reduce costs associated with building the interface.

- CAISIS is an open-source application which facilitates customizing tables to be compatible with HL7.

6.4.2Weaknesses

As the NSBSP has systems from various vendors, each system must be compatible with HL7 to communicate with CAISIS. In order to achieve this, the NSBSP has to update these systems as well as resolve complaints and table issues associated with high costs for this updating.

- HL7-CDA has some security and transportation issues. In order to fix these issues, utilizing implementation technology is required (Dolin et al., 2006) which could bring additional costs.

6.4.3Opportunities

- Numerous health care organizations that use CAISIS could mutually benefit from implementing HL7.

- Integrating CAISIS with legacy systems will increase productivity and reduce the amount of time that is required to enter data.

- Integrating CAISIS with the legacy systems could provide a framework to build an Electronic Medical Record (EMR).

- According to the Centers for Disease Control and Prevention (2012), adopting an Electronic Health Record and using HL7-CDA to build Cancer Rounds reports will facilitate providing an "automatic cancer registry", which can then be used to identify "at-risk populations".

6.4.4 Threats

- There is insufficient governmental funding.
- CAISIS technical support and resources are limited.
- Not all applications vendors support the latest version of HL7.

7. Recommendations

Using HL7 to create interoperability between various systems at the NSBSP is crucial for facilitating and enhancing data exchange, which will reduce data entry duplication as well as increase productivity.

Moreover, further work is required in relation to the pathology images plug-in that would involve modifying the PACS system to share pathology images. According to Milon et al (2012), using the PACS system to share pathology images is practical and useful for clinicians and pathologists and will facilitate access to pathology images.

Finally, creating a pathology synoptic report is essential. The ASPE Expert Panel on Cancer Reporting Information Technology College of American Pathologists and the Altarum Institution (2009) indicate that the use of synoptic reports in pathology is associated with improved report quality, reduction in typographic errors, increased productivity, and enhanced cancer diagnostic data quality.

8. Conclusion

The author found his internship at the NSBSP to be a wonderful learning and life experience. The tasks required of him helped the author apply what he had learned in the Master of Health Informatics program. Being involved in each step of the software development lifecycle was also inspiring and helped the author to learn new skills. The positive feedback he received for his efforts was warmly appreciated.

As the author had encountered barriers in sending pathology report data from CAISIS to CERNER MILLENIUM and in exchanging data between CAISIS and the Legacy systems, he

provided a proposed solution that applied what he had learned in the Master of Health Informatics course Flow and Standard.

The author encourages the NSBSP to consider his suggested recommendations to improve productivity as well as data accuracy and quality, and hopes that his work at the NSBSP will help the organization achieve its goals.

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Appendix A: Scoping document

Scoping document

Mammography Rounds

A formal meeting at which radiologists, pathologists, surgeons, residents & mammography and ultrasound technologists review the results and or treatment in specific clinical cases for patients. Rounds are an integral component of patient care and offer continuing medical education (CME) for both technologists and radiologists. They present clinical problems in regards to diagnostic breast imaging by focusing on current or interesting cases. They also serve as a venue to review certain, low frequency procedures such as localizations or triple reads. The objectives of rounds are to:

- Present a wide variety of breast imaging, pathology, and surgical intervention topics
- To ensure appropriate differential diagnoses prior to cancer treatment
- Present cases and topics that will highlight the appropriate use of breast imaging techniques and effect on patient outcomes

The NSBSP would like to enhance the current process for preparing and recording rounds by utilizing the CAISIS platform. Rounds are a requirement of the NSBSP and an essential part of all medical specialties and would be a desired module within the CAISIS environment. The following are some initial notes on the development of a rounds module:

- Every site is responsible for reviewing and recording their own rounds

- Need to be able to select type(s) of cases (eg ALL localizations) to auto-populate rounds section; only cases from respective sites for rounds

- Need to be able to manual enter cases into rounds

- Cases requested for rounds; need to be able to capture who requested the case (rad, tech, pathology, patient, GPs) and why the case is being requested

- Patient' s history must be included in summary for radiologist to present at rounds

- Need an indicator to tell if a case has already been reviewed in rounds. This indicator must be present in the rounds module

- Any case reviewed in rounds must show-up in the chronological listing of procedures for the patient with the rounds results being accessible this way

- Need to be able to record outcomes from rounds

    - The follow up and the date it was recommended

    - A rounds change form if recommendation changed after review at rounds

- Need a template for minutes from rounds (select pertinent information from template and that information only prints out in the minutes; have any booked recommendation from rounds populate in the minutes)

- Track attendance at rounds (pathologist, radiologist, surgeon, technologist) and have them read over minutes from rounds before they are given CME credit for attendance.

- Track who has read the minutes (even if they have not attended) and if there is any administrative business to record that this has been read

- Need quarterly evaluation of rounds (requirement of CME) to be incorporated into module

- Need a way to select cases as teaching files (anonymized summary of cases of interest)

- Want letter with recommendation from rounds to auto-generate to be sent to patient's GP/attending physician

- Want any recommendation from rounds needing action to be put on list in DRS to be able to follow up on (proactive)

- If a radiologist defers to report a diagnostic case until it goes to rounds, that case must auto-show in rounds module and an interim report must be issued indicating this

- Need to be able to upload pathology images (jpeg) to the associated rounds cases