ROLE OF NURSING OFFICERS

IN PROVIDING IMPROVED PATIENT CARE

USING COMPUTERS AND INFORMATION TECHNOLOGY

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Nursing
INformatics

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*Computer Mediated communication transgresses the normal cultural boundaries
between oral and literate practice. (Yates (1994:i))*

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Introduction

With the aggressive advent of computers and information technology in every work field, the question of its implementation in medical and nursing fields is not of 'if' anymore but of 'when' and 'how'. The advent of computers for medical record keeping, point of care nursing, integration of net based communications with daily practice and involvement of computerized applications for clinical work has led to an inescapable reality that the nurses have to learn computers and effectively use its application in day to day clinical work.

	The use of computer-based technologies, for information management and for communication, will increasingly be part of the normal work experience of many nurses.

Nursing has been described as an information-intensive profession (Ball et al 1988), with nurses needing access to accurate, pertinent and timely information in order to provide the highest quality of care (Hays et al 1994). Advances in nursing and health care depend as much on the quality of communication as on the quality of information.

Before we proceed further it would be relevant to mention that a few terms have been used extensively in this project and for any reader, it'd be important to understand these terms for effective comprehension of this project. The terms are **CIS, CMC and POC charting**.

- CIS stands for Clinical Information Systems. This essentially consists of a bunch of computers in a hospital setting and a few of medical gadgets (MRI, digital x-ray, cardiac monitors/ventilators, ECG etc) and few other gadgets (like smart card swipe machines, bar code readers etc) connected to each other in a Local Area Network (LAN). There is a central server to manage flow of information. This system has a hospital automation software installed which essentially has a central database and various

groups of password authenticated users (with variable set of user privileges) who have the authorization to enter/read/print data into/from that database. The system is dynamically updated and info can be accessed by all terminals upon providing authentication in the form of password or fingerprint confirmation etc. as per user's authorization to information.

● <u>CMC stands for Computer-mediated communication</u>. This essentially includes all forms of communication in a networked environment. This will include e-mail, messenger functioning, file transfer protocols (dicom transfer, telepathology slides transfer etc.) , video/audio conferencing, telemedicine network, automated paging system and even net-based video monitoring of patients for clinical purpose.

● <u>POC Charting stands for Point of Care Charting</u>. This is done in the following manner. The computers provided to nurses in the wards are installed with long duration battery backup on a mobile trolley and are connected to the LAN* by Wireless router (common and cheap hardware nowadays). The nurse's computer trolley is custom made to accommodate her clinical paraphernalia like thermometer, sphygmomanometer, etc. The nurse moves from patient to patient with this mobile trolley and enters the patient data then and there, at the point when she measures the vitals etc. This is POC Charting. This saves the nurse a lot of time in entering charting data later and also makes the patient data available to everyone in real time. This also puts a time stamp on when the data was entered.

It is clarified that 'net' here refers to LAN (Local Area Network) and it has been assumed that CIS and CMC will neither be a part of Internet nor a part of Army intranet (as per existing policy). However the telemedicine network has been assumed integrated with hospital network and this is technologically so simple that integration of these two networks is a child's play and makes life easier for everyone without any significant security issue.

Having understood these terms, we can proceed further with the conceptual details of nursing informatics.

Computer-mediated communication (CMC) forms an important part of computer usage in clinical work and encompasses a number of methods, including computer conferencing, e-mail, the use of list servers, data-feeding at one terminal and its accessibility to everyone, etc. It allows for the development of communication and co-operation between groups of people that is not restricted by geographical or temporal proximity (Lyness & Raimond 1992), but based on shared expertise.

CMC is a new phenomenon for many nurses, particularly in the Army (due to restriction of Internet communication facilities at end-user terminals), although it has been in use within clinical and educational nursing settings in other countries, especially the USA, for many years. Currently, only a small proportion of the nurses who could have relatively easy access to the facilities actually use CMC (Anthony 1994a,b), even in 'developed' countries with a history of healthcare computing. In the Army most nurses do not currently have access to computer networks at places of work or education.

While computer networks have undoubted importance, the possibility of nurses using such networks to "talk" to each other has even more profound implications. Much of nurses' everyday work, whether they are involved in clinical, educational, administrative, or research work, or the new field of nursing informatics, necessitates communicating, by spoken or written means, with colleagues or with patients/clients.

While the global total of nurses currently using CMC is relatively small, it is growing rapidly. **The questions that arise about these nurses are- What do they communicate to each other/ doctor/ patients etc. and what impact it has on their everyday experience as nurses.**

Consequently a sore need was felt for establishing the need, developing a protocol, identification of turn-key solutions for providing computer aided nursing care and to define the accompanying necessity of the nurses being computer literate and capable to march ahead hand-in-hand with the rapidly progressive, technologically enabled global medical fraternity.

This project is a pilot project to establish the points where a nurse can effectively use computer to the benefit of both, the hospital and the patient.

There is a dearth of scientific studies done in this regard and whatever few are available have mostly made use of the resources that were available and not of pre-defined resources as the case ought to be, for any scientific study. This said, we made a conscious effort to identify key areas where a nurse can be helped by a computer and not where a computer merely acts as an additional workload for her and does not pay her back in terms of increased efficiency and improved patient care, not to mention faster, effortless communication and better diagnostic, prognostic and research capability.

Establishing the need

In recent years, hospitals and healthcare facilities have been implementing clinical information systems (CIS) as a means to streamline processes and reduce costs. Evaluations of these implementations often focus on the technical aspects and tend to overlook the social and organizational issues, which actually play a more important role once the installation of a CIS is over. By studying social and organizational issues of the end-users in their local environment, important issues can be discovered to help improve the system's overall acceptance and usability.

Army Medical Corps has adopted an IT Road map 2008 which has significant implications. Hospital automation is but a part of it. Implementation of CIS and CMC is inevitable and Nurses being the hub of any clinical ward cannot remain untouched by this process. More importantly, they have to be active participants in the whole process to make the automation concept a success. It must be understood that a nurse is an important cog in the wheel of any hospital and if she gets sidelined from any progressive development, she'd actually begin to be a spanner in the works. This is so because the maximum efficiency that can be achieved by any system is equal to or less than the maximum efficiency of its most inefficient member.

So we see that a nurse cannot afford to remain unconcerned and non-participative with hospital automation lest she ends up being inefficient. This would have serious implications on the success of any organization's IT enablement and its road map. It would be detrimental to the hospital to have a nurse who is ignorant of CIS. This will practically translate into deterioration in patient care because while the older manual systems would become obsolete and rendered unusable, the nurses, who do most of the ward work would be inefficient in carrying out CIS and CMC resulting in a complete breakdown of maintaining patient records, communications and all other automated delivery systems. End-sufferer would be the patient.

Late in 1994, a nurse in the USA typed a message into a computer keyboard. It was sent by e-mail (electronic mail) to a computer in Canada, whence it was automatically redistributed within minutes to over 1200 other nurses around the world. An extract from that message reads:

> "...Nursing is the only field in which massive numbers of workers within it do not believe that the substance of the science and the profession should be defined, researched, elaborated, and taught by those who are educated to the highest level in that field. Why is this? If we are ever to have parity with other disciplines this must become a reality. Speaking as someone who was an unlicensed health care worker, an LPN, an ADN, a BSN, MSN, and now a PhD-prepared nurse and a professor, I honestly believe that those who hold the PhD in Nursing Science should have the greatest say about what is nursing science, nursing art, good nursing practice, bad nursing practice, NOT nursing practice, etc..."

During the following weeks, nurses in North America, Europe, Australia, South Africa and elsewhere engaged in *electronic discussion of the issues raised within the context of global changes in the availability and technology of telecommunications and computer-mediated communications (CMC), which affect the potential for nurses to use new means of communicating with their colleagues, and with patients/clients.* It was felt that it is of paramount importance for the nurses to use the newer facilities like CIS and CMC so that not only are the patients benefited, but the profession of nursing also survives this test of modernization of a profession whose roots emanate from personal touch and empathy.

Some studies have investigated practical, everyday applications of CMC, demonstrating its utility for overcoming problems in teams of co-workers, while others have described effects on organizational structure and on degrees and types of co-operation. McCreary & Brochet (1991) discuss, for example, the use of CMC by international teams and how geographical and temporal separation were overcome. Additionally, and significantly, they found that the "level of interaction of this [European] continent-wide network of researchers was estimated to be five to six times greater than their experience led them to believe would have been possible using the telephone and mail services only" (McCreary & Brochet 1991:71).

So we came to the conclusion that it was important for a nurse to be computer literate to be a part of rapidly changing scenario at this front. *This established, the bigger question was raised; that of determining the points and aspects of nursing care where computers would be an aid and not detrimental to their efficiency.*

It was felt that everything cannot be aided by computers. This was because nursing includes abstract things like sympathy, empathy, humane behavior, psychological handling of patients, ensuring ward discipline, etc. Needless to mention that a computer cannot do any of these things and a nurse cannot function without these. Computers cannot thus replace a nurse because the personal touch is the basic essence of nursing an ill person.

However, the advent of science and implementation of scientific attitude, Insurance claims and patients' awareness towards acts of commission and omission leading to negligence led to a practice of extensive documentation in the field of medicine and nursing.

Nurses must spend a considerable amount of time documenting the care they are giving to their patients. In non-computerized environments, this involves writing the nursing notes in longhand. These notes report on the treatments, medications, procedures, diagnostic tests, and other components of the patient's health and activity over a certain period of time.

In other moments, they are seen busy with manual patient monitoring systems like mercury sphygmomanometers, secluded pulse-oxymeters who keep beeping at their own whims, keeping a time check about a particular patient's periodical need for suction, keeping a tab on the tracheostomy, monitoring the third patient's IV line while looking over the shoulder to ensure that next patient's IV Blood infusion has finished uneventfully or not, manual ventilators etc.

Therefore we endeavoured to identify where the computerization would be rendered most effective and **following areas were broadly outlined as goals for effective computerisation of a nursing station:-**

1. Better documentation
2. Better patient monitoring

This translated into improvement in following areas of functioning of a nurse:-

- **Better documentation**

    1. Do not have to search for chart to do documentation of assessments, intake and output (I/O's) and vitals
    2. Point of care (POC) charting (improves timeliness and reduces redundancy)
    3. Legible documentation
    4. Automatic I/O totaling and net amounts and warnings about shortfalls and excesses.
    5. Remote access to physicians at a click by automated paging systems.
    6. Electronic queries for chart audits
    7. One place to view/review: assessments, I/O, vitals, respiratory therapy, and rehabilitation services
    8. Laboratory, radiology and transcribed reports available to view at a single place.(Read: not having to shout at Nur. Asst to fetch reports because senior advisor is coming for grand round)
    9. Not having to maintain case sheets and other documents in physical form in a cupboard. (Read: reduced risk of residents misplacing the case-sheets)
    10. Automated maintenance of controlled drugs etc.
    11. Automated indenting of drugs, ward consumables etc. with warning systems for expiry dates and falling stock level in the cupboard.

- **Better patient monitoring**

1. Automated reminders for procedures, pre-operative preparations, referrals, PA Check-up, surgeries and drug delivery timings.
2. Centralized monitoring of all patients in the ward.
3. Automated emergency procedures at the click of a button. E.g. Paging of intensivist, paging for ambulance driver, activating the OT, sending a paging call/sms to concerned doctors and technicians, asking blood bank for blood etc. can all be done by clicking a single button.
4. Better monitoring of false alarms.
5. Better handling of electronic equipment due to adequate knowledge and **integration of equipment on the same platform.** (E.g. A doctor at CH(NC)(J&K) orders an MRI but is called away for another emergency. The Nursing officer sends the patient for MRI, receives the report and film on CMC, finds that situation is critical but since their own doctor is unavailable she pages a senior doctor at AH(R&R)(Delhi) by integrated telemedicine network making entire case history and records available to him; The R&R doctor advises that this case should be priority-I. The Nurse then sends emergency info and paging call to CH(NC) doctor who loses no time in coming back *because the higher priority of this case has already been established and he is not being called for re-evaluation purpose only*; Meanwhile the nurse, on cue, also alerted the OT, Anesthetist, Blood Bank and ambulance driver by a single 'Emergency Paging' button click. Time saved. Life saved.)

Thus it can be seen that there is a dire need for nurses to be computer literate to provide modern day health care and their involvement with CIS and CMC projects is critical for the success of any hospital automation project.

To proceed further, we must now study the CIS environment in which the nurses will soon be expected to work.

The Vision

To study the viability of any project, it is of paramount importance to visualize and conceptualize the situation where that project is going to be implemented. Indian Armed Forces have already been automating several hospitals and several examples of hospital automation exist. Most of them have been achieved to some intermediary stage and complete automation as achieved by some model hospitals of Ohio or Boston, Massachusetts is yet to be achieved. But considering the constantly narrowing gap in the technological know how of India vis-a-vis the West, it does not appear to be a distant dream.

For the purpose of study we shall not take any hospital as a role model but will consider a hypothetical, Utopian prototype model of a Military Hospital. Having stated this, it would also be pertinent to mention that a majority of features projected in this Utopian model are functioning in some way or the other in various Military hospitals, some military establishments (like CSD, AEC Libraries etc) and at INHS Ashvini, too, though it'd be difficult to say for the author if any single hospital has implemented all these features of automation already.

We assume that the workflow of a military hospital cannot be changed drastically because of its unique organizational requirements. Therefore we envision a Clinical Information System which is well integrated with military pattern of administration, reporting systems, communications and protocol.

Thus we shall study a model in which **every step of present workflow has been conceptualized in an automated atmosphere** and direct comparison has been provided to the reader for easy comparison and formation of a mental picture.

	Present scenario	*Future Vision*
Step 1	A dependant patient arrives at the gate of the MH. His Dependant card is checked by the guard to ensure identity and he is allowed to enter.	A dependant patient arrives at the gate of MH. He swipes his *Medical smart card* at the gate and puts his thumb over finger print scanner (a common device in most laptops today) for identity verification. The automated gate allows him to pass.
Step 2	He arrives at MI Room and goes to 'Reception' for registration and getting his registration slip and token no. in queue for his respective OPD. The nursing asst takes appx. 3 mins. to fill out his details. Variable time is spent in standing in the cue at registration counter.	He goes to 'Reception Computer Kiosk' and again swipes his *Medical smart card*. He is offered the option to choose his OPD on a touch screen. When he does this, a printed reg slip with his personal particulars & queue no. comes out of printer.(Note: This system is already functional at some hospitals and banks in India)Time taken about 30 secs.; consequently no queue would usually form.
Step 3	He is examined when his turn comes and the MO prescribes admission. (We consider this scenario because nurse's role begins mainly for admitted patients)and writes a case sheet.	He is examined when his turn comes and the MO prescribes admission. The MO then merely chooses the option 'admission' as the disposal of the case on his computer screen & selects the ward. Writes a case sheet, of course.
Step 4	He goes to admission counter where his particulars are noted down on filmsy, A&D Book, and other forms are filled up. He is then guided to the ward.	No formalities are required (because all details have been automatically filled from the smart card swipe). The ward has also received an urgent mail at Nursing station giving the admission details. Nursing offr starts preparation for admission. Patient goes to ward directly.

	Present scenario	*Future Vision*
Step 5	Here onwards, we stress mainly on nursing care. The Nurse receives the patient and again fills up all the data in admission report book. Makes an I/O chart and again fills all his details. Fills lab Inv forms and fills all personal details. Makes treatment chart and again fills all details. And so on....	No admission book filling (automatic SQL database dependent admission book available to Commandant, PM etc). No I/O chart making (Point of care filling in of details creates accurate electronic charts. No paper charts. Charts available to doctors, lab, radiology, Commandant etc online **all the time**.) She takes his samples and runs the bar code reader on the pre-printed bar code on standardized vials/ sample bottles (in which sample is being dispatched). On computer screen she chooses from the desired investigation from a drop down menu. (When the lab receives the sample, they will run the bar code reader on the sample bottle and will come to know all that they need to know on their screen.)
Step 6	The nurse then proceeds to note down the vitals of the patient in *TPR book*. Then notes them down in the chart attached to case sheets. She also fills in the *treatment book* and then fills it in treatment chart. Then measure *I/O* and fills it in charts. Makes *diet chart*. Checks whether or not she has the required drugs and their expiry dates in *stock*. Finds a drug short and prepares *urgent indent*. More similar activities and their charting...	Upon arrival of patient, does not need to fill personal particulars anywhere. Enters treatment drugs **once** at the time of admission (& when changed by physician) and then merely clicks 'done' every time she dispenses the medication. *Fills TPR, BP etc only once* in her ward vitals' page and all patients' charts get automatically updated. Ditto for all other charts. Each time a controlled drug is clicked 'done', the *ward indent also gets automatically updated* about stock position and warns her when stocks fall low or approach expiry dates. When drug levels fall, she *clicks 'indent' button* and medical store receives the urgent indent. They send back 'confirm' message and she details ambulance assistant to fetch the stock.

	Present scenario	*Future Vision*
Step 6	The nurse is filling her charts when she suddenly remembers and runs to check IV bottles of two patients. Then remembers to send *ward sahayika* to pick up the patients' lab and x-ray reports. She must also find out if medical store has passed the urgent indent (collection would be done later). Then checks the BP and Pulse oxymeter of 2 DIL cases and then returns to entering values in charts. Takes 5 min to remember where she was...	Fills in charting details at patients bedside usually only once **and with peace of mind** because centralized patient monitoring systems would alert her when IVs finish, when BP falls or pulse oxymeter shows low value. **Lab reports and x-ray** are *not to be collected* as they are already available at a click to anyone who needs them. Urgent indent has already been 'confirmed' and collected much earlier. She gets more time for patient care and lesser documentation and hassle free patient monitoring leads to greater efficiency.

We stop here confident that by now the reader has got the picture of our vision of a modern CIS and CMC enabled hospital environment that we envisage.

Any new idea, when introduced is initially criticised and written off, then termed radical but revolutionary, then accepted and made functional.

We now proceed to discuss the anticipated changes in the workflow of the Nursing officer.

Study of changes in workflow of a nurse using CIS and CMC

The success (or failure) of any new system depends on how well it has been designed keeping in view-

- The present working system
- Work flow of that organization
- Work ethos
- Ability of the potential workers to assimilate it in their system
- Finances

Therefore we consider it important to anticipate how the nursing officers, hospitals and patients are going to get affected by this proposal. We make a major reference to '*A qualitative assessment of changes in nurses' workflow in response to the implementation of an electronic charting information system'* by Erica Danielson, a study done at Division of Medical Informatics and Outcomes Research of the Oregon Health & Science University School of Medicine for this purpose because the pattern studied closely resembles the pattern of workflow in our military hospitals. Moreover it avoids the pitfalls of bias when we use a major scientific study for understanding implementations of a project that is ,as yet, an unchartered territory.

The purpose of this study was to assess workflow of nurses both before and after implementation of a CIS. This was a qualitative study using both observational and informal interviewing techniques to gather data. Five nurses were shadowed at three time periods, pre-implementation and at two and four months post-implementation. The data were analyzed in three ways. First, each nurse was presented as an individual case study, which provided an assessment of individual changes in workflow over time. Second, observations from all of the nurses were considered globally, providing insight into general themes and

changes in workflow that applied to the nursing unit as a whole. And third, a comparison was made between the benefits of using the system as stated by the hospital facility, which funded the implementation, and the benefits as perceived by the nurses, who were the end users of the system.

With this in mind, we also recognize that there is a broad continuum of "problems" or topics to consider in evaluation of a systems implementation. Of those that have been undertaken, many have focused on the computer technology itself. But over time, with larger more pervasive systems being implemented, leading to an increasingly extensive number of people being impacted, evaluators are realizing the importance of studying the people and the organizational issues as well. Although it is hard to determine the actual failure rate of systems implemented in healthcare organizations (for obvious reasons, health care facilities do not want to publicize failures), there is no doubt that the end-users have the power to make or break a system implementation. These are the people who use the system routinely and they have the power to determine whether the implementation is a "success" or a "failure."

Subjects/Sampling
Five nurses from the Med/Surg wards were selected for this study initially (one was added later). They were recommended by the Matron in-charge as "representative" of the nursing staff.

Computer proficiency of nurses under study
With respect to computer proficiency and comfort level using a computer, all nurses were requested to fill out a self-reporting form two months prior to implementation of the CIS. This information was used to provide a general sense of nursing skills and exposure to computers, allowing the development of appropriate training information to be put together for the nurses prior to implementation. The form asked the nurses to rate themselves with respect to experience (no experience, some experience, and experienced) and comfort level (uncomfortable, comfortable, and very comfortable). The nurses selected to participate in this study all described themselves as having some experience. However, with respect to their comfort level, they ranged from uncomfortable to comfortable (two rated themselves as uncomfortable and three rated themselves as comfortable). All of the nurses were women and they all worked the *day shift* in the Med/ Surg wards.

Observations

Six prototypical nurses were studied and the differences in their workflow were observed. They are described below.

Nurse A

Nurse A was a senior nurse who had practiced for over thirty years. She relayed the fact that *she was not comfortable with computers* and *did not feel that their use in patient care was appropriate*. From the outset, she was the least proficient computer user of all the nurses in this study and was the slowest to figure out the system. When she was observed at two months post-implementation, she slowly entered data with her index finger alone.

In looking at Nurse A over time, the following are summary observations of her work patterns. She finished her work/shift at about the same time both with and without the computerized system in place (although her perception was that it took her longer with the computer). Prior to implementation, she did most of her charting toward the end of the shift, and by two months post implementation, this had not changed. However, by four months post-implementation, she had completed the majority of her patient assessments by 11:30am, leaving the I/O's, nutritional assessment for lunch, and progress notes to be charted later toward the end of the day. Although she was not necessarily doing point of care (POC) charting, she did appear to be doing some of it earlier in the day. Nurse A's impression of the system was that patient care was suffering with the CIS in place. At two months post-implementation, she said, "The computers take away from time that I would rather be spending with my patients." She relayed that same sentiment again during the six-month post-implementation member checking session.

Nurse B

Nurse B was a younger nurse who worked in the Med/Surg ward and in the ICU. She was a very proficient computer user and highly self-motivated, spending extra time on the computer to figure out shortcuts in the system. Prior to implementation, she was the only nurse who had already completed her main

charting for the day early in the shift. For this reason, it was not surprising that she had also completed the majority of her charting prior to the time when she was shadowed with the CIS in place at both of the two and four-month post implementation observation periods. Her approach to charting with the computer was very systematic and she outlined it as follows:

Received her patient assignment 7:00am

Checked each patient's orders in the chart

Checked on each of her patients

Filled out the majority of the assessment for each of her patients by 8:00 am

Completed the nutritional assessment for breakfast at 9:00am

Did the final I/O totals and nutritional assessment for lunch at 2:00pm

Filled in the other required fields of the assessment toward the end of the day

Interestingly, she was one of the only nurses observed who actually made a concerted effort to habitually do POC charting during the two-month post implementations observation period. Although she did not actually take a computer into her patients' rooms, she gathered the information such as I/O's at the bedside and then came directly out to a computer terminal where she inputted the information immediately. However, when she was observed again at four months post implementation, she admitted that it was simply too disruptive to try to do POC charting. Instead, she saved the information that she gathered in the afternoon on her "personal sheet", which was most often kept in her pocket and sat down to chart it all at about 3:00pm.

Nurse C

Nurse C tended to be a sedentary nurse who worked at the same nursing station all of the time. She had spent fifteen years as the head nurse for a smaller hospital and was posted in this one for 4 years. She noted that the aspects she liked best about working at a bigger hospital were the good friendships and support networks she had developed in her working environment.

As a result, she exemplified an individual who worked closely with other nurses and was willing to ask questions or help others with questions if needed. This was pertinent in the sense that her closest friend was a strong advocate of the system, providing Nurse C a resource to turn to when questions about the system arose. Some of the other nurses were not as comfortable "bothering" people around them to ask their questions.

Another interesting finding in observing Nurse C was how she changed her workflow at the two month post implementation observation period and then reverted back to her original way of doing things by the four month observation period.

Prior to implementation of CIS, Nurse C did her charting and her shift reports at the same time. She started working on her charting at 1:30pm, allowing herself plenty of time to get her shift reports done prior to 3:00pm, which was the time when they needed to be completed. The benefit of charting in this manner was that all of the information put on each patient's shift report also needed to go into the patient's chart. She could therefore process the same information at the same time. In order to chart this way, she had three out of four of her patients' paper charts stacked at the nursing station throughout this entire time, from 1:30 until 3:00pm. *This was an ideal system for her to have the charts at her disposal during this entire time, but for others who also wanted to view/review the chart (such as the respiratory therapist, physical therapist, dietitian, or a physician), they needed to come looking for the chart.*

By two months post-implementation her routine had changed. She had already completed three out of four of her patients' assessments by 1:00pm, **which she noted was a miracle**. By completing her charting earlier in the day (i.e. closer to POC) she no longer did her charting and her shift reports at the same time. However, at the four month post-implementation observation period, she had reverted back to working on them at the same time, which she found to be much more efficient. ***As a side note, when she was charting at the four-month observation period, she suggested that it would be good if the shift reports could be automatically generated from CIS since she was spending time entering the same information in two different places.****(This was a deficiency in the software and should not exist in the custom made software for armed forces.)*

Nurse D

Nurse D had been practicing for eleven years. Her personality was non-confrontational and a bit passive. For this reason, it was not surprising that she approached the computer system more contemplatively. Instead of clicking on things to figure out what they did, she was more inclined to sit and look at the screen to see where the information should be placed most appropriately.

She was observed on some particularly hectic days when getting her charting done in a timely manner was difficult. At both the pre-implementation and the four month post-implementation observation periods, she needed to admit a new patient at 3:00pm and it took a least half an hour each time. With her patient load already heavy and the extra work of admitting new patients coming to her at the end of the day, it was not surprising that she was not able to finish her charting until 4:45pm on both of those days. However, at the two-month observation period, when things were not quite as busy, she had already completed three out of four of her patient assessments by 12 noon and she was totally finished charting by 4:00pm. This longitudinal assessment demonstrates that she too had attempted to do "closer to POC charting" at the two-month observation period. However, at the four-month observation period, she did not have the time to complete any of her patients' charting until the end of her shift at 3:30pm.

Another particularly striking issue that arose while observing Nurse D on such hectic days was the fact that she was constantly interrupted. Even so, she had a exceptional ability to multi-task and keep track of many things at once while still completing everything by the end of the day. However, in such an environment with constant interruptions it was not surprising to find the issue of leaving the computer terminal logged-in inevitably occurred. This is not to suggest that she was the only person to leave the computer terminal logged-in, but it was apparent after observing her that when things were busy it was more likely to occur.

Nurse E

It was not possible to do a longitudinal assessment of Nurse E due to the fact that she moved away after the pre-implementation observation period.

Nurse F

Nurse F was randomly selected to be shadowed in place of the Nurse E. Nurse F already had some preconceived notions regarding CIS. She was reluctant to embrace the system and had one of the most pessimistic views about its role in the healthcare environment.

By the two-month observation period, she was very capable and proficient with the computer. However, it was apparent she had not taken the time to actually discover where to document everything appropriately, which she thought was a waste of time.

Like Nurse A, her stance was that she preferred to spend the time with her patients versus "dragging the computer around." Unlike Nurse A, she did make an effort to do some POC charting by bringing the computer just outside a patient's door when she was doing their I/O's at the end of the day. This was also true at the four-month observation period, although she admitted she only really did POC charting when it was convenient and she had the time. Her routine during the last observation period was to finish her patients' assessments by 11:00am and do the rest when it was convenient at the end of the day from 2:30pm until the end of her shift, which ended at 3:50pm.

General *Unanticipated* effects of implementing the CIS

From the informal interviews and observations of the nurses, themes and trends were discovered that have broader contextual implications as compared to solely looking at the workflow issues of individual nurses. In this section, unanticipated effects are presented that affected the workflow of the nursing unit as a whole. These issues are not presented in any particular order. They were validated by the nurses themselves at six months post implementation using the member checking technique.

Processing of Information

The perception of the nurses was that patient information was being processed differently with the computer as compared to when the nurses were charting on paper. This issue appeared to have left the nurses with a disconnected feeling with respect to patient care.

This sentiment was more true for some nurses than others, but they all agreed that the dynamism that CIS had introduced into their environment had changed the intimacy of the nurse-patient relationship. One visible example of how the information was being processed differently was seen while observing Nurse C. Prior to implementation of the CIS, she would quietly work her way through her paper charting. However, when she logged on to the computer to do her charting with HC, she had started whispering to herself as she made her way through the screens. She found it funny that she whispered to herself but said it helped her in thinking about her patients.

Although the other nurses did not display visible signs of processing information differently, nor could they put their fingers on exactly why they felt less connected, they all agreed that the computer system had introduced a less personal means of relaying patient information. Another issue that arose in relation to processing the information differently was the fact that the nurses felt like it was more difficult to remember what they had and had not charted.

Prior to the implementation of the computer system, the nurses had sat down to chart everything at the end of the day, allowing them to enter all of their patient information at one time. The benefit of charting this way was that they were doing it all at once and could be certain that the pertinent fields had been entered.

Prior to implementation, most of the nurses kept their patient information that they gathered throughout the day on a 'personal sheet' on a clipboard. Then, at the end of the day, they would cross the information off this sheet as they transferred the information into the paper chart. However, with the introduction of the CIS and the hospital's desire to have the nurses do Point of Care (POC) charting, the process had changed. The nurses were supposed to be entering patient data at POC, which was possible at some times, and not at others. For this reason, the process of entering information became staggered with part of the information making it into the computer at POC and the rest being entered at the end of the day. By entering the data into the computer at different times, it left the nurses feeling uncertain of what they had and had not been able to complete.

Point of Care (POC) Charting

This leads into the discussion about POC charting. In general, this was a difficult habit for the nurses to embrace. On the whole, it was observed that the nurses were doing a lot of their charting closer to POC (as was mentioned in the individual assessments). However, the overall feeling was that it was not practical for them to be "dragging" a computer in and out of each of their patients' rooms. This was validated by the fact that it was never observed that any of the nurses took a computer into a patients' room. The nurses reasoned that they traveled in and out of the rooms at such a fast pace, that it was too cumbersome for them to take a computer with them. They were also concerned with their patients' impressions that they should be tending to patient care and not "messing around with a computer."

At the six month member-checking session, it was acknowledged that only one nurse out of all of the nurses on the Med/Surg ward had integrated POC charting into her daily routine. Overall, some of the nurses were doing it when it was convenient and when they had the time, while the rest admitted they were not attempting to do it at all. The general feeling was that it was not worth the trouble. They felt it was more important to have a block of time dedicated to patient care versus continually logging in and out of the system, which they found disruptive.

Logging In and Out

Across the board, all of the nurses agreed that logging into the system was the biggest "hassle." Nurse B eagerly relayed her frustration with logging in at the two month observation period, and thought that the ideal system would be a voice recognition log-on to speed up the process. Many times throughout the observation periods the nurses failed to login correctly. Typically this occurred when it was very busy, in which case the nurses were visibly frustrated to be wasting time retyping their log-in and password when they had more important things to do. (*This can now be easily overcome by finger-print recognition hardware which is cheaper than before and well integrated with most modern computing environments*)

As far as logging out, the biggest hurdle the nurses faced was that the environment in which they worked was filled with interruptions. From patients calling to them, to doctors paging the nurses for patient updates, interruptions were inevitable. As a result, it was not surprising to see that occasionally computer terminals were left logged-on when the nurses were called away. This issue is problematic in the era of patient confidentiality issues, but it is not a difficult issue to rectify under these circumstances.

A simple solution is as follows. It is routine now to have a single click screen locking mechanisms in-built into the software where the nurse, when interrupted, simply presses a single hot-key on the key board and the computer is safely locked and screen becomes dark. Anyone trying to open the computer will be asked to provide a password or a finger-print. The beauty of the system is that if an authorized person (resident etc) genuinely wants to log in, the computer will allow him/her to log in as himself/herself and will not allow him/her to meddle with what the nurse was doing and will also let this new user access only that part of info which he is authorized to see as per his rank/job profile.

Interruptions

There was another issue with respect to being interrupted while charting on the computer. Each of the nurses liked to check over the information they had charted in CIS prior to saving it to make sure the information entered was correct. However, this was not an option when interruptions occurred while they were only midway through entering their data. In this situation, they had two choices: either to save the information and modify any incorrect fields later, or to log-off without saving the information, in which case they would have wasted all of the time they spent entering it in the first place.

Either way, the nurses would have to spend time either fixing or redoing their charting if they were interrupted midway through. This was in contrast to the simple solution they had when they were charting on paper, which was to close the chart and pick up where they left off once they returned without repercussions.

Disjointed Charting

Another issue that became apparent was the fact that the charting became more disjointed; half was still done in the paper chart and the rest was done on the computer CIS. Some of the nurses felt that since the hospital had pushed to have them do most of their charting on the computer, that **all** of it should be done on the computer. Others, like Nurse A, felt that although the charting was more disjointed, they were not ready to put everything in the computer, especially since the doctors were not "required" to use the system and important information might be missed. *(Doctors' speed and conditions of adapting to the use of CIS and CMC was different than the nurses' speed of adopting CIS and CMC. This will remain a critical factor in its implementation in AMC as well)*

The "half paper-half computer charting" also created confusion as to where to chart some items most notably the progress notes. It was not clear to the nurses whether they should continue to write the progress notes in the paper chart or if they should put them in the nursing notes section of CIS. For that reason, some nurses were putting the information in both places while others, understandably, were putting it in one place or the other.

Pulling Information Forward

There was another feature within CIS that noticeably changed the nurses' workflow and the way information was conveyed. This had to do with the capability of letting the nurses pull previous nursing assessments forward to use as part of a new assessment. There were a few issues that arose as a result of using this feature. First, nurses had to be careful to make sure that all of the information that was charted previously on a patient was still pertinent. If the entire assessment was not looked over meticulously, information that was no longer relevant could accidentally be carried forward. Second, by pulling the exact same information forward on a patient, day after day, the nurses felt that there was no apparent "ebb and flow" to the patient's overall assessment. They felt that the subtle changes in the patient's condition were not as likely to be captured leading to a less accurate picture of the patient's status. For these reasons, two of the nurses in the study did not want to use the pulling forward feature. They wanted to be certain that what they charted on their patients was done personally, accurately, and up to date. The other three nurses felt that this feature worked well for them as long as they vigilantly checked all of the information to make sure it was correct.

Relieving duty Nurses (RDN)

There was one final issue that significantly changed the workflow of the nurses and increased the pressure on them with the CIS in place. This related to use of relieving duty nurses. These are nurses detailed to some other ward to cover staffing shortfalls. The problem with the RD nurses relative to the CIS was that they were required to use CIS just like the staff nurses. Sometimes, they were not knowledgeable about the new CIS or the intricacies of entering patient data in that particular ward.

Consequently, the staff nurses would need to help the RD nurses use the system.

Anticipated effects of implementing the CIS

Overall, the nurses identified about half of the benefits of using the system that were initially stated by the hospital. It took time for the nurses to feel comfortable enough with the system to identify some of the benefits of using the new CIS but ultimately they had identified some of these benefits by the end of the study.

The issues that they acknowledged are:
1. Charting can be done anywhere where there is a computer terminal
2. Do not have to search for chart to do documentation of assessments, I/O's and vitals
3. Do not have to call or FAX as many things to the doctors
4. Remote access to physicians
5. The chart can be accessed from anywhere to look things up, including labs.
6. One place to view/review: assessments, I/O's, vitals, resp. therapy, rehab. Services etc.
7. Laboratory, radiology and transcribed reports available to view

The benefits that the nurses did not acknowledge as benefits of using the CIS (in comparison to the original hospital goals and benefits list) are presented below:
1. POC charting
2. Legible documentation
3. Automatic intake and output (I/O) totaling and net amounts
4. Electronic queries for chart audits

Experience of other institutions

Results of a survey of older students' perceptions of technology-based active and collaborative learning assignments were analyzed in a study '*OLDER STUDENTS' PERCEPTIONS OF TECHNOLOGY BASED LEARNING ASSIGNMENTS' By Kathleen G. Mastrian RN, PhD and Dee McGonigle RNC, PhD, FACCE Associate Professor The Pennsylvania State University, New Kensington Campus*. The forty-six students surveyed were registered nurses (RN) enrolled in a transition to baccalaureate education course. Fewer than half of the students had computer experience prior to the course enrollment, and only two had electronic mail and World Wide Web skills. ***Overall, students reported a positive course experience***. They also report that their learning was positively affected by the innovative course design and delivery. Most were apprehensive and frustrated initially, but changed their perceptions as the course progressed. ***Students strongly suggested a computer orientation course as part of the nursing curriculum.***

The Roadmap & determination of requisite actions

From what we have seen so far, we have come to the following conclusions about the role of computers in nursing:-

1. Computerized automation of hospitals in the armed forces is inevitable though it is only natural that it will be done in phases and bigger, tertiary care hospitals will be given a higher priority.
2. Nurses being the hub of any ward work cannot remain untouched by this modernization and will have to upgrade their computer knowledge to enable themselves to make use of the CIS and CMC and thus deliver more efficient services.
3. A proper initiative will have to be taken in MNS to conduct a survey/ study to determine the level of computer skills in the present workforce and this study must also recommend strategies to educate nursing officers regarding this. Individual commands can be made responsible for determining their own needs and all the nursing schools can determine their needs simultaneously.

This brings us to the question that how will such a huge workforce be trained and will it be cost effective for the organization?

Whereas it is beyond the scope of this project to determine the logistics, a training strategy has been recommended for use in the armed forces in the next chapter.

Training & Integration of IT in Nursing education

From what we have seen in the study conducted on the workflow and detailed analysis of nurses' attitude, we can see that by and large three prominent groups will be formed viz.

- The reluctant group
- The indifferent group
- The keen group

- *The reluctant group*
    We expect that a certain group would be absolutely reluctant to adopt the new technology. This would typically be the group who will see little benefit and have a more negative attitude. It will be a challenge to convince them and train them. Though it was seen in the study that more senior nurses were found to be more reluctant, this is not a representative case because attitude variations exist beyond the age barriers. However it will not be surprising if senior nurses are found to be more reluctant because they have had a lot lesser exposure to computers and they find the technology absolutely alienating from their old working pattern and even intimidating.

    It would be advisable that this group should be determined by a name based survey and trained in the second or third phase of training so that-

    1. More willing nurses are trained first and their improved efficiency can be used as a model to convince the reluctant, doubting group.
    2. Whenever a new system is installed, teething troubles are but expected. The reluctant group would use these glitches to trash the system and will highlight these deficiencies and oppose its implementation vehemently thus stalling progress. The keen group will have a better understanding of the technology and will give optimistic feedbacks to allow the system administrator to correct the initial glitches so that the perfect system can evolve. This is important because biased negative feedbacks during testing phases can skew the system and damage its potential.

- *The indifferent group*

    This would typically be the group who believe in mediocrity and do not mind tech advancements but are initially unwilling to put in extra efforts. These people will be the easy convertees to CIS once they observe the keen group succeeding with the CIS and will start picking up the working patterns even before the training will start.

- *The Keen group*

    This is the group which has the exposure to computers and are willing to go that extra mile to test out the system for a long term benefit. They should be identified and trained first during the testing phase.

A separate project would be required to work out detailed training strategies.

Having said this about the work force, it is of paramount importance that the budding work force should be prepared for this tech advancement even during their training as nursing cadets.

It is strongly recommended that computer education in relevance to standard industry CIS practices should be made a part of the curriculum of the nursing students in armed forces. A tentative curriculum is prescribed hereunder for inclusion in the B.Sc. Nursing curriculum.

Nursing informatics curriculum for nursing students
(as recommended for B.Sc. Nursing Program at Kwantlen University College, Canada 1999 – 2006)

Semester One

      Electronic Literature Search

      Nursing Informatics as a Competency

      Observation: Nurse's Use of Computers

      Reverie Journaling (Word Processing)

Semester Two

      World Wide Web Searches

      Email, Netiquette

      Personal Portfolio: (Spreadsheets)

Semester Three

      Use of Nursing Info Systems In Acute Care

      Discharge Planning (Pamphlet, Booklet)

      Health Challenge Research

Semester Four

      Technology & Caring

      Health Information: Nursing Components

      Confidentiality & Security

      Visual Teaching in Pathophysiology

Semester Five

> Nurse Expert Systems
>
> Teaching Prevention
>
> Preparing for the Future
>
> Bioethics & Technology
>
> RN ACCESS: Intro to Nursing Informatics

Semester Six

> Health Promotion Tool
>
> Research Software
>
> Website Development
>
> Online Collaboration
>
> Community Development

Semester Seven

> Computers & Change
>
> Data Analysis Software
>
> Group Chats & IRC
>
> Telemedicine

Semester Eight

> Multimedia
>
> Lifelong Learning & Competencies
>
> Nursing Informatics   Specialization

Conclusion and summary

As a pilot project studying the viability and use of computers in nursing, it was the primary aim of this study to establish the need of training the nurses in anticipation of the ongoing automation of hospitals in the Indian armed forces. This study puts it beyond any doubt that the computerization of hospitals is a reality and nurses have to upgrade themselves in knowledge and workfield to remain competent.

It is also visualized that there will be initial inertia in accepting the changed protocols mainly because it will require extra efforts initially to learn the system. And we must remember that this extra effort is being demanded from an already overworked force. However, it is also clear that this knowledge upgradation is essential and all nurses, in heart of their hearts, are willing to work harder and harder if their patients get benefit out of it. It is this philanthropic streak of the nursing profession which has seen nurses take huge strides in contributing to development of their profession which, till about 70 years ago was merely a haphazard, uncontrolled, partially scientific helping profession.

It would also be pertinent that the author feels that it would be in order to set up a committee of nursing officers with representatives representing various age/service groups, computer literacy and nursing education so that this committee can scientifically study the requirements in detail and chart out a detailed training programme.

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-------------------------------End of report-------------------------------