Gathering and Designing a Multi-Disciplinary Surgical Clinical Ward Handover System at the SAN Hospital

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Surgical Clinical Ward Handover System

Abstract

Acknowledgements

Contents

Glossary

A Infection by Airbourne.

ACAT **A**ge **C**are **A**ssessment **T**eam.

AD **A**s **D**esired Diet (anything the patients wants to eat).

AIN **A**ssistant **i**n **N**ursing.

AMO **A**ccredited **M**edical **O**fficer.

Analgesia pain medication.

Anti-emetic medication against nausea.

Arthroplasty plastic surgery of a joint.

B **B**owels.

BD twice a day.

BGL **B**lood **G**lucose **L**evel.

Bolus a rounded mass of food or pharmaceutical preparation ready to swallow, or such a mass passing through the gastrointestinal tract.

BP **B**lood **P**ressure.

BSL **B**lood **S**ugar **L**evel.

C infection by contact.

CF **C**lear **F**luids.

CMO **C**areer **M**edical **O**fficer (doctor on call).

Comorbidity other illnesses that a patient has that are not part of the diagnosis but affect the health of the patient and possibly the treatment (ie. Diabetes, Hypertension).

Cont **C**ontinence (bowels).

CVC **C**entral **V**enus **C**atheter.

D infection by droplet.

DW **D**ry **W**eight (weight of patient before breakfast).

Dx diagnosis.

EDD **E**stimated **D**ate of **D**ischarge.

EEN **E**ndorsed **E**nrolled **N**urse. Have completed further medication endorsement. Allowed to administer Schedule 2,3, and 8 medications via all routes except intravenous, epidural, intraventriuclar and intrathecal. Any medication which requires checking prior to administration must be checked with a RN or Midwife. Excluded also from administering fluids or medications via CVC, PICC and femoral lines as well implanted devices or arterial lines.

EN **E**nrolled **N**urse. Nurses undertook 18/24 month course at TAFE or related health facilities). Even more restricted than EEN.

FF **F**ull **F**luids incl. milky drinks.

HITH **H**ospital **i**n **t**he **H**ome.

Hx history.

iCIMS **i**ntegrated **C**linical **I**nformation **M**anagement **S**ystem. A design application developed at the University of Sydney allowing the creation of information systems without the necessity of programming experience.

IDC **I**n-**D**welling **C**atheter.

IM **I**ntra**m**uscular (routed into muscle tissue).

IVC/F **I**ntravenous **C**annula (a catheter that is inserted into a vein for supplying medications or nutrients directly into the bloodstream) / **I**ntravenous **F**luids (fluids given through a vein inserted catheter.

L Light Diet.

LOS **L**ength **o**f **S**tay of a patient.

MO **M**edical **O**fficer.

MRN Medical Record Number.

MRO Methacilin Resistant Organism; an organism that shows resistance to Methicillin, a very strong antibiotic.

MRSA Multi Resistant Staphylococcus Aureus; any strain of Staphylococcus aureus that has developed resistance to beta-lactam antibiotics, which include the penicillins (methicillin, dicloxacillin, nafcillin, oxacillin, etc.).

N Neutropenic (very low white blood cell count). Caution must be taken by staff as they could pass something to a patient.

NBM Nil By Mouth.

NCR Nurse Care Record.

ND night shift.

NFR Not For Resuscitation. The patient does not want the clinical staff to use life saving measures.

NG Nasal-Gastric Tube.

NP Nurse Practitioner is a RN educated and authorised to function autonomously and collaboratively in an advanced and extended clinical role. Requires addition 1.5-2 years of study.

NUM Nursing Unit Manager.

OT Occupational Therapist.

PAC Pressure Area Care.

Palliative relieving or soothing the symptoms of a disease or disorder with effecting a cure.

PEG Percutaneous Endoscopic Gastrostomy tube; tube that is inserted into the stomach to give nutrition.

PICC Peripherally Inserted Central Catheter.

PRN as required medication; these are not part of the patients regular medications).

QID four times a day.

RN **R**egistered **N**urse. a graduate nurse who has been legally authorized (registered) to practice after examination by a state board of nurse examiners or similar regulatory authority, and who is legally entitled to use the designation RN..

Rx treatment pertaining to medication / subscriptions.

S strict precaution (Infection Risk).

SC **S**hower **C**omode (in chair).

SC Fluids **S**ub**c**utaneous Fluids; fluids administered just under the skin and not into a vein.

SH shower.

SP sponge bath in bed.

SPC **S**upra **P**ubic **C**atheter.

ST shower with trolley.

TB **T**owel **B**ath.

TDS three times a day.

TEDS brand of Anti-embolic Stockings that are used to prevent blood clots.

TKVO **T**o **K**eep **V**ein **O**pen.

TL **T**eam **L**eader.

TPN **T**otal **P**arenteral **N**utrition; all nutrition is given through a catheter.

Trainee Consultant/Registrar doctor learning his or her speciality.

U **U**rine **OR** MRO Risk (Unknown Status) mean a risk assumption has been made but not proven.

VTE **V**enous **T**hrombo**e**mbolism; i.e. blood clot in the vein.

Warfarin anticoagulant medicine; nurses need to be aware of patients receiving this due to higher risk of bleeding and in case of bleeds.

1. Introduction

1.1. Client Profile

Originally opened in Wahroonga on January 1 1903 as a 70 bed Sanitarium, the Sydney Adventist Hospital (SAH), known to the local residents as 'The San', is a not-for-profit hospital of the South Pacific Division of the Seventh-day Adventist Church. Today, the hospital is a private hospital offering acute care and currently has 358 licensed overnight beds. SAH is the largest single campus private hospital within NSW and was the first of its kid to be accredited by the Australian Council on Healthcare Standards. SAH is proud to have won the Australian Private Hospitals Association Award for Clinical Excellence in the category 70 beds and over in 2006.

The San prides itself on being the single biggest employer within the Hornsby-Kruing-gai area employing over 2,2200 staff and around 700 accredited medical pactitioners. Together, the SAN staff care for more than 50,000 inpatients and about 160,000 outpatients. The San is also known for its maternity wards and is proud to be bringing over 2,000 babies a year into the world. The SAN, being one of few private hospitals to offer emergency care, admits over 20,000 patients annualy making it NSW's largest and busiest emergency care department among private hospitals. The SAN offers medical services ranging from acute surgical, medical and obstetric care to complex cardiac and orthopaedic procedures. The SAN boasts cutting edge facilities that include a dozen operation theatre suites, 3 state-of-the-art Cardiac Catheterisation Laboratories and Australiaś first dual source CT scanner. The SAN is also responsible for operating the San Day Surgery Hornsby and Dalcross Adventist Hospital, located in Killara.

Having the mission statement "Christianity in Action", the SAN not only offers world class care to the patients within the hospital, but also to disadvantaged third world men, women and children as part of its HealthCare Outreach program. Since its inception in 1986, the HealthCare Outreach program has undertaken 100 trips to 13 different countries culminating in over 2,800 surgeries and lives saved.

1.2. Project Description and Scope

1.2.1. Project Description

The SAN Hospital Information System has to service many different clinical specialities and environments. This project will develop a prototype application in the form of a simulator of a novel HIT system for surgical patients. These patients typically have specific and predictable post-surgical outcomes and hospitalisation time-frames, as outlined in various surgical clinical pathways (e.g. Urology such as, Greenlight Laser Prostatectomy, Ear, Nose and Throat (ENT) and Plastics). Caring for these patients requires multidisciplinary nursing and allied health staff information systems. Constructing a requirements document will be a complex task but gives students the richest possible experience in understanding all the stages of requirements gathering, systems design and systems implementation. The project will use a research technology simulator that enables the process of requirements gathering and system design to be integrated as a single process and thereby enable validation of requirements by their implementation into a design simulator.

1.2.2. Scope

The project will commence with the gathering of requirements by meeting and interviewing various clinical staff fulfilling a variety of roles on the surgical ward, level 11. The student will also gather all paper based forms in use on the ward as references during the design process. Upon completion of the first phase of requirements gathering, a requirements document will be created and will represent the basis for design decisions. Throughout the rest of the semester, the student will update the requirements document as necessary. The student will design forms including the clinical handover in the simulator as well as obtain end user feedback during the majority of the semester. Towards the end of the semester, the student will undertake user acceptance testing as well as evaluations of the work done. The project will conclude with a first draft of the clinical handover form and a presentation to SAN staff. The project will finish at the end of the academic semester.

1.3. Project Objectives

- Collect the requirements for a Clinical Handover for use by nurses, allied health and medical staff in the care of surgical patients
- Produce an accurate record of the information each worker needs access to in the form of a requirements document including process flows
- Design and develop a prototype which simulates an electronic clinical information system with handover processes for nurses, doctors and other clinical staff

1.3.1. Risks

Ref #	Probability	Impact	Description	Mitigation
R.1	High	Medium	Reduced performance through use of new technology	Increase allotted tool usage time
R.2	Low	High	Unable to complete project objectives due to simulator issues	frequent communication with simulator developers
R.3	Medium	Medium	Scope creep	Clearly outline scope at outset of project

1.3.2. Assumptions

Ref #	Description
A.1	The simulator will not need to connect to existing SAN applications
A.2	We will have access to a simulator developer
A.3	A project manager will be available to use to assist us in our work at the hospital
A.4	We are not developing a system for actual use

1.3.3. Issues

Ref #	Priority	Description	Owner
I.1	High	Simulator bugs & issues	Simulator Developer
I.2	Medium	Exposed to immense amount of information	Student
I.3	Medium	Sporadic staff availability	Student & PM
I.4	Low	Time constraints due to university courses	Student

1.4. Anticipated Outcomes / Results for the Project

1.4.1. First Draft Computerised Handover Form

At the conclusion of this project, the student should have designed a first draft of a computerised handover form. This draft does not need to contain all information required but should focus on the most important pieces of information especially in regards to nurses. It should convey all relevant design decisions and be capable of representing patients with varying degrees of complexity, the degree to which a patient is ill.

1.4.2. Understanding of IT/IS within the Health Domain

The student will have gained a general understanding of not only the health domain but also the role of IT IS systems within a hospital setting. The student should see the advantages of using computerised information systems to support the clinical staff in their daily work.

1.4.3. Requirements Analysis Complete

By the end of the semester, the student should have completed the requirements analysis for the project. This should include all relevant requirements up to the end of the academic semester. As part of the requirements analysis, the student should have creating as-is and to-be process diagrams for the nurse to nurse handover.

1.5. Benefits of the Project

1.5.1. Technology Evangelisation

Through the project, the student will be able to show the advantages and abilities of computerised information systems to clinical staff in particular nursing staff. Although the clinical staff at the SAN are using applications to record information already, not all aspects of their daily work are digitised; this includes handover. By working with staff throughout the semester, the student will be able to generate end-user buy-in and support for a computerised clinical handover.

1.5.2. Pilot Project

This project constitutes a pilot project in the sense that future students can build upon the achievements of this project. The foundation, both in regards to system design as well as end-user exposure, will provide future students with a lower entry barrier into the clinical domain and into the SAN.

1.5.3. End-User Driven Development

Mention the use of the methodology here

1.5.4. Trialing Designer Tool

This project allowed the student to use a novice health information system application developed at the University of Sydney called iCIMS. The project can thus be seen as a trial for the designer tool enabling the student to not only use a new technology but also to document bugs and suggest enhancements to the system. In essence, the student ran the application through its paces and noted shortcomings as well as possible additional features allowing the application to go through a maturation process.

2. Process

2.1. Overview

In order to take full advantage of the tools employed in this project as well as the opportunity to work at the hospital, an iterative and incremental user driven development process was chosen. This allowed the student to take advantage of the tacit knowledge of clinical staff and allow the end-user to actively participate in the design of the system. The iterative and incremental nature of the process allowed the student to start with one form and then incrementally adding more forms as well as managing iterative changes in existing forms through user feedback. The ultimate goal of any project is to supply an outcome that will be accepted by the stakeholders, in this case the end users. User driven development enabled the student to ensure that during all steps in the project, the system met stakeholder needs and requirements. The active feedback gained from clinical staff enabled the student to shape and form the system to meet user needs. It is important to note that sitting down with clinical staff will was not always possible as their priority lies with patient care. In order to facilitate a continued design process throughout the semester a number of methods were employed. The student utilised participative observations, interviews as well as feedback notes to gain an adequate understanding of the user needs and requirements. The student's work at the SAN was supported by a project manager from the SAN, Hannah Chong, that facilitated first meetings with clinical staff as well as offering feedback on relevant project management aspects of the project.

2.1.1. Participative Observations

As this was the first time the student undertook a IT project within the health domain, it was important to learn how clinical staff worked. Participative observations facilitated this need through *shadowing* clinical staff during various points in their shift. This included sitting in on clinical handover, the process through which the nurse of the previous shift conveys patient information to the nurses of the oncoming shift. By sitting in on handover, the student was able to gain an understanding of the overall process of clinical handover as well as experience the shortcomings and inefficiencies first hand. This enabled the student to relate to the clinical staff when discussing the system design.

The student did not actively participate in handover, that is to say that the student merely observed and did not give handover. Thus, the student acted like a 'fly on the wall', remaining in the background looking on. This method proved vital to the project as it provided a first

hand experience of the current situation. One disadvantage of using participative observations is that the student was overwhelmed at first by the sheer amount of information that he was exposed to. It took some time and effort on the part of the student to sift through, filter and understand the information in order to make the most efficient use of it. As the project progressed, this information overload continually decreased.

2.1.2. User Interviews

In order to supplement participative observation, user interviews were undertaken with various clinical staff fulfilling different roles within the hospital. This enabled the student to understand the viewpoints of various staff in regards to what they do as well as their view on clinical handover. The interviews lasted between ten and fifteen minutes and were held casually. During the interviews, the student asked specific questions about handover and the user's involvement. The interviews were held on the ward or in offices depending on the role of the staff being interviewed. The interviews also served the purpose of building a relationship with the clinical staff. The student's aim was to go back to the interviewed staff throughout the project and attain their feedback on the system design. This social component was very important in order to elicit staff support especially nursing staff as their time was extremely limited. Not undertaking this social component would have made the work of the student much more difficult.

2.1.3. Feedback Notes

During the course of the project, the student met with clinical staff at various times in order to show them the current status of the design as well as to get answers to open questions. During each of these encounters, notes were taken in order to preserve the exchange allowing the student to return to the notes at a later time to refresh his memory. In order to maximise the use of time with the clinical staff, the student was accompanied by another student who assisted with taking notes during the feedback sessions. This allowed the student to focus on the staff and not waste time trying to write down information as well as facilitating a smooth flow during the meetings with staff.

2.2. Tools and Skills

From the beginning of the project, one of the key aspects was the use of the iCIMS. Having been created at the University of Sydney recently, the project was meant to trial the tool in a real world scenario. The main ideology behind iCIMS is to use a graphic interface to build a system thus avoiding the necessity for programming skills. This means that end-users could actively participate in designing the system by creating the system together with the designer. iCIMS aims to be applicable in any clinical situation and thus utilises Ockham's Razor of Design (Budd [2011]), which states that :

"a design should use the minimal number of entities with their maximal generalisations"

In conjunction with using iCIMS, the student utilised Trac, a bug and issue tracking system that also offers documentation functionality in form of a wiki. Two separate instances of Trac were used because the iCIMS project had an existing instance. All bugs and issues were documented in the iCIMS instance of Trac and all project documentation was created in a separate instance of Trac available for the project. All relevant project information, such as interview notes, process flows, etc., was documented on the Trac instance. Apart from playing a vital role in the completion of the project academically, the wiki will also serve as a starting point for future students continuing the project. This ensures that the student's efforts were not in vain and will allow future students to more easily find their way while undertaking future projects.

Apart from electronic tools, the student needed to use communication and people skills in order to successfully undertake this project. Communication and people skills played a vital role as the student was dealing with end-users that were very technology-adverse as well having a low computer-literacy. Inter-personal skills allowed the student to found common ground and terminology with which to communicate with end-user. It also allowed the student to quell most reservations that clinical staff had towards the project or its purpose.

2.3. Scope and Schedule

Although the project description outlines that the student undertake a design of the entire multi-disciplinary handover occurring at the SAN, this was deemed too big of a scope to handle within an academic semester. Below is a depiction that hints at the complexity and size of the entire clinical handover process.

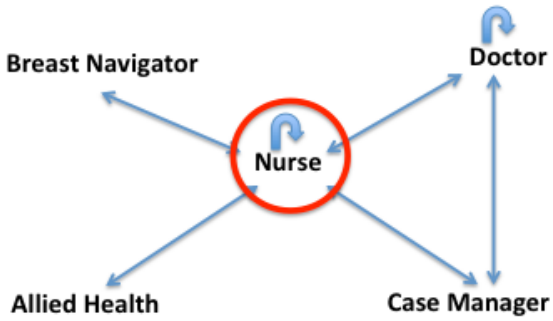

Figure 1: Clinical Handover Overview - All User Roles

As one can see, there are numerous roles involved in clinical handover each with their own needs and requirements. It was deemed unfeasible to undertake requirements analysis, system design and evaluation for all clinical staff involved. The sheer amount of information, communication complexity as well as immense design effort lead to the decision to focus on the nurse role for this project, denoted by the red circle in the figure above. Furthermore, the scope was defined as focusing on the clinical handover between nurses as this was deemed most important in discussions with staff. The nurse to nurse handover is also the most structured handover between clinical staff lending itself to be used in this project.

In regards to scheduling, the project was broken down into four major phases as depicted in the figure below. The week numbers are based on the academic semester timeframe.

Figure 2: Project Process and Schedule

Even though the project was broken down into four phases, all phases were undertaken at most times. The separation merely depicts where the focus lay at each point in time. The schedule of four weeks for requirements gathering was a good estimate and allowed the student to perform an adequate analysis allowing the student to proceed to the design phase. The design phase's projected timeframe of three weeks was too short and was actually the focus of the student's work until week twelve. This stems from the fact that the student had numerous issues with the designer in the form of bugs and it also took longer than expected to convert design ideas into reality within the designer. This was the case most notably because the student was not familiar with the designer or its components prior to commencing the project.

Due to the extensive design phase, the usability and acceptance testing phase was pushed back into the weeks twelve and thirteen after the student was at a point in the design that lent itself to such testing. Although the testing phase timeframe was reduced to two weeks and pushed to the very end of the academic semester, the student nevertheless managed to obtain testing data in coordination with staff. Due to availability issues with staff, not all clinical staff could undertake the usability and acceptance testing. It should be noted that these availability issues did not stem from bad time or appointment management on behalf of the student, but rather on issues surrounding staff being sick or having to take personal days.

The last phase, the reporting phase, was the focus of week thirteen of the project having been pushed back in order to allow for usability and acceptance testing. This did not pose a major issue as the majority of the reporting phase was in the form of the academic report. The other portion of the reporting phase where the weekly status meetings with Prof. Jon Patrick and the documentation of information in the wiki throughout the semester. At the centre of all phases and indeed of the project lay the communication with clinical staff as well as the project manager Hannah Chong and Prof. Jon Patrick.

3. System Design

This chapter will describe SANSURGIMS, "SAN Surgical Information Management System", which embodies the results of the project. The overarching goal of the project was to design a computer based handover prototype for clinical staff as outlined in 1.3. The prototype that was produced in the course of this project is the first attempt within the hospital to create a computerised handover and as such required the student to analyse the current processes as well as undertake a requirements analysis of the handover process. The requirements analysis was accompanied by the gathering of all paper based forms used on the ward. Together, these three aspects represented the design drivers for the project. Each of these aspects is described in more detail in the following pages.

3.1. Handover Overview

Before undertaking any kind of design work, it was necessary for the student to understand and analyse the current handover processes employed on the ward. The handover between nurses, in the formal sense, takes place three times a day, once for each shift. Handover is held at 7 am, 2 pm and 10 pm. The handover takes place in the staff lounge room on the ward. The purpose of the handover is to transfer information about the patients on the ward from one shift to the next. This is especially important in patient care because the handover process enables nurses to highlight important information about a patient that a nurse that is starting her shift **must** know in order to properly care for her assigned patients as well as to properly plan her shift. The information sources for any type of handover, not just the nurse to nurse handover, are diverse as are the communication channels employed as depicted by the figure below.

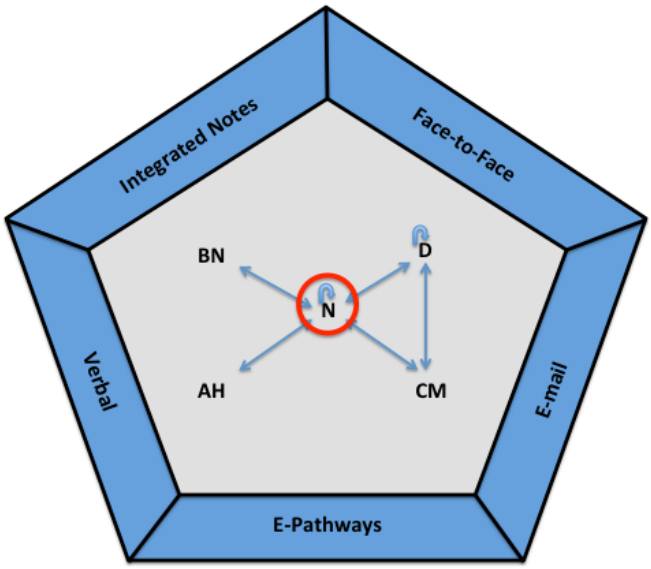

Figure 3: Clinical Handover Overview

As the figure shows, there are five information sources that are also utilised as communication channels. Face-to-Face and verbal communication is the quickest and most efficient way of relaying information in a clinical setting. This is emphasised by the fact that clinical staff have very little time during their shift that isn't devoted to patient care. Thus, communication usually occurs ad-hoc and spur of the moment whenever staff have a minute to spare. This includes communication with doctors, other wards and other nurses. Another advantage of using face-to-face and verbal communication is the fact that clinical staff can obtain immediate feedback to their questions or information exchange. This allows staff to quickly act on information instead of wasting time waiting. This is also one of the reason why handover is being done in a verbal, usually face-to-face, manner on the ward.

As stated, handover should focus on highlighting vital patient information and thus, the nurses and other clinical staff still need to go back to documented information sources to obtain a complete picture of the patient. Such documented information includes a patient's integrated notes or e-pathways as is the case on the surgical ward. A patient's integrated notes is a folder containing all the information in regard to the patient such as filled out paper based forms, doctors orders, medication orders, etc. The integrated notes thus represent everything that is known about a patient. While most wards at the SAN still use paper based integrated notes, the surgical ward has moved to an electronic system called e-Pathways, which stores all patient information electronically. In essence, e-Pathways is the electronic equivalent of a patient's integrated notes. It should also be mentioned that these integrated notes are used by all clini-

cal staff that are charged with the care of the patient including case managers and if relevant breast navigators. This leads to the natural conclusion that it is also used as a communication medium between staff albeit a slow one. This is especially the case for any non-nursing staff as they are not on the ward at all times and the nurse caring for a patient might not be around at the time so information is written into the notes that the nurse needs to read. This in turn leads to the necessity that the nurse go through the integrated notes or e-Pathways of her patients several times a day to check for new information, something that is rather tedious and time consuming and takes the nurse away from her primary duty of patient care.

The last communication channel and source of information is e-mail. This channel is not used in regard to handover information but was added for completeness sake. E-mail is usually used by doctors or breast navigators between each other. It also depends on personal preference whether or not e-mail is used.

As can be seen by the variety of communication channels and information sources, it is quite a difficult task to transform the current processes into an electronic form. Needless to say this would require a change, depending on each staff member this could be a drastic change, in how handover is done and how information is handled within the hospital. This will be discussed further in XXX.

3.2. Current Handover Process

This section will outline and describe the current handover process for a nurse to nurse handover taking place during a shift change. There are two points of concern with the current handover process that needed to be addressed by the prototype. The first point of concern is the fact that currently, nurses will add “fluff” information to their handover. This “fluff” is any and all information that is not vital information about the patient. This fluff ranges from repeating information to mentioning things such as “the patient is moody”. This fluff is not only irrelevant information in regard to handover but it also consumes time during handover and forces the nurses of the oncoming shift to hear information that they must actively filter out.

The second aspect of concern is the fact that nurses on occasion only write down handover information for the patients they are responsible for. This means that the nurse is only aware of her own patients thus limiting her ability regarding other patients on the ward. A situation in which this limited knowledge of patients on the ward becomes an issue is for example when

family members of patient come onto the ward and request information about the person they want to see. If a nurse does not take down handover information for that patient then she cannot be the family members the information they seek and instead has to say "I don't know, let me get someone who does". This negatively represents the work of the nurses and that of the hospital. Another kind of situation in which the lack of patient knowledge causes problems is if emergency action must be taken for a patient. If the nurse that is responsible for the patient in distress is not available, another nurse must take her place and action the care necessary. This can only be done if the nurse is aware of the relevant patient information. While this situation is very rare it is nevertheless a possibility and should be handled appropriately.

Before describing the current handover process, it is necessary to describe the two main roles that partake in the handover. The two roles are the Team Leader (TL) and the Nurses. The roles have the following responsibilities:

Team Leader	**Nurse**
• looks after ward • checks to make sure registered nurses (RN) are fine • is also a nurse • calls out NFR status to all other nurses during handover • in contact with the Assistant Director of Nursing (ADON)	• primary carer of patients • handover to next shift • administer medication • fill out patient forms such as Observation Chart and Nursing Care Record • the night shift creates roster

When the TL comes on for duty, he or she will check each patient to see what their NFR status is. This is recorded in the patient's integrated notes, not on e-pathways. Before the start of each shift, the nurses of the on-coming shift meet in the staff room for handover. The handover usually last around 30 minutes. All of the nurses on the on-coming shift remain in the room during the entire handover.

The first thing that happens is that the TL tells all the nurses which of the patients are NFR. Afterwards, the TL assigns each nurse a set of patients for that shift, which the nurses mark on their Patient Handover List (see Appendix **??**). Then the nurses from the off-going shift come in, usually one by one, and verbally tell everyone in the room about the patients they were responsible for. Each nurse does her handover a little differently even though there are guidelines for handover. They tell everyone the room number, patient name, short history, diagnosis, test results, medication changes, treatment changes, drug allergies as well as outstanding test results and tests/procedures that will occur that day. They report on any variances in vital signs, bowels, or any complications that the patient has. They also mention how the patient is feeling, if they are annoyed, sleepy, disoriented and other general information such as non-critical allergies, ie. shell fish allergy. If a patient is being discharged, the nurse will say where that patient is going and if the patient has left the hospital already, he or she is stricken from the list by the on-coming nurses.

The nurse who is responsible for that patient on the next shift writes down the important information on her Patient Handover List. The nurse will also create a small schedule of upcoming tests and procedures so that she can plan her shift accordingly and not be pressed for time during the shift. Any nurse can ask questions about the patient and the off-going nurse will try to answer them. If a patient is not assigned to a nurse, that nurse will not write down patient information. Should there be any doctor's notes or orders, then these are also mentioned during the handover process. When the off-going nurse is finished giving her handover she leaves the room and thus ends her shift. Should any information be missing then the on-coming nurse will check e-Pathways, the integrated notes or contact the relevant person in the hospital.

Below is a process diagram depicting how handover is currently undertaken based on the previous description.

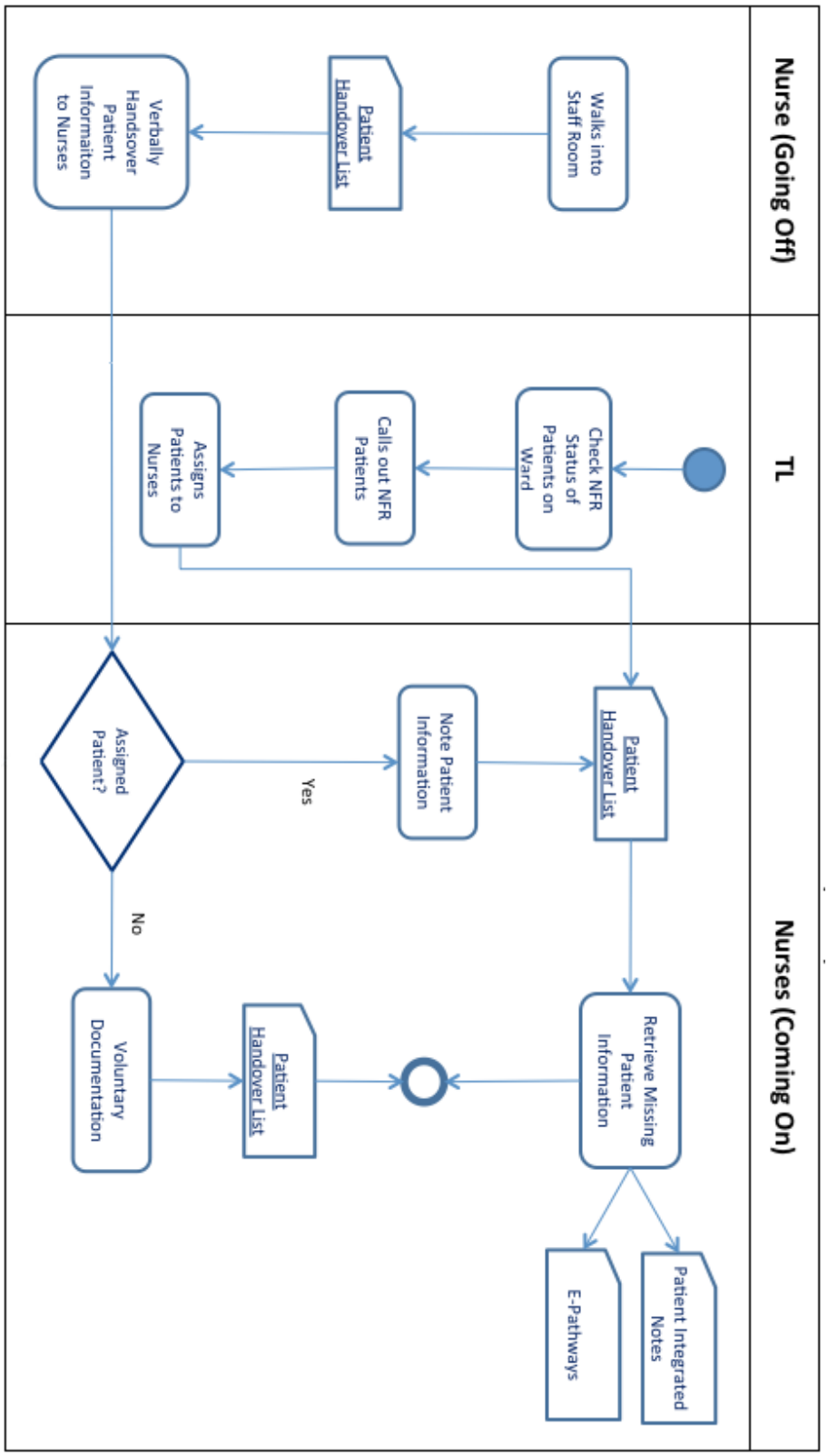

Figure 4: Current Nurse-to-Nurse Handover

3.3. Requirements Analysis

Concurrently to understanding the current handover process, the student undertook a requirements analysis for handover. The student interviewed various clinical staff fulfilling varying roles within the hospital. For a complete list of roles encountered during the requirements analysis see Appendix B.2. The interviews allowed the student to better understand the various roles within the hospital as well as obtaining the view on handover from the major roles involved in handover. After having undertaken the interviews, the student compiled a requirements document that was then verified by staff.

The student based his requirements model on that of the Business Analyst Body of Knowledge (IIBA [2009]). The requirements were split into business, stakeholder, pre-requisite requirements, functional and non-functional requirements. Pre-requisite requirements were requirements that must be fulfilled in order to design a clinical handover and refer to various paper based forms obtained throughout the project. The requirements are documented in Appendix B.1.

It should be noted that the requirements gathered and documented are an attempt to fully document handover requirements and thus are not limited to requirements that can be fulfilled by iCIMS. An example where this is the case is with printing the handover information. While iCIMS has a print function, it merely prints out the web page content and does not allow for print styling. Printing out the web page handover would not aid the nursing staff in their work as each patient would reside on a separate printed page. Nurses would have to carry around seven to fifteen pages worth of patient information, which is not something that is feasible. Instead, the information system containing the handover should be able to print a handover list such as the one currently employed by the nurses.

3.4. Form Gathering

As part of the requirements analysis the student collected all forms in use on the ward. All forms were collected in order to identify the sources of information that ultimately is handed over between shifts. The student collected over twenty forms during the requirements analysis. After collecting all of the forms, the student went through all the forms and identified the ten most important forms in regard to handover. This was done in order to keep within the scope of the project and to reduce the number of forms to a number that could be managed by the students in regard to analysis and digitisation. Of all the forms collected, the following

ten forms were deemed most important by the student in conjunction with clinical staff, in no specific order:

1. Nursing Care Record Form
2. Fluid Balance Chart Form
3. Intravenous Fluid Orders Form
4. Pain & Symptom Assessment Form
5. Patient History Form
6. Adult Observation Chart
7. Medication Chart Form
8. Temporary Transfer/Handover Form
9. Patient Handover List Form
10. Patient Mobility Form

Apart from forms 5 and 8, all forms are filled out at least once a day and thus hold the most up to date information on the patient. In order to better understand the forms and how the relevant information is documented, the student also gathered filled-in versions of these forms. A very important issue to raise here is the fact that because the forms are paper based, they are filled out by hand leading to issues with legibility. The student, on numerous occasions, encountered this problem and had to seek assistance from the relevant staff member to clarify noted information. The issue of legibility was also raised by clinical staff themselves, not only in regard to doctors but to all staff, and is something that they wished to be addressed. The filled-in forms also allowed the student to enter realistic data into the prototype in order to present the functionality to clinical staff.

Another issue that should be noted in regard to forms is the fact that most of the time, certain parts of forms were not filled out because they were not relevant for that patient. This presented the student with the problem that diverse variations of information was not available for all parts of forms. Unfortunately, it was unrealistic to ask clinical staff to provide such information for all possible situations because that would have required them to use a considerable amount of their time to generate the information, time that they did not have. Nevertheless, the student managed to adequately design the prototype based on the available information.

3.5. Design Process

Figure 5: Design Process

Describe figure of how you designed: paper-designer-web page Give an example (Nursing Care Record) -¿ NEED TO SCAN THIS! SCAN EMPTY HANDOVER LIST AS WELL

Describe design choices Describe how you have to weight off between "Handover by Exception" and providing all relevant information to medical students/temp nurses/junior nurses that don't necessarily know what is normal

3.6. User Scenarios

Describe NEW process and its shortcomings (include Diagram) how do users interact with the system? What operations do they perform?

4. Evaluation

4.1. Testing Procedures

4.2. Interpretation of Results

5. Future Work

6. Reflection

6.1. Contribution

6.2. Difficulties

6.3. Lessons Learned

6.4. Future Suggestions

7. Conclusion

think about taking out future work and moving concluding remarks to the end.

7.1. Concluding Remarks

7.2. Strengths and Weaknesses

7.3. A Second Time

7.4. Future Work

A. Bibliography

Alhir, S. S. (1998). *UML in a Nutshell*. O'Reilly & Associates, Inc.

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B. Appendix

Include the following:

- Roles at SAN wiki page
- Scans of original questionnaires
- Screenshots of SANSURGIMS (Web and Designer)
- Scans of important forms (Nursing Care Record & Patient History)

B.1. Handover Requirements

Assumptions

- A1: The adding of patients to the ward list is automatic and will be undertaken by the admission system (this is out of scope)
- A2: Handover should be done by exception rather than the rule, this means that the handover should focus on variances
- A3: Resuscitation is not part of the clinical handover
- A4: We can make up data such as Doctor Names, etc
- A5: We can use abbreviations if they are standard abbreviations
- A6: In regards to the Discharge Plan, we can simply put the Discharge Destination and assume that all relevant information resides in another system that we are linking to
- A7: In regards to test results, we can assume that we are linking to a different system where all the relevant data is present and we merely have to show the status of the test

Business Requirements

- B1: Increase efficiency in conducting Clinical Handovers by reducing human errors
- B2: Increase productivity in conducting Clinical Handovers by reducing time in accessing patient information
- B3: Reduce redundancy in delivering Clinical Handover information for the staff on the next shift

- B4: Reduce time in doing handovers by providing nurses, doctors and allied health access to an electronic copy of patientÕs information
- B5: Create a uniform handover for clinical staff

Stakeholder Requirements

- S1: A user must be able to access patient information of any patient on the ward
- S2: A user must see the critical patient information first when accessing that patient's information in the system
- S3: The status of the patient in terms of current location, procedure or activity should be accessible by the user
- S4: A user has to be informed of changes in the patient's information for:
  - test results
  - variances in observations
  - change of medicine whether in dose or type
  - change in patient treatment
  - ward transfer
  - basic patient information
- S5: A patient must be displayed as a whole on a screen
- S6: Users have to know which !Nurse/!Doctor(s) is assigned to a patient
- S7: Users need to know, at all times, which patient they are looking at
- S8: Nurses and Doctors should see the patients they are responsible for first
- S9: Nurses and Doctors must be able to view a complete list of patients on a ward
- S10: Nurses and Doctors must be made aware of variance incidents of prior shift
- S11: The end users care about color so the forms need to be pleasing to the eye
- S12: In terms of handover, the nurses want to know the following:
  - Any tubes, lines, drains

- The rate of the IV (ml/hour)
- If the patient has voided or not
- If the patient has a catheter or not and whether the catheter has been removed
- What drains a patient has or what drains have been removed
- The volume that has drained
- How much blood is going (blood transfusion)
- Relevant Dr's orders
- Discharge plans & management
- Short summary of patient history
- Allergies
- Upcoming procedures
- Upcoming tests
- Outstanding test results
- Patient Mobility
- Patient Fall Risk
- Medications patient is on
- Whether the patient has NFR status
- Infection control

Pre-requisite Requirements

The following requirements are necessary in order to design a complete clinical handover:

- PR1: The system must contain the same information as the Resuscitation & Treatment Directive form
- PR2: The system must contain the same information as the Nursing Care Record form
- PR3: The system must contain the same information as the Fluid Balance Chart form
- PR4: The system must contain the same information as the Intravenous Fluid Orders form (Medication/Order by a Dr.)

- PR5: The system must contain the same information as the Initial Admission Assessment form
- PR6: The system must contain the same information as the Initial Pain & Symptom Assessment form
- PR7: The system must contain the same information as the Prescription & Observation Chart for Continuous Subcutaneous Infusions via Syringe Driver form (Medication)
- PR8: The system must contain the same information as the Patient History form
- PR9: The system must contain the same information as the Adult Observation Chart form
- PR10: The system must contain the same information as the Medication Chart form
- PR11: The system must contain the same information as the Temporary Transfer/Handover form
- PR12: The system must contain the same information as the Patient Handover List form
- PR13: The system must contain the same information as the Patient Mobility Assessment form
- PR14: The system must contain the same information as the Nursing Risk Screening & Assessment form

Functional Requirements

- F1: The system must display the patient's critical information on the handover screen
  - critical information is any and all of the following:
  - short concise patient history including comorbidities
  - patient age, name, MRN, POD and EDD
  - diagnosis
  - whether the patient is NFR or not
  - admitting and consulting DRs
  - medications that impact the care for the patient
  - outstanding procedures

  - outstanding test results
  - any and all variances in tests results or observations
  - important allergies such as those to medications or materials used in the hospital (eg. latex)

- F2: The system must be able to print out a "Handover List" with the critical patient information on it:
  - Bed/Room #
  - Patient Name
  - Age
  - MRN
  - POD
  - EDD
  - Admitting Doctor
  - Consulting Doctor
  - Diagnosis
  - Medications
    - Antibiotics
    - Anticoagulants
    - Antielgesic
  - Diet
  - IVs in patient and their rate
  - Drains in patient
  - Allergies
  - Medical History / Comorbidities
  - Small space for notes
  - Infection Status
  - NFR Status
  - Observation Frequency

  - Outstanding Test Results
  - Urine and Bowel voiding
  - Wounds
  - Operation Information (Theater, Time, NBM)
  - O2 Status
  - Fluid Restrictions
  - Blood Glucose Level
  - Discharge Information
  - Test result status

- F3: The system must be able to print out a filled schedule for the patients a nurse is responsible for
- F4: The system must be able to display a schedule of all procedures or time restrained actions the nurse must undertake for her patients
- F5: The system must allow a user to assign each nurse a set of patients for the shift
- F6: The system must log all user action for reference as well as auditing purposes
- F7: The system must allow the user the opportunity to add notes to a patient's information
- F8: The system must "highlight" variances for the user
- F9: The system must allow a user to enter information in regards to:
  - observations
  - transfers
  - notes
  - form data
- F10: The system should be able to qualify a user based on their role
- F11: The system must timestamp all printouts
- F12: The system should differentiate between allergies in regards to clinical treatment and other allergies (eg. latex allergy vs. shellfish allergy)

- F13: The system must be able to store multiple procedures for each patient with the varying operation dates and times
- F14: The system must be able to store complications that arose during a patient's operations
- F15: The system should inform the user of the status of test results at the following various stages
  - blood drawn
  - ready to be read (result available)
  - result acknowledged
- F16: The system must display a list of all patients on the ward
- F17: The system must allow the user to access handover information at any time during the shift
- F18: The system must visually differentiate between patients who are NFR and those who are not
- F19: The system must visually identify the infection control for each patient
- F20: The system must alert the user in the handover if infection control for the patient is necessary
- F21: The system must alert the user in the handover if there are vital sign variances for the patient
- F22: The system must provide a patient history summary in the handover
- F23: The system must provide the discharge destination of the patient to the user
- F24: The system must display the status of test results
- F25: The system must alert the user in the handover of any medically relevant allergies of the patient
- F26: The system must alert the user in the handover of any complications arising from surgery
- F27: The system must inform the user in the handover of the patient's dietary needs

- F28: The system must be able to store visual impairments of patients (eg. Glaucoma or Macular Degeneration)
- F29: The system must alert the user in the handover to any visual impairments the patient has

Non-Functional Requirements

- NF1: A clinical handover supported by the system cannot take longer than 30 minutes in regards to one nurse and her assigned patients
- NF2: The system must adhere to the Australian National Privacy Principles
- NF3: The system must adhere to the Federal Standard 6 "Clinical Handover"
- NF4: A user must be able to access a patient's information within 30 seconds
- NF5: Users with reduced vision must be able to use the system

B.2. User Roles

Roles	Responsibilities
Breast Navigator	• autonomous in their activities • regular communication with NUM/TL/Nurses • social care • documents social or emotional notes for nurses • share information between each other • reports directly to medical admin • undertakes follow ups with patients after treatments such as chemotherapy
Case Manager	• monitors patients length of stay • undertakes social activities with patients and their familiy • works towards a discharge plan with the patient • coordinates patient care with clinical staff • reports to Director of Medical Services • is in charge of patient's discharge plan • initiates referrals to RehabHospitals • ensures that the estimated date of discharge is met

Roles	Responsibilities
Career Medical Officer	• has 12 hour shifts • responsible for one of three areas: ICU, Acute Care or all Wards • fullfils doctor role • responsible for handling urgent matters that require review if responsible doctor is not reachable • checks ward book for routine tasks and problems written by nurses • arranges consultations with specialists • handover to each other as well as to specialists • verbal, face-to-face contact with TL, NUM and ADON
Doctor	• verbal, face-to-face commuication with all staff • sees patients • decides patient treatments • undertakes referrals to other parts of the hospital • checks in with only his/her patients • requisitions tests for patients • does handover whenever/wherever he/she finds the necessary people

Roles	Responsibilities
Nurse	• primary carer of patients • handover to next shift • administer medication • fill out patient forms such as Observation Chart and Nursing Care Record • the night shift creates roster
Nursing Unit Manager	• communicates with the TL • management role • oversees the entire ward • does not undertake any patient care • meets with staff in regards to patients/problems/how staff are doing • responsible for the staff roster and ward budget • handles patient complaints
Team Leader	• looks after ward • checks to make sure registered nurses (RN) are fine • is also a nurse • calls out NFR status to all other nurses during handover • in contact with the Assistant Director of Nursing (ADON)

Roles	Responsibilities
Volunteer	• in charge of putting flowers in rooms • undertakes light patient care for example bed baths
Ward Secretary	• manages inter-hospital transfers • manages calls into the ward and gives out information • manages a discharge board • handles patient pickup for external transport • handles communication with patient's family • ensures all paperwork is done • updates whiteboard for pharmacists, physios, cleaners and therapists • manages bedflow • information liaison on the ward
Wardsmen	• assist with transport of patients to other wards • assist with full care of patient • checks black clipboard on ward for information