

# Systems Analysis at Capital District Health Authority

by

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Performed at  
Capital District Health Authority,  
1276 South Park Street,  
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In partial fulfillment of the requirements of the Master of Health Informatics Program,  
Dalhousie University

Report of Internship for the period April 18<sup>th</sup>, 2011 – August 18<sup>th</sup>, 2011

Date Submitted: August 18<sup>th</sup>, 2011

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

I would like to thank the Pharmacy IT team (Judy Doucette, Peter MacMillan, and Hazel Wayte), Pharmacy Manager Roberta Baker, IT Project Managers Jim MacLean and Mike Thibodeau, Senior Systems Analysts Brian MacNeil and Devin Broome, and Systems Analyst Holly Shubaly for all their assistance and knowledge throughout my internship. Without their help, this learning experience would not have been possible.

Jodi Hunt

## Executive Summary

Health Informaticians are faced with a tough challenge in today's healthcare environment – to deliver innovative solutions for improving the way we deliver healthcare, while keeping within a strict budget. Capital District Health Authority is the largest health authority in Nova Scotia and due to the tight provincial healthcare budget, they are seeking cost-savings initiatives, while still hoping to maintain a high level of quality patient care. Processes need to be evaluated, updated, and streamlined, where possible. They want to implement leading-edge technologies, but while on such a tight budget, everyone is forced to do “more with less”.

Systems Analysts are crucial in delivering these solutions to the healthcare providers. They act as the liaison between information technology and the care providers, assisting the clinical areas with IT solutions to improve the delivery of patient care. They make suggestions for improvements on current processes and collaborate with the clinical areas to make the changes.

The author worked as a Systems Analyst during the internship in the IT department at Capital Health. Multiple projects were planned for the internship, as well as some ongoing maintenance with existing systems.

The first major project involved implementing a new technology called Orders Connect, which would change the way that orders were sent to the Pharmacy department, and implement a bigger change to the way in which Pharmacy processes, fills, and checks their orders. Despite the hesitation to change, the project was a huge success with only positive comments coming from the Pharmacy department. By implementing Orders Connect, order turn-around time has decreased, while patient safety has increased.

Another project for the Pharmacy department was a Profiled Pyxis project, which involved installation and configuration of new Pyxis Medstations to the Dartmouth General site and making them profiled, where the medications that are distributed from the Pyxis are linked to the patient's profile in the Centricity Pharmacy system. This is not the case for the existing Pyxis Medstations that exist throughout other sites at Capital Health. In the future, it is the intent to make the existing Pyxis profiled. This initiative also decreases medication turn-around time, while increasing patient safety.

The last project that was worked on was a Business Intelligence reporting solution for the Decision Support department. It was the intent of the project team to then look at options for further extending the reporting solution throughout the rest of the hospital. This would mean quicker access to data and should provide decision makers with timely, accurate data for making decisions about the future of our healthcare. Business Objects was the tool used for the project. A security model has been suggested by the author, and once thoroughly tested, it can easily be expanded to an enterprise-wide solution. This project is still on-going.

The author applied her knowledge and experience from the Health Informatics program to bring a different perspective to the Systems Analyst role. It was a great learning experience and has increased the level of expertise in the author.

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# 1. Introduction

The author performed her internship at Capital District Health Authority as a Systems Analyst with the IT department. Systems Analysts are assigned information systems that are usually spread out amongst different departments. This gives the analyst a variety of exposure to different areas throughout the hospital. Systems Analysts tasks may include development, design, coding, configuration, and software installation and maintenance.

There are a mix of Systems Analysts in the IT department – some are from a solely IT background while others are from a clinical background. This is similar to the backgrounds of Health Informatics students. While there is no requirement to have a background in both areas, a Health Informatician would surely advance in this environment with that advantage. Health Informaticians play an important role of being able to understand both clinical and technical aspects and being the liaison between these groups. Having the advantage of an IT background combined with education in Health Informatics, the author was aiming to gain an even further understanding of the clinical processes and requirements and how information technology can deliver solutions for these areas.

The author was given multiple projects to work on during the internship period. One of them was working on a project with the Pharmacy department called Orders Connect. The goal of Orders Connect was to replace the current paper-based ordering system with an electronic-based system in which Nursing would fax their orders to Pharmacy and the Orders Connect server would organize these faxes and display them by priority from within the Centricity Pharmacy software. The primary goal of this project is to decrease medication turn-around time and as a result, improving patient safety and patient outcomes.

The second project given for this internship was also one with the Pharmacy department, called Profiled Pyxis. The goal of this project was to implement profiled Pyxis Medstations at the Dartmouth General site, which would also increase patient safety and decrease medication turn-around time.

The third project was working on a Business Intelligence solution for the Decision Support department using Business Objects. While the Cardiology department is currently using Business Objects for their reporting solution, and this project will hope to bring the Decision Support department into this environment, it is anticipated that Business Objects will become an enterprise solution that will service many other departments throughout the hospital. The author's main duties on this project involved establishing an architecture that can be expandable for the enterprise-solution and developing a security model which will suit the same purpose.

Other smaller duties and system maintenance tasks were performed over the duration of the internship. All work performed will be discussed in further detail.

## 2. The Organization

Capital District Health Authority (CDHA) or Capital Health, as it is commonly known as, is the largest health district in Nova Scotia, providing health care to residents in the Halifax Regional Municipality, and residents as far away as West Hants to Sheet Harbour. With the ever-growing demand on health care and the limited budget, Capital Health has introduced a Business Plan to work towards creating a more financially stable health care system, while still striding to achieve Our Promise of becoming “a world-leading haven for people-centered health, healing and learning.”(2011a)

With more demands on health care come more demands for innovative and cost-effective information technology solutions to improve on patient care services. “The Information Technology and Communications Services (ITCS) Department provides communication and computer services to all staff and physicians at all sites within Capital Health.”(2011b) The requests to the ITCS Department are plentiful and it is an ever-changing and hectic environment.

The IT portion of the ITCS department consists of Desktop Services, Application Services, and Infrastructure Services, each playing an integral role in the delivery of information technology within Capital Health. Desktop Services consists of Technical Support Representatives (TSRs) that serve the role of HelpDesk, Desktop Technicians, Procurement, User ID Access Team, along with a Manager. Application Services consists of System Analysts, Database Administrators, Interface Specialists, Project Managers, and a Manager. They deal with the implementation of new administrative and patient care systems and the ongoing support of the existing systems that are used throughout Capital Health. Infrastructure Services consists of System Administrators that handle server installation and maintenance, as well as Network and Security technicians, and a Manager.

While each of these groups mostly works independently of one another, there are many instances where these teams have to work together, such as a new project to introduce a new software application. This would involve collaboration between the Infrastructure Services team and the Application Services team to determine hardware and software requirements for the server, procurement of the server and possibly desktop software installation from our Desktop Services team. As expected, each team has their own priorities and projects and with so many interdependencies, it can sometimes be a struggle to mesh these priorities together to complete a project as per schedule. A project of one team may supersede the priorities of another team and vice versa. A strong work ethic and willingness to collaborate with one another make this struggle less difficult.

### **3. Work Performed**

The author performed the duties of a Systems Analyst within the ITCS department as a part of the Application Services team during the internship. A Systems Analyst can perform a variety of tasks on a daily basis. Generally a Systems Analyst is in charge of multiple systems or applications and would do anything from report writing, database administration, software development, technical writing or being a technical liaison between the clients, vendors, and other staff working in the IT department.

There are many systems used in Capital Health and they are distributed amongst the Systems Analysts. Some Systems Analysts may focus on one main system, whereas others many have multiple systems that they focus on. With the huge demand on the IT department to add new enhancements to existing systems and introduce new technologies to keep up with the ongoing trend to become more electronic, the demand on the Systems Analysts is substantial. They must be ready and willing to take on new challenges, expand their portfolio by taking on new clients and step out of their comfort zone with learning new technologies and clinical processes that they might not be familiar with.

This internship was no exception. The author was originally given the task of being part of a team responsible for developing a Business Objects Business Intelligence solution for all of Capital Health. The request originally came as a result of the Decision Support department needing a better solution for their reporting services. Currently they pull reports together from various sources, including Access databases and Excel spreadsheets. It was very obvious that a more enterprise solution was needed for them. The Cardiology department currently uses Business Objects for their reporting solutions and the need to expand into other departments, such as the Decision Support department, was evident.

Before the IT department could proceed with expanding Business Objects as a Business Intelligence reporting solution for the rest of Capital Health, an architecture and security model needed to be established, which would provide software and hardware recommendations for expanding this solution to the rest of the hospital. This was the author's primary responsibility on this project.

However, a Systems Analyst usually juggles multiple tasks/projects at the same time. Another project was with the Pharmacy department implementing a new system for receiving orders and working out the process changes surrounding this new system. The Pharmacy department is a very active department and they are always working towards improving patient safety and finding new ways to do things. Along with this project, called Orders Connect, they were also implementing new profiled Pyxis Medstations at the Dartmouth General site.

Other tasks involving the Pharmacy department included troubleshooting technical issues that arose surrounding Pharmacy workstations, printers, and servers, as well as assisting with report writing as needed.

Two other systems were a part of the author's duties on a minimal basis; one from the IT department and one from the Hematology department. The IT departmental software, SDE (Service Desk Express) needed some general maintenance, such as the creation and testing of new business rules, SQL script creation and execution, user and group maintenance, server maintenance, and technical troubleshooting. The Hematology department software, CellaVision needed a solution for cost-savings on their software licenses. The software is extremely pricey and the department was looking for an IT solution on how to save money by reducing the licence count. The author worked with Hematology and implemented the solution that was decided upon.

At the beginning of the internship, the author focused mainly on the Pharmacy Orders Connect project, as well as the Profiled Pyxis project. Pharmacy had set deadlines for implementing these solutions, so it was important to focus on these early on in the internship. More time and effort was needed on these projects than originally anticipated.

In the latter half of the internship, the Pharmacy solutions were in place and the author focused mainly on the Business Objects project. Due to time constraints and scheduling conflicts (such as vacations and other Systems Analysts duties), the Business Objects project will continue into the fall. The author will continue to work on the project until its completion. While a security model has been suggested, it needs to be thoroughly tested prior to implementation.

Working on the other duties were scattered throughout the duration of the internship, but the majority of time was split between the two Pharmacy projects and the Business Objects project.



### **3.1 Pharmacy**

The Pharmacy department at Capital Health uses an information system by GE Healthcare called Centricity Pharmacy. This system performs all the functions used by Pharmacy for ordering medications, such as maintaining patient and physician listings, a drug catalog, drug interactions, and medication orders. Combined with Actuate Reporting, a variety of data can be pulled from Centricity and put into a report, such as Inventory Reports, Ad Hoc Reports, Quarterly Reports, Year End Reports, and patient MARs (Medication Administration Records). Report requests come from Pharmacy staff, as well as other hospital staff, such as Nursing or Physicians.

#### **Orders Connect**

Centricity has add-on modules that can be incorporated into the local Centricity install to facilitate changes and enhancements to the pharmacy processes. While CPOE (Computerized Provider Order Entry) is a future plan for Capital Health, it is not a current reality. However, the need for improvements in the existing order entry process is evident as we are constantly trying to increase patient safety. Reducing errors in medication doses and missed doses is always a top priority.

Orders Connect (also called FAX Connect) is one of Centricity's add-on modules can assist with these problems by streamlining and automating the physician order entry process. The Pharmacy department proceeded with their strategic plan to implement this module. Orders Connect benefits include a decrease in order turnaround time, a decrease in transcription errors, facilitation of pharmacist decentralization, and helping to eliminate lost orders. This new module not only introduced changes to the way in which Pharmacy receives their orders, but it also changes the way in which the pharmacy staff performs the steps of the order entry process.

Prior to the Orders Connect system, the Pharmacy department would receive the majority of the physician orders from the nursing units via Porter Services. The Physician Order sheets were a 3-part NCR form. The back copy would be sent with the porter to the Pharmacy department. The porters would pick up orders on a schedule, however disruptions could occur, leaving hours before orders may be picked up from the nursing units. Some nursing units would fax their orders to the pharmacy departments, while others may use the tube system that is in place at the Halifax Infirmary site. Due to the numerous methods of getting an order to the Pharmacy department, this could lend itself to orders going missing if a paper gets misplaced. There would occasionally be legibility issues with the back copy of the 3-part NCR form. Other issues with the paper-based order system include costly resources such as the 3-part NCR paper, fax toner and paper, and the costs associated with having to store the orders as well as confidentially dispose of them.

Once the paper order reaches the Pharmacy department, the pharmacist would then enter the order into Centricity, which would generate a label that would print off from the label printer. A Pharmacy technician would fill the order from the label and then match it with the order as a double check. The Pharmacist would then do a double check of verifying the drug against the order. Then the paper orders would have to be stored for a period of time. In some cases, the Pharmacy staff would have to search through orders to find a particular one, a task that was always tedious and time-consuming.

With the introduction of Orders Connect, the way that the orders get to Pharmacy is now changed. Orders Connect leverages the already existing fax machines that are located in the nursing units. A new server was installed which contains two fax modem boards (8 ports/fax lines each), for a total of 16 fax lines/queues. GE installed software on the server which takes the image that is faxed from the nursing unit, arranges it in a folder structure on the server which organizes the faxes by Year-Month-Day, and presents the faxed image in Centricity for the queue that it was intended. Additional setup had to be done in Centricity to assist with this process.

Prior to the setup in the Centricity system for Orders Connect, much thought had to be put into the creation of the queues. With a current limit of 16 fax queues, determining which sites were given how many queues was a large task. The larger sites, such as the Halifax Infirmary and the Victoria General not only had to be given a regular and a stat queue, but they also received a secondary regular queue. Due to the large number of orders coming into those sites, it was determined that two regular queues were necessary. Then another choice had to be made on the secondary regular queue – would it be simply be a second number that Nursing would be given and if the first one was busy, they would call the second or would Pharmacy only give certain Nursing units the first number and give the rest of the units the second number? After consulting with other Centricity Pharmacy clients in Canada who are using the Orders Connect module, an idea of using a hunt group was brought forth. A hunt group is programmed by the phone company and distributes phone calls from one telephone line to a group of several phone lines. We would still give the Nursing units only one fax number for a regular order, but if it were busy, it would automatically dial the second number, while being completely transparent to Nursing. We decided it was best to go with this route and we had Aliant program the hunt groups according to our specifications.

Some of the smaller sites only required one queue, where stat orders seldom occur and a call to the Pharmacy department requesting a particular order be processed as a stat order would be sufficient. It was also determined in the planning on the fax lines/queues that it was best to split up the units that do have multiple fax lines onto different modem boards. It is possible that one card could fail and if a site had all of their fax lines on the same card, this would mean the entire site would be down, whereas having them split onto different cards would ensure the least amount of disruption in the event of a hardware failure.

On the same line of a hardware failure, we not only had to plan for the event of a modem board failure, we also had to plan for the event of the server being completely unavailable. Orders can be sent to Pharmacy at any time of the day and it is not acceptable for there to be any unplanned downtime. If the server is not available, there needs to be a plan for Pharmacy to receive the orders. To assist with this, we had Aliant also program a RNA (Ring No Answer) scenario for each of the fax lines. This would come into effect if an order is being sent to Pharmacy, but the server is not picking up the fax. An example of this would be if the server was offline. The ring no answer numbers for each queue are the fax machines that are located in each of the pharmacy departments. So if the Halifax Infirmary Nursing unit sends a fax through to their fax queue and the server is down, those orders will print on the fax machines in the Halifax Infirmary Pharmacy department. This way Pharmacy can continue to process the orders as if Orders Connect hasn't been implemented and the units can still receive their medications. This would also be transparent to Nursing.

The author developed the Orders Connect Downtime Procedures (Appendix A), which have been distributed to the Pharmacy staff. It covers all scenarios in which something can go wrong with Orders Connect and what steps the Pharmacy staff needs to follow in each scenario. In the event of an unplanned downtime or problem with the Orders Connect server, the author is responsible for investigating and resolving the issue. In the event that the author is unavailable, GE can also be called to resolve this issue, as they have the ability to remotely connect into our environment and resolve any issues that arise. Due to only having one person on-site to be able to handle the issues, the author will develop a document which details the scenarios where something can go wrong with the server and how to resolve them from an IT perspective. This will be developed after the internship is complete, where it is not completely necessary. GE is able to resolve any issues and at other Orders Connect hospitals, GE is usually the first point of contact, not the local IT department. However, there are many scenarios similar to this one where there is only one member of the IT department that is aware of how to resolve issues and documentation of such scenarios is lacking. While documentation is time consuming, it is a necessary step to ensure we have coverage and support while someone is off sick or on vacation.

In addition to the changes in how the orders are being sent to Pharmacy, there are also workflow changes in how Pharmacy processes the orders. Instead of working off of the paper order, Pharmacy now brings up the faxed image of the order on their monitor. Due to this process change, Pharmacy PCs in which order entry was being performed on were given a second monitor, as to increase their workspace. When an order gets faxed to Pharmacy through the Orders Connect server, it gets put in the appropriate queue and the pharmacist will be able to see the order in their site queue. They open the order and bring it up on their dual monitor (they can zoom in or out as needed, which reduces illegible issues), while they enter the order in Centricity on their primary monitor. A big change to this process is that the fax image of the order gets attached to the user profile in Centricity for who the order is for, once the order is entered by the Pharmacist. As with the previous process, a label is generated on the label printer and a Pharmacy technician fills the order against the label. Then the Pharmacist brings up the order off the user's profile and checks the drugs against the order. Instead of checking against a paper order, the pharmacist is now bringing up the user's profile and is able to see all the drugs that the patient is on. This is an extra step that is adding to the increase in patient safety by increasing the patient information available to the Pharmacist at the time of order entry and at the time of checking.

As with any process/workflow changes, there are always concerns about added steps which may take more time to complete. Many people may be under the assumption that new technology means less work, but that is not always the case. Sometimes technology changes may mean added work, such as some added steps that the Pharmacy department now has to perform due to Orders Connect, like bringing up the user profile. However, these added steps come with added benefits – like an increase in patient safety.

Whenever a new technology is being implemented, training should be a top priority. For those that are hesitant with the new changes, advanced notice and plenty of training should ease hesitation and increase the level of comfort. Allowing users to be a part of decision making with regards to the new system also eased the anxiety of the new system.

While some process changes may only require a written notice of new steps to follow, a training manual, or an e-Learning course, others require face-to-face training sessions. GE first had a webinar for the Pharmacy IT group and the author on the Orders Connect setup that needed to be done in Centricity. An overview of the Orders Connect process was given and the different setup options were explained.

We decided to employ a “train the trainer” training method where the trainers would be considered “super-users” in the department and once they were trained, they would train the rest of the staff and be the “go-to” person in their area for questions. A second webinar was put on by GE where the author and Pharmacy IT group attended, as well as Pharmacists and Pharmacy technicians who volunteered or were suggested as the potential trainers. Instead of going over the setup that needed to be done in Centricity prior to using Orders Connect, the second webinar focused more on the processes that the Pharmacists and Pharmacy technicians would have to do to process the orders.

After many meetings and e-mail discussions, the various setup options in Centricity were agreed upon and the Pharmacy IT group and the author worked through the setup. Setup included creating the queues, creating the groups, associating PCs with their queues, and determining priorities that can be associated with an order (such as flagging an order with a priority for review by a clinical pharmacist or waiting to hear back from a physician about a particular order). Once all the setup was done in Centricity (in the test environment), the Pharmacy IT group, the author, and the trainers were given access to perform testing and ensure everything was working properly prior to go-live. The hunt groups and ring no answer telecommunications setups were also tested.

The Pharmacy IT group then had to do up a user manual for Orders Connect as well as a FAQ (Frequency Asked Questions) document. Downtime procedures also had to be documented. Posters were created with a general overview of what Orders Connect is hoping to achieve that were distributed to Nursing and to Pharmacy. It was determined that simply distributing the poster, FAQ document, and user manual were not enough training for the Pharmacy staff. The staff that was designated as trainers would hold one-on-one training sessions for a few hours long each for each of the pharmacy staff. The roll-out schedule was by site to ensure a smooth roll-out and to iron out any issues before proceeding to the next sites.

While many of the Pharmacy staff were reluctant about Orders Connect, once it went live there was a great deal of positive feedback about the new system. Having the order saved right on the profile in Centricity was a huge benefit. Prior to Orders Connect, Pharmacy would have to manually file each order (which is a time-consuming process in itself), but then also would have to search through many orders to find one particular one in the case of any inquiries on a particular order. This was something that Pharmacy found very tedious. Now in the event of an inquiry about a particular order (such as Nursing inquiring about a dosage), Pharmacy simply has to pull up the patient in Centricity and then view the order attached to the profile. Other hesitations were also put to rest once the staff became familiar with the new system and the processes surrounding it. The staff believed that the extra time spent on training was an absolute must for this new system and it lent itself to a successful project.

Orders Connect is simply a stepping stone to an electronic ordering system with even a greater level of improved patient safety. Capital Health is on the verge of purchasing a Clinical

Documentation system, which will take us one step closer to a true EHR (Electronic Health Record). This Clinical Documentation system will eliminate the need to use Orders Connect, as it will hopefully have an ordering interface that directly gets sent to Centricity. Even with this new system on the horizon, it is still years away from being implemented and Orders Connect will pay for itself over the next few years in the meantime. Besides increasing patient safety, Orders Connect also is decreasing the order turn-around time. The Nursing units no longer have to wait for Porter Services to pick up the orders and deliver them to Pharmacy. This used to result in Nursing piling up the orders for a specific time in which the porter would arrive. Now Nursing can send orders to Pharmacy anytime and Pharmacy can start processing the order in a more timely matter. Although it's not CPOE, Orders Connect was the next step needed to continue to move Pharmacy in the right direction of improving their processes by leveraging technology.

### **Profiled Pyxis**

Another project this summer which the Pharmacy department was planning on implementing was Profiled Pyxis Medstations. The Pyxis Medstation is a system from CareFusion and is essentially a secure medication dispensing cabinet. It supports "decentralized medication management", helps "ensure accurate medication dispensing" with barcode scanning, has "features to prevent loading of the wrong medication and active alerts to provide an added safety precaution for high risk medications."(2011c)

There were already multiple Pyxis Medstations throughout Capital Health; however the new Pyxis were going to be implemented at the Dartmouth General site. They were also going to be profiled. The other Pyxis Medstations at Capital Health were not profiled, so this was a new process change for the Pharmacy and Nursing staff. Profiled Pyxis means that instead of simply withdrawing medication from the Medstation without any link back to the actual order or the patient; the medication is actually withdrawn and linked to the patient's profile. This ensures a greater level of patient safety, where allergy information for the patient and any adverse drug interactions can be viewed. This also ensures that drugs given to a patient from the Pyxis shows up in the patient's profile in Centricity, so that it is a true representative of all drugs given to the patient from Pharmacy. This is essential for future projects that Capital Health has on the horizon, such as the Case Costing project, which will aim to give a cost snapshot of what a patient visit costs from admission to discharge.

The Dartmouth General Profiled Pyxis project involved meetings on a regular basis, as well as weekly teleconference meetings with CareFusion. It involved a huge process change for Nursing staff, who had to be trained on the proper use of the Pyxis Medstation, as opposed to being delivered drugs from Pharmacy. CareFusion were on site for a week providing the necessary training to the Nursing staff and the Pyxis team worked effortlessly to work on the setup needed before-hand as well as assist in the transition. The author also had to work with CareFusion to resolve technical issues and assist in the technical setup of the new devices.

The Rehab Centre also has some Pyxis Medstations that they will like to have profiled in the future. In the future it is likely that we will see other units throughout Capital Health purchasing Pyxis Medstations so that they can have easier access to medications for their patients.

## **3.2 IT/Decision Support**

### **Business Objects**

Business Objects “is an industry-leading suite of tools for reporting, query-and-analysis, performance management, and information manager. The tools that make up the suite allow you to access, format, and share data, as well as analyze the information this data contains and measure your organization’s performance.” (Torres, D., Mudie, S., & Albaret, J., 2008)

Business Objects is a very powerful, enterprise reporting solution. It is already in use at Capital Health in the Cardiology department. Cardiology uses multiple information system for their needs and the data from their systems is available in Business Objects for reporting. However, other systems in Capital Health use other reporting tools. For example, SDE (Service Desk Express) uses Crystal Reporting, while Centricity Pharmacy uses Actuate Reporting. Each department/system uses their own solution, which in turn results in a great deal of duplication of effort. Capital Health lacks an enterprise reporting solution that can be used for any department/system, which can not only be used for their own reporting needs, but can be used to collate and report on other events during the patient visit which lie outside of their area. For example, an enterprise reporting solution like Business Objects can be useful to assist in the Case Costing project that is currently in the works at Capital Health. Instead of asking each department to generate reports (all in different formats) from their systems, it can be collated and reported on all from Business Objects. It would simply requests like these a great deal and makes it easier to follow a patient through their entire visit with one solution.

The plan to expand the Business Objects solution into other areas started with the idea that Decision Support were in need of a better reporting solution. Decision Support generates numerous reports, some for internal use, some for external use, including ones for CIHI (Canadian Institute for Health Information) and the Department of Health. These reports are extremely critical to Capital Health; however the way that Decision Support creates and generates these reports is very scattered. Some reports are generated from data dumps from the source system and then collated using Microsoft Excel. Others are pulling data from outdated Microsoft Access databases. Pulling together some of these reports must be like putting together pieces of a puzzle. This dispersed way of reporting needs an improved solution and Business Objects could serve as the solution.

Prior to expanding the existing Business Objects solution, the existing architecture had to be examined to ensure that it was suitable for a more enterprise solution, and if not, recommendations for additional server architecture had to be made. As well, someone had to fill the role of Security Analyst for the Business Objects solution. No one in the IT department had any skills with the security portion of Business Objects and it is crucial to put forth a security model that will ensure clients will only see their data and will not see data from other systems if not permitted to. The security in Business Objects is very complex, where security can be applied to groups, users, connections, objects, folders, and so on. A security model is needed where the data will be kept secure, but the security would not be too cumbersome to maintain, as it can get very complex and detailed.

The role of the author was to fill this security vacancy, work with the rest of the Business Objects team and develop a security model that could be put forth for an enterprise Business Objects solution for Capital Health. This solution would be maintained by the IT department, but used by any department in Capital Health that may require it. It was not the intent of this project to bring on other departments into this solution, but build a structure and security model that could allow for it in the future. This project will test the security model and structure by bringing the Decision Support department into the Business Objects environment. If successful, this would be the first step to developing a more robust, enterprise reporting solution for Capital Health.

The author had no previous experience with Business Objects, so a great deal of research was done about Business Objects Universe creation, the different reporting tools available (Desktop Intelligence and Web Intelligence), and the Central Management Console, where all the user management and security settings are applied. Bi-weekly meetings were attended with the whole Business Objects team and one-on-one meetings as necessary were attended with the Senior Systems Analyst who was responsible for developing the Business Objects universes for the Cardiology department.

The two different applications that can be used for reporting in Business Objects are Desktop Intelligence, which is the full client application that is installed locally on the user's desktop, and the Web Intelligence (also called WebI), which is the thin-client that is accessed via an Internet Explorer browser. The Cardiology department report writers are using the Web Intelligence tool; however members of the Decision Support department are aware of the Desktop Intelligence tool and wanted to use it instead. It is a more powerful application and because they received some training in it, they wanted to go right to Desktop Intelligence and bypass Web Intelligence.

One of the main issues with using the Desktop Intelligence tool is that a user can create reports that reside locally on their computer. They may start with a report that resides on the server, but then continue to edit and work on a local copy. Many other users may do the same thing and then there are multiple copies of the same report on different computers and one user is not seeing the same data as another, because of tweaks and additions that they themselves have done. It is extremely similar to the problem of local Microsoft Access databases that we deal with at Capital Health – people make changes to a local Access database and then try to figure out why it is pulling different data than someone else's local Access database. Due to the problems and confusion this may lend itself to, it is preferable that the users in Decision Support start with using Web Intelligence, and if they find they need additional functions that are not available with WebI, then they can start using Desktop Intelligence.

Starting out with this project, the Decision Support universe was created (using STAR data, which contains patient registration information) on a test environment solely for their department. The test environment is not very powerful, so queries may take longer to generate than they would if they would in a production environment. The Business Objects team worked with Decision Support to create a universe that meets their specifications. The universe was created in the test environment, the users were added in the Central Management Console, and they were given access to the Desktop Intelligence application. The users were given instruction to test out the universe, create reports that mimic their existing reports, and ensure that the environment meets their needs. Some changes were made along the way and the team updated the universe accordingly.

While Decision Support were testing out Business Objects, it was suggested that because they use so many other data sources for pulling reports, that another universe be created from another data source. This would be a proof of concept to demonstrate that their other sources can be used in Business Objects in conjunction with the STAR data. This second universe was recently created, but the team ran into a technical error that is still being worked on. Due to vacation schedules of the team members, the issue is still ongoing, but it is anticipated to be resolved shortly so that the second universe can be tested.

A security model has been recommended by the author; however, due to vacation schedules of the staff, it has not been thoroughly tested yet. The testing and documentation of the proposed security model will be continued to be worked on into the fall. The author is also recommending that before users are given access to Desktop Intelligence, that they thoroughly work with Web Intelligence first and only if it is deemed necessary that they be given access to the Desktop Intelligence application.

Once the technical issues are resolved, the security model is implemented; more universes for Decision Support should be created to bring all of their data sources into Business Objects so that they can stop using the older, more tedious solutions for their reporting needs. Decision Support's environment will have to be transitioned over to the production environment. Once this proof of concept is in place, other departments and their systems can be evaluated to determine if they can also be brought in the Business Objects environment.

### **SDE (Service Desk Express)**

SDE is a software application used in the IT department at Capital Health. It follows the ITIL (Information Technology Infrastructure Library) standards. Modules in SDE include Asset Management, Change Management, Problem Management, Incident Management, and Work Order Management. SDE was primary used by the Desktop Services team for incident and asset management. This is the call-tracking system for the Helpdesk and technicians. SDE maintains a table of all clients who work at the hospital who may call in a problem with their PC, printer, monitor, software, network connection, or just have a how-to question. The Helpdesk would log a ticket under their name, and resolve if it possible, or send the ticket to another group to resolve the issue.

Tickets may be sent to the field technicians, or it may also be sent to another group, such as Networking, or to a team in Application Services. As Capital Health grows with new systems, there was a demand to use SDE for Application Services to track their calls. Prior to using SDE, e-mails would have been sent around or direct calls from the clients to the application support analyst would have taken place. However, it is much easier to track everything for the whole department in one system.

Application information for all Capital Health systems is maintained in SDE, as well as client information, asset information, purchasing information, and so on. Not only is SDE used in the IT department, but there are also other departments that use it, such as Diagnostic Imaging and



Pharmacy. The outside departments use SDE to handle requests that come through the Helpdesk, such as user ID access requests to ancillary systems, or issues with said systems. Change management is also tracked through SDE, especially for new projects and systems or changes to existing systems.

Requests to made changes and additions to SDE are always coming through. The author completed many request such as writing and executing a SQL script to perform a mass update for the asset information a spreadsheet full of assets, report creation for asset inventory information, the addition of fields to multiple tables (such as new applications being added to the User ID Form) and the business rules associated with the field additions. Business rules added were one that send work orders to a particular user or group for access to an application and also notify the user or group about the details of request via e-mail.

Other process changes are in the works, such as bringing a new group of users from a different department onto using SDE for tracking of their work. This request involves patient information that needs to be kept confidential and separated from the rest of the data in SDE. Due to this privacy restriction, separate tables, fields, business rules, forms, groups, and staff members need to be created. This request is partially completed, where all the tables, fields, and some of the business rules have been completed to date, but the rest of the business rules, as well as the staff members and groups need to be added. Once this is tested with the department, the managers of the area would like to see reports based on the data entered by their staff to determine how many requests they are receiving, of what type, and so on.

### **3.3 Hematology**

#### **CellaVision**

CellaVision is a system used in the Hematology department for performing microscopy analysis. This is meant to save time by performing digital cell morphology and presenting it to the technologist for confirmation. The CellaVision Remote Review software allows users to verify or correct analyzed slides remotely, as well as collaborate with other users.

The CellaVision technologies have been in place for a few years now, but with the increasing demands to decrease costs throughout the hospital, the department was looking for a way to save money. The CellaVision Remote Review software licenses are very costly (over \$8000 each) and Capital Health held 15 licenses. These licenses were installed on each of the physician's PCs in the department, as well as on the PCs located in the lab. However, not all licenses were in use at the same time and they were looking for a way to decrease the amount of licenses needed.

It was discussed amongst the author and the Hematology department about removing some of the licenses from the physician's PCs and possibly some others in the lab, and having the users use remote connectivity to connect into a PC that CellaVision was installed on. It was determined that this would be a suitable solution.

The author proceeded with removing the software from some PCs while installing it on some other new ones. The ability to use Remote Desktop on the Capital Health PCs has been removed for everyone, except for Administrators and IT staff. The author had to gather a list of all the staff in Hematology who use CellaVision and add their accounts to the Remote Desktop Users group on each of the PCs where CellaVision was going to be kept or installed. Then instructions had to be documented and distributed to the users for using Remote Desktop to connect into another computer and how to properly disconnect so the session would be cleared for the next user.

This was completed and the department managed to get rid of more than half of their original license count. Depending on the success of using Remote Connectivity and the possibility of moving to virtual desktops in the future, they may look at further reducing the license count when the renewal comes up again next year.

## 4. Internship relation to Health Informatics

While working as a Systems Analyst in the IT department, you not only have to be knowledgeable with IT, you also have to be aware of and understand things from a clinical perspective. Coming from an IT background, the author lacked the clinical background that would truly make a more flexible and informed Systems Analyst. Although a Systems Analyst does not have to be a subject matter expert in the clinical areas they are working with, it certainly would be more advantageous if they could easily learn the clinical processes that take place in their areas.

A good introduction to the different systems that are in use in the healthcare system was learned in Health Information Systems & Issues (HINF 6110). This course taught what information systems are used in other parts of the world – ones that are far more advanced than our systems. Learning about hospitals that truly have Electronic Health Records (EHRs) in place is inspiring for a Health Informatician.

Health Information Flow and Standards (HINF 6102) further explored in greater detail the different information systems used locally in Nova Scotia. Tracking the flow and use through these different information systems was extremely useful in achieving a better understanding of the processes that take place in different clinical areas. Learning about the different systems and the issues surrounding interoperability between them gives a broader understanding of the technological issues surrounding the healthcare system in Nova Scotia and the rest of Canada. The more systems that are being implemented in the hospitals, the number of interfaces needed to be configured to allow communication between them increases. Learning about HL7 was a highlight of this course, as it is used in Capital Health and unless it is part of your current job, it is something you may not be aware of. The author sees the need for all Systems Analysts at Capital Health to at least have an introduction to HL7, so that they truly understand the complexity behind the communication between all the systems, and have a better understanding of how it all works.

For the Profiled Pyxis project, it had to be determined how the messaging would be setup between the Pyxis Medstations and Centricity. Because these Pyxis Medstations were going to be profiled, once a drug was pulled from the Pyxis for a particular patient, an HL7 message needs to be sent from the Pyxis to Centricity so that the drug now shows on the patient's profile. The demand on the Interface Specialists at Capital Health is huge, and therefore the wait for getting new interfaces designed is quite extensive. The team decided instead of having the messages being handled by the HL7 Interface Manager, the messages would be sent point-to-point and would need no manipulation. The team had to work with GE and CareFusion to ensure that the information sent between the two would match in format so that the information would be understood by both systems. Without taking Health Information Flow & Use, the discussion and work surrounding the interfaces and the messages between the systems wouldn't have been understood by the author. The course gave a good introduction and a basic understanding so that a conversation could be carried on with general knowledge of HL7. In addition, the author also completed the 14-week e-Learning course through HL7 this summer to gain an even greater understanding of HL7.

Health Information Flow and Use (HINF 6101) was another extremely valuable course in understanding the healthcare system in Nova Scotia. It gave a complete snapshot of how the

patient data comes into the hospital and what happens with it afterwards, starting with how the paper chart gets filled in, how it gets coded and sent to other systems, how the data is used for reporting outside of the hospital (such as to CIHI) and also inside the hospital, and what types of decisions can be made from this data. Learning about the problems with coding and what this means for data quality was very interesting. Although this type of information is not known by the majority of Systems Analysts, it leads to a well-rounded knowledgebase which can only be beneficial to have. Patient-centered care was studied in depth and is a reminder to everyone (even those who do not work directly with patients, such as the IT staff), that the main reason we do what we do is because of the patient. This is something that should be engrained in our memory. When working on systems and searching for ways to improve current processes, it should be noted that increasing patient safety and ensuring the patient's level of comfort is high is the main goal. When an IT staff member can communicate with clinicians and empathize with their desire to improve their processes, it leads to a more united front and is definitely appreciated by the clinicians. It helps break down the barriers between these two groups, which should be the role of a Health Informatician.

Knowledge Management for Health Informatics (HINF 6230) teaches the issues surrounding knowledge management and explores solutions for these issues, such as how to capture tacit knowledge and represent it in a way that can be used in a health informatics solution. Analyzing the different knowledge management solutions that exist adds insight into the future of our healthcare system. Capital Health and the rest of Nova Scotia seems to be behind in utilizing knowledge management solutions to improve healthcare delivery, however learning these technologies and being aware of what is possible is valuable for a health informatician. While the Pharmacy department is not using a CPOE system, Centricity Pharmacy does provide alerts for allergies and drug interactions. While a CPOE system would be favorable and will definitely happen in the future, it is not a current reality. Holding the knowledge of the issues and solutions surrounding these future systems is necessary to continue to steer the healthcare systems in the right direction.

Last but certainly not least, IT Project Management (HINF 6300) provided to be the most useful course for the author during the internship. As a Systems Analyst, you are juggling many different priorities and tasks. Projects overlap with one another, while existing systems require maintenance and technical assistance. The author had 3 projects ongoing at the same time and had to manage the priorities of each one. Being organized and understanding the Project Life Cycle were extremely useful for these projects. Even though Systems Analysts report to a Project Manager, they may still completely run their own projects, especially for smaller to medium-sized projects. A very important process to ensure is complete for a new project is a Project Charter with a well-defined scope that is agreed upon between the client and the Project Manager. It is very common for a client to come back to IT and state that something wasn't done right or something is missing. A well-defined Charter can resolve these communication mishaps. Even for the larger projects which may be run by a Project Manager, understanding the components of the Project Life Cycle is extremely useful.

## 5. Critical Analysis

The problem that was experienced while at Capital Health was the lack of an enterprise reporting solution. In line with the Business Objects Project, it was very evident that Capital Health requires a solution for collating the data from the multiple information systems and producing useful reports. While the rest of the province uses MEDITECH, which incorporates many different departmental systems into one, Capital Health uses the “best of breed” methodology, which results in a huge array of systems used. Even within a single department, multiple systems are used.

Due to the large amount of systems, this lends itself to the fact that the Systems Analysts are dispersed and working in silos. There is little collaboration between Systems Analysts unless a joint project involving systems from both their areas is initiated. Even from the few systems that the author was responsible for during the internship, there are different reporting solutions for each of them. This results in duplication of effort. There is similar information that is generally the same throughout the different systems, such as patient demographic information.

The true complexity of the multiple information systems of Capital Health isn't realized until there is an initiative to collate information across these systems. A perfect case of this is the upcoming Case Costing initiative. While this project is in its early stages right now, it is evident that the complexity involved in this project is extensive. To begin with, many of the information systems do not even have the information in one place as to what a patient's visit costs from their system's perspective. For example, the Pharmacy department will have to do quite a bit of work, and may even need a customization to the Centricity Pharmacy system before being able to generate the patient's medication expenses.

Each information system will use different reporting solutions and as a result, the reports will be in different formats. Then the information will have to be collated and put into yet another format. This makes a large project even more complex. Having a single reporting solution for all of Capital Health's information systems would be extremely beneficial for scenarios like this.

With the restrictive healthcare budget, reducing costs is always a top priority. Having a single reporting solution would reduce the duplication of effort that occurs when multiple Systems Analysts are performing the same tasks in their own systems. Many systems pull data from the STAR patient registration system. Instead of each analyst writing code to pull the necessary data, it can be shared when using the same reporting platform. Stored procedures and complex queries can be shared for multiple systems.

Business Objects is a powerful reporting solution and due to the tight operating budget, where it is also a product that is already purchased, it fits the bill for an enterprise-wide reporting solution. With more powerful hardware architecture in place, it can handle all the reporting requirements for the multiple information systems throughout Capital Health. While some departments are very active with report creation for their information systems, others aren't aware of the potential of what reports can provide them with and they probably are only generating reports with basic counts of patients, services, and so on. By having a Business Objects team in the IT department, they can

work with the departments to fully discover the potential of reporting solutions for their department.

Even though the Decision Support department provides many reports internally and externally, it is no surprise that some of these reports are un-necessary and do not provide any useful information. The purpose of a report should be to provide valuable information to the decision-makers who can use the data to make decisions about the future of our healthcare system. A report that cannot provide useful information is not worth the time spent creating it.

It is very evident to the author that an enterprise-wide reporting solution should be implemented at Capital Health so that it is easier to generate reports that provide useful information to the decision makers. The health informatics solution is to use Business Objects for this purpose. If Decision Support is satisfied with using Business Objects as their new reporting solution, it will be a matter of time before other clients are brought into the Business Objects environment.

## 6. Conclusion

Performing the many duties of a Systems Analyst can be challenging, but interesting at the same time. There is no shortage of work and there are always new things to learn. Due to the many complexities in the healthcare system and the demand for new technologies, being a part of this fast-paced environment is pleasurable. Health Informatics is such a growing field, and even though the healthcare budget is tight, there is still no stopping the flux of project requests and new solutions being implemented.

The two Pharmacy projects that the author worked on (Orders Connect and Profiled Pyxis) were both completed on schedule and were a success. A great deal of time was put into the Orders Connect project and although there was a great deal of hesitation from some of the Pharmacists, there has only been positive feedback about the new system.

The Business Objects project is still ongoing. A great deal of work has been done on it to date, however, due to other duties of the project team members and vacation schedules, it will continue into the fall. So far the Decision Support department is pleased with the progress and hopeful that it will become their reporting solution in the future.

The author enjoyed working on a variety of health informatics solutions, but favored the Orders Connect project. A great deal of time was spent learning and understanding the existing processes in the Pharmacy department and what the changes in workflow meant for the staff in their daily processes. It is much more interesting learning about clinical procedures and assisting in new solutions, where the author comes from an IT background.

In conclusion, System Analysis is a stimulating job role and is well suited for students completing the Masters of Health Informatics program. It allows for the fusion of information technology and clinical information to come together and the possibilities for improvement and new solutions are endless. It is a growing field in which there is no end in sight.

## 7. Recommendations

Once the Business Objects solution is rolled out to the Decision Support department, it is recommended to reach out to the other System Analysts and discuss the hope to use Business Objects as an enterprise solution at Capital Health. Due to the fact that the Systems Analysts work in silos, it is more likely than not that the majority of them are unaware of the potential for Business Objects to become an enterprise-wide solution. Having a meeting with everyone to discuss the potential would be extremely beneficial.

Not only is there duplicated effort for reporting for each of the information systems, there is also duplicated effort in general among many duties that the Systems Analysts do on a regular basis. Some data is duplicated among systems instead of being shared. More effort needs to be put into bringing the Systems Analysts together to discuss work being done, projects on the horizon, and possibilities for collaborating efforts. Meetings were held in the past for Systems Analysts for these reasons, but they were short-lived.

Whenever a request comes in for a new system or technology, this information should be distributed amongst the Systems Analysts to see if a similar solution already exists in another department and can be leveraged for the new request, or if other departments are also seeking such system and a collaborative effort can be initiated. Everyone is very busy with their current job, but the time must be taken for possible collaboration to save the hospital time and money.

As for the Pharmacy department, it is recommended that they continue to look at ways to introduce new technology to improve their processes and improve patient safety. Although many are hesitant to change, with the proper training and advance notice, the comfort level with the change reduces and assists in the potential for a successful rollout.

Health Informatics solutions are dynamic and plentiful. Capital Health and the rest of Nova Scotia needs to progress with implementing new solutions that are used in other hospitals throughout Canada and the rest of the world. We are by no means technologically advanced compared to other areas and there is a great deal more than we could be doing. By finding more innovative ways to reduce costs and implement new solutions, we can help Capital Health improve on patient safety and patient outcomes.



## 8. References

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## 9. Appendix A

### Orders Connect Downtime Procedures

There are several scenarios under which there can be a loss of service. If the Orders Connect Fax Server goes down generally it will cause a “ring no answer” where it does not “pick up” the incoming fax call. Telecommunications has set the system up such that if this happens the fax will automatically print to our existing fax machines in Pharmacy. If faxes start coming out on the physical fax machines unexpectedly it means that the fax server is probably down. You should call the IT Helpdesk (473-3399) to let them know there is a problem with the Orders Connect Fax Server.

#### Scenario 1 Loss of Orders Connect Fax Server while Centricity is Intact

This is the circumstance where Pharmacy cannot read fax orders or connect to the Orders Connect Fax Server. The following should be tested ASAP:

Pharmacy should try faxing to all of the Orders Connect fax numbers for their areas (See list of #'s on Page 2). The faxes should come out on the physical fax machines. Orders from nursing stations should start to come out on fax machines as well.

In this case the IT Helpdesk (473-3399) should be called ASAP.

Until the server is restored, process the orders from the paper fax printouts- Make sure that you write on the orders so the orders can be easily identified as entered-to enable attaching when the server is back up.

Once the server is back up and running, you will need to re-fax the orders into your queue so that they can be attached manually in Centricity (Clicking save on the order will attach the fax).

#### Scenario 2 Loss of Centricity while the Orders Connect Fax Server Remains up

This is the circumstance where Centricity is down and the orders cannot be viewed in the usual way. The Orders Connect Fax Server has remained functional and receiving orders. In this case it is preferable to print the orders directly from the fax server.

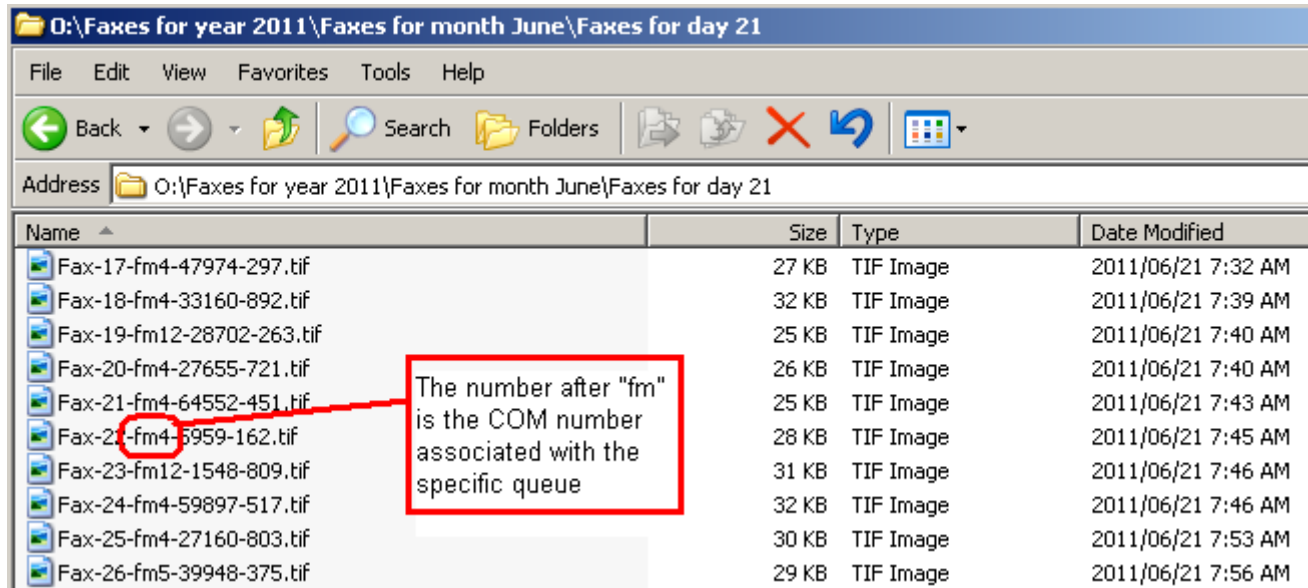
All pharmacy users should have a shared drive mapped to the fax server. It is the “O” drive mapping “Faxes Prod on ‘Cdha.nshealth.ca\RXFax’ (O:)”. (See Page 2 for access.)

When a user opens this directory they will see all the faxes for any day or month. They can open up the appropriate date and multiple select the orders they want to print.

Please note that this folder contains faxes for all pharmacy locations, not just your own. To locate the faxes for your location, you must know the COM number associated with your queues. Each fax image file name begins with:

Fax-Seq#-**fmCOM#**...

After “fm”, the COM# (between 3 and 18) is given. See screenshot below:



Below is a list of all queues and their COM#s:

<b>QUEUE</b>	<b>COM</b>	<b>DESCRIPTION</b>	<b>PHONE#</b>
HI_STAT	COM3	HI STAT LINE	492-1005
HI_R1	COM6	HI #1	425-1905
HI_R2	COM14	HI #2	425-1916
6N_STAT	COM5	6N STAT LINE	423-4139
6N_R1	COM4	6N #1	425-3864
6N_R2	COM12	6N #2	425-2819
6N_Chemo	COM13	6N CHEMO	425-0429
2N	COM8	2N	425-9097
DGH_STAT	COM11	DGH STAT LINE	429-2857
DGH_R1	COM9	DGH #1	425-1790
DGH_R2	COM17	DGH #2	425-1491
ECFH	COM15	CORFOR	425-9646
NSH	COM7	NSH	425-2834
Hants_STAT	COM10	HANTS STAT LINE	425-2007
Hants_R	COM16	HANTS	425-9645

For example, if you are working at the HI site, COM3, COM6, and COM14 are what you should be looking for (only files that contain fm3, fm6, or fm14). Examples of faxes for the HI site are:

Fax-7-**fm3**

Fax-20-**fm6**

Fax39-**fm14**

You should note the date and time of the last order you print. Orders cannot be deleted from this folder so it is important to note where you left off. This way you will know how far back they need to go to print the next set of orders. When multiple orders are selected the printing process should be very fast.

(Suggest that one staff member prints the orders – as more than one person could access the same fax.)

- Procedure:**
1. Click on the Start button
  2. Click on My Computer
  3. Double-click Faxes\_Prod on 'Cdha.nshealth.ca\RX\Fax' (O:)
  4. Double-click faxes for year current year
  5. Double-click faxes for month current month
  6. Double-click faxes for day current date

To Print:

7. Look for faxes for your pharmacy and select the first fax you want to print
8. Press Ctrl on your keyboard and hold it down while selecting all the other faxes for your pharmacy that you want to print
9. Then go to File → Print
10. This will take you through the Photo Printing Wizard – click Next two times, select your printer and click Next again, Next, and then Finish
11. Make note of the last fax printed (name, date and time) so you know where to continue from later.

**\*NOTE\***

If you need to go back and print more faxes, go through steps 1-6 again. Instead of selecting the first fax, select the next fax from where you last printed and continue with the remaining steps.

Please note that once Centricity is back up, all the orders will be displayed in the queues and will have to be attached to the profiles.

May be difficult to identify which orders in the queues have been already entered- Use time stamps (only as accurate as the fax machine.)

### **Scenario 3 Loss of Network**

If the network is down, orders should start automatically printing to the pharmacy fax machines. Orders will need to be processed from the paper printout. Once the network is back up, IT Services may need to re-start the fax server. When everything is confirmed operational, the printed orders must be re-faxed to the correct queues so that they can be attached to the profiles in Centricity.

### **Scenario 4 Loss of Phone line**

- a) Loss of CDHA Internal Phone lines  
If the CDHA internal phone lines are down, the nursing units will not be able to fax from their fax machines. Except in the cases where the Nursing unit has external fax # (ie VMB). The nursing units will need to photocopy orders and bring to pharmacy or call to have a porter pick up the orders. Once restored, Pharmacy will need to re-fax those orders to the queues.
- b) Loss of External Phone lines  
All of the Orders Connect fax lines are external phone lines. If they go down, the nursing units will get a failed transmission when trying to fax orders. Likewise, they will need to photocopy orders and bring to pharmacy or call to have a porter pick up the orders. Once restored, Pharmacy will need to re-fax those orders to the queues. (They could Fax to the Paper fax #'s)