The Role of Design in Communication, Interaction and Teamwork

by Ketki Balaram Harale

THE ROLE OF DESIGN IN COMMUNICATION, INTERACTION AND TEAMWORK

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by

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ABSTRACT

This study examines the relationship between physical design and communication in healthcare delivery. It explores the communication and work patterns of nurses in an Intensive cardiac care unit with a decentralized nursing station layout. This research investigates the impact of a decentralized nursing unit on interaction patterns of clinical staff.

Using a combination of observation, interview and survey, data was collected on a 16- bed ICCU at the Cayuga Medical Centre two years after moving to a new facility. To examine whether behavior in and attitudes about the new space had changed over time, this data was compared to a study (Phase I by Ronojoy Dutta and Anton Villacorta) using similar methods in the same facility three months following the move to the new facility. Data was collected on the nurses' activities, duration of activities, interaction with other staff and time spent with patients at various locations in the ICCU. This phase also involved observation of backstage areas and the role they play in fostering interaction and teamwork among the multi-disciplinary clinical staff. The key element of this research has been to observe how the users have acclimatized and modified their work environment and to check whether decentralized nursing units should be propagated as the best practice in ICCU design.

The Phase II study found that ratings of job satisfaction, job stress, teamwork, and feeling valued increased significantly from data collected three months after the move to the new facility (Phase 1). There were no significant changes in the overall observed interaction patterns. Nurses' interaction with doctors, in particular, remained at a very low level. Implications for nursing unit design are discussed.

BIOGRAPHICAL SKETCH

Ketki came to Cornell with a Bachelor of Architecture from the reputed Sir JJ College of Architecture, Mumbai. At the time, she also had over a year's worth of professional experience as an architect and a design consultant. While working as an architect she conceptualized, designed, developed and co-coordinated some large-scale architectural projects, including a 15-floor hotel complex in Dar es Salaam, Tanzania.

At Cornell she had focused on Facilities Planning and Management with a minor in health administration. Over the course of her studies she has developed a keen interest in Healthcare facilities and Strategic Facility planning and plans on furthering this interest.

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TABLE OF CONTENTS

LIST OF FIGURES

LIST OF TABLES

1. LITERATURE REVIEW

1.1 Introduction

The healthcare industry is one of the largest growing sectors, absorbing a multitude of resources and providing millions of jobs. In 2006, $2.2 trillion were spent on healthcare. Studies estimate that in the next ten years $200 billion will be spent on healthcare construction projects alone (Nelson, West & Goodman, 2005). In the same year, 2006, the industry accounted for 16% of the GDP and is estimated to reach 20% of GDP by the year 2015 (Borger et al., 2006). The industry currently faces major challenges including staff retention, patient satisfaction, policy shifts, increase in the number of older patients and cost containment. These problems have become more acute in the light of the current economic downturn. Studies estimate that in the next ten years $200 billion will be spent on healthcare construction projects alone (Nelson, West & Goodman, 2005).

Healthcare has been in a state of flux for the past several years due change in policy, advancement in medical technology and change in patient demographics. These have led to various changes in the care delivery model in terms of patient safety, staff effectiveness and design of healthcare facilities (IOM 1999; Marberry, 2006). Improving the delivery of care in the hospital system has traditionally been treated as an organizational and management issue (Pati et al., 2008). However physical elements of an environment can shape and be shaped by certain organizational and social systems (Becker, 2007). Research findings suggest that the design of the hospital environment contributes to improving patient and staff satisfaction and the overall quality of healthcare (Ulrich et al., 2004, Joseph, 2006). Drawing on the growing body of research examining the relationship between health and facility

design, healthcare organizations are increasingly adapting an 'evidence-based design' approach i.e. design that is supported by research with the aim of creating environments that are "therapeutic, supportive of family involvement and efficient for staff performance" (Center for Health Design, 2007).

1.2 Healthcare design and Delivery of Care

Improving the delivery of care in the chaotic hospital system has traditionally been treated as an organizational and management issue (Pati et al., 2008). However physical elements of an environment can shape and be shaped by certain organizational and social systems (Becker, 2007). With the increasing importance given to evidence based design, researchers are better able to understand the relationship between the physical design and the delivery of care. This results in a growing body of scientific research. The present literature on evidence-based design concentrates on the influence of physical design on patient safety, healthcare quality, reduction of stress and overall effectiveness in delivering care (Ulrich et al., 2004).

Early research on hospital design was patient-centered and focused on the role of the physical environment in increasing patient safety, reducing patient stress and improving outcomes. Ulrich (1984, 1991, 1999) conducted studies on the role of physical features – such as, a window with a view, single rooms, reduced noise, improved lighting – on reducing stress and a shorter recovery time. In spite of this early focus on patient outcomes, there are several studies that examine the effect of the environment on staff safety, satisfaction and effectiveness (Joseph, 2006). A recent study focusing on the relationship between exterior views and nurse stress, by Pati et al (2008) found that view content and duration influenced alertness and acute stress.

Nurse fatigue induced by the time spent walking has also garnered a lot of scrutiny recently (Ulrich et al. 2004). A study by Shepley & Davies (2003) linked, the type of unit layout to the amount of time spent walking. In spite of such staff-centered studies, there is a substantial lack of literature on many issues like staff communication, teamwork and informal learning and their relation to physical design (Becker, 2007). Most of the hospital layouts have generally been studied from the patient perspective with very little attention paid to healthcare teams even though they are enormously important.

1.3 Centralized and Decentralized Nursing Stations

Patient floors were originally designed such that the patient rooms were clearly visible from the nursing stations. This transformed the centralized nursing stations into a focal point of various complex processes of healthcare delivery. Thus, nursing stations became important hubs of activity where almost all type of hospital functions overlaps (Broomberg, 2006). Just how the design of nursing stations, particularly more decentralized designs, affects the delivery of patient care, as well as issues such as staff fatigue and communication patterns, has become more recently a focus of research The design of nursing stations has been highly debated with a recent preference for decentralized nursing stations over centralized ones (Gurascio-Howard & Malloch, 2007).

Historically various patient floor configurations have been used. Over the past fifty years nurse stations were typically located in the center of the nursing unit with patient beds spreading outward. A paper for The Institute of Medicine (2004) classified different patient floor plans in use into various categories. These categories included

the simple open form (an open ward without individual patient rooms), the racetrack form (with patient rooms around a race track hallway), the radial form (circular layout of nursing units permitting “fishbowl” view of patient rooms) and the courtyard configuration (open courtyard for ventilation in the middle of unit). In each of these, the nursing station was essentially in the midpoint of the configuration for easy patient access. This made it the center of all activity. Unit equipment and many building systems were also located around the central nursing stations thus simplifying access. All of these configurations used the centralized nursing station design.

In spite of the earlier inclination for centralized nursing unit design, currently there is a preference for decentralized nursing unit designs. Canadian architect Gordon Frissen suggested in 1970 that bringing the nurses and patient supplies closer to the patient could positively impact patient care. A decentralized layout does not have a central hub and nursing stations are located outside patient rooms. This design allows a closer proximity to patients, access to computers and individual desks. However, the nurses are located farther from centralized utility systems like the fax and copy rooms or medication rooms.

A growing body of patient-centered literature suggests that decentralized nursing unit designs reduce nurse fatigue, increase patient time and decrease noise levels. These studies have been outlined in the next section.

1.4 Evidence supporting decentralized nursing stations

Numerous patient- centric studies have shown the positive outcomes of decentralized nursing units:

Reduction in staff fatigue

Ann Hendrich, working with Ascension Health, reported that nurses can walk up to 6.0 km per day depending on the type of centralized nursing unit configuration (Ulrich, 2005). The same study also showed that in a similar unit but with decentralized nursing stations, the nurses walked 2.9 km per day. Thus, decentralized nursing units reduced the nurses travel time by over 50%. This reduction in walking time and fatigue was believed to translate into increased time with patients and improvement in the quality of care.

Decrease in noise level

Central nursing stations are huge activity magnets attracting various hospital personnel. Christensen (2005) showed that there was a direct relationship between the noise and the number of people present in a unit. High noise levels have shown to increase patient recovery time, cause headaches and increase sensitivity to pain (Biley, 1994). Higher noise levels also have adverse effects on the staff and have shown to cause burnouts and increase in stress (Topf & Dillon, 1998). Since decentralized nursing units are less conducive to a gathering of large groups of people, the subsequent noise levels are lower. Theoretically, this should contribute to lowering stress among staff and shorten patient recovery time.

Increase in patient interaction time:

Another study by Hendrich (2004) also found that nurses spent more time with their patients in a decentralized nursing unit layout. Page (2004) linked an increase in time spent with the patient to a decrease in patient falls resulting from patients trying to get up on their own. Thus it could be argued that a decentralized nursing unit layout is

cohesive to more nurse-patient time thus decreasing the number of patient injuries from falls.

Current literature suggests that decentralized nursing stations have various positive ramifications on staff and patients. Although this type of nursing unit design has shown a potential for improving patient care (Boschen, 1978), it is purely from an operational and functional perspective. There is very little study of the role of the nursing stations in staff interaction, teamwork and organizational dynamics. As seen earlier, nursing stations are a hub of a multitude of activities and professionals, helping in problem solving, assisting, on-the-job learning and team building. There is a huge gap in the literature pertaining to these issues and their relationship to the decentralized nursing unit. Thus, further research is the need of the hour as there is very little guidance for nursing unit design with respect to communication and teamwork.

1.5 Communication and Teamwork in Healthcare

Characteristics of Healthcare teams

Over the years, healthcare delivery has become increasingly complex. Diverse professionals working together as a cohesive group have been found to improve patient outcomes and increase patient satisfaction (Grumbach & Bodenheimen, 2004). Thus interdisciplinary healthcare teams improve overall healthcare delivery (Wood, Farrow & Elliot, 1994). Better teamwork at hospitals has also shown to improve nurses' job satisfaction, reduce stress and attrition (Rafferty et al., 2001). A study by McCarthy and Blumenthal (2006) shows that some hospitals are using 'multi-disciplinary' surgery rounds in order to encourage collaboration and interaction.

While studies support the benefits of a cohesive healthcare team, a non-cohesive team could lead to preventable system and patient problems. An Australian study found that 50% of such preventable 'adverse' events were directly related to inadequate communication (Coiera, Jaisurya, Hardy, Bannan & Thorpe, 2002).

Communication characteristics

Interactions in hospital settings occur in various locations and are short and frequent (Becker, 2007). Parker and Coiera (2002) showed that healthcare staff depended on each other for information and assistance and preferred face-to-face encounters to planned (scheduled) communications despite the presence of various technology solutions (e.g. Paging, email). Coiera et al. (2002), observed communication patterns of 12 hospital staff members to find that 82% of all communication were through face-to-face interactions indicating that conversations between hospital staff was the best resource of information. Since most hospital accidents occur due to inadequate communication, it is necessary to tap the large information network within healthcare institutions and encourage communication.

Since these unplanned interactions are imperative to healthcare delivery, it is important to better understand how the design of the nursing unit affects communication and interaction patterns among care providers.

1.6 Physical Layout and staff communication

While the importance of communication in the delivery of quality healthcare has been well established, the effect of the physical environment on interaction has not been

adequately studied. Hospitals are chaotic environments and until recently, improving healthcare delivery was considered to be a management issue (Pati et al., 2008). Becker (2007), in his concept of Organizational Ecology, showed that there is an interdependence of organizational, social and physical systems within every organization. The physical elements help in shaping the other characteristics. The effects of physical layout on communication have been studied more extensively in various corporate settings. One such example is a study by Allen (1977), who found that face-to-face interaction was significantly influenced by distance and that chance of interactions declined beyond 50 meters.

Similarly Communication patterns have also been found to vary significantly in traditional closed offices, open plan cubicles and team oriented clusters (Becker & Sims, 2004). Employees in team oriented clusters reported greater clarity of the teams' direction and the ability of making decisions faster due to unplanned and opportunistic interaction within their teams. Such studies suggest how design may affect communication patterns in the hospital environment. However because healthcare environments are extremely unique and differ in many ways from the corporate workplace, studies are needed examining the relationship between design and communication in hospital settings specifically. Many of the design principles used in corporate settings could be applied to a healthcare context in order to improve care delivery.

Though few, there have been some studies which focused on the influence of physical design on informal communication in a healthcare setting. Becker (2007) cites a study conducted in Hong Kong of an 1860-bed hospital (Gilleard & Tarcisius, 2003) where the researchers examined the relationship between medical unit design and multi-

disciplinary team interaction. They found that introducing alternative workplace strategies to a pediatric ward of doctors and allied health professionals, significantly improved communication patterns, helped resolve conflict, increased cooperation and produced higher quality service from the patient's perspective… Communication among various disciplines and with patients was also enhanced."

Research has also linked a few other design concepts, including physical and visual proximity and the creation of different activity zones, to unplanned interactions. A study at the Sutter Roseville Medical Center in Roseville, California, reported that nurses in the horseshoe shaped decentralized nursing stations felt isolated and unable to effectively support each other due to the lack of visual and physical proximity (Flynn & Barista 2005). Broomberg (2006) writes about the importance of creating distinct zones within a centralized nursing unit. She identified three zones: curbside – for impromptu meetings; step-in – for involved work and immersive – for private and planned meetings. Another important zone is called the 'neutral zone', which is not owned by or assigned to an individual, or group and is devoid of any hierarchical boundaries (Becker, 2007).

In the Phase I study of a move from a more centralized to a more decentralized ICU which the current research (Phase II) extends, Ronojoy Dutta (2008) conducted a pre-post study at an ICCU, which had moved from a centralized nursing unit to a decentralized layout. He compared unplanned communication and interaction between the same staff in both the physical settings before and after the move to the new facility. In his Master's thesis Dutta (2008) reported that there was a decrease in unplanned communication and interaction between staff after moving to the decentralized ICCU. The results also showed that the staff tended to congregate in

specific areas creating defacto hubs even though these had not been a part of the design. Another interesting aspect observed in this study was the reduction in reported teamwork and job satisfaction, which occurred during the move from centralized to more decentralized units.

Another aspect of the same study compared interaction and communication patterns before and after move to the more decentralized unit study conducted at the same ICCU. Nurse movement and communication patters all over the unit were recorded (Villacorta, 2008) and it was reported that nurses interact the most with other nurses. Interactions with the doctor accounted for 10% of all interactions; nurses spent approximately 30% of their time with the patients. Contrary to the assumption that nurses located in a decentralized pod near their assigned patients would spent most of their time there (thereby reducing walking distances and increasing visual surveillance of patients) nurses were constantly moving throughout the whole unit over the course of their shift. In a similar vein, a case study of graduate nurses (Adams, 2008) examined the duration of various types of graduate nurse interactions with others on the staff and found, as did Dutta 2008), that nurses interacted very infrequently with other professional who were not nurses.

This brief review of literature suggests that understanding the pattern of unplanned communication between diverse care providers and the factors that affect it, including the physical design of units, is important to explore.

1.7 Research Questions

Based on quite limited empirical evidence, current best-practice often advocates decentralized nursing units. In this layout the nursing "pods" are distributed throughout a unit, closer to the patient rooms (Ulrich, 2005). It is assumed that nurses working on decentralized units will spend more time with the patients. However the literature reviewed shows that the nurses in a decentralized unit do not spend a large amount of their time with the patients. The research also suggests that the move from centralized to decentralized nursing units might have had a few negative ramifications in terms of communication and interaction.

This thesis continues research conducted by Dutta (2008) and Villacorta (2008) which examined how a move from a more centralized to a more decentralized design of an ICCU affects communication and interaction patterns. Specifically, this study examines whether communication and interaction patterns observed over four months after moving to the more decentralized unit have persisted two years later. The broad objective, like its predecessors, is to understand the influence of the decentralized nursing unit design on staff communication. A secondary goal is also to compare the findings to the prior studies and make note of all changes to communication patterns and physical design.

The main research questions were:

1) How do the nurses communicate? E.g. who do they speak with, where do interactions occur, for how long and about what?
2) Are there any major differences in the communication patterns and design features between Phase I and Phase II? Phase I refers jointly to the studies

conducted by Dutta and Villacorta in the ICCU at Cayuga Medical Center, Ithaca, NY. Phase II refers to this thesis.

3) Do certain design features help certain interactions? E.g. The formation of a communication hub.
4) Which locations on the ICCU do the nurses travel to most often and how is their time distributed?

2. METHODS

2.1 Research Design

This research was a pre-post study on the Intensive and Cardiac Care Unit (ICCU) at the Cayuga Medical Center in Ithaca, NY. The research assessed the influence of the nursing unit layout on the communication and interaction patterns, learning opportunities, stress and job satisfaction of nursing staff, as well as how the space was used by nurses. The influence of the physical layout on the interaction patterns and other outcomes collected from January-April 2009 was compared with the data obtained from the same period in 2007, the Phase I of this research conducted by Ronojoy Dutta (2008) and Anton Villacorta (2008). The original data collection occurred one to three months after initial occupancy of the new ICCU. This study was essentially a replication of the earlier study, using the same or very similar methods, to assess whether the initial results changed over time. A multi-method approach was used to collect both quantitative and qualitative data.

2.2 Site Selection

The Intensive Cardiac Care Unit (ICCU) of the hospital moved to its present setting two years ago. Dutta (2008) and Villacorta (2008) conducted a pre-post study immediately after this move of the ICCU. This thesis draws on their research and also examines whether communication and interaction patterns observed immediately after the move have persisted two years later. Since it is possible to not only understand the influence of decentralized nursing unit design on staff communication, but also to

compare the findings to prior studies, the ICCU unit of the Cayuga Medical Center was selected as the site to conduct this research.

2.3 Site Description: Phase I (Dutta 2008) and Phase II (Harale 2010)

2.3.1 The ICCU Physical Layout

The ICCU at the Cayuga Medical Center consists of 16 single-patient rooms and is spread over an area of 83,500 square feet (See Figure 2.1). Each patient room also houses a restroom and additional storage space. Along with patient rooms, the ICCU also includes nine nursing stations henceforth referred to as 'nursing pods', located strategically to allow visual access to about two to three patient rooms from each station. During Phase I, one of the patient rooms was being used as a temporary staff lounge, while one nursing station continues to be assigned to the ward clerk.

The physical layout of the ICCU has not changed since Phase I and is similar to a semi-racetrack arrangement, with the patient rooms on the outside, enclosing a core service area and the corridor. The core service area houses a medication room, a medical utility room, a building utility room and a fax & copy room. There is a separate work area near the back hall with a seven-person seating arrangement, provided for doctors and medical staff to perform any writing tasks. The Nurse Manager and the Intensivist have individual offices that do not allow visual access to any patient rooms and are hence not intended to be substituted for any nursing pods. All nursing pods have visual access to two to three patient rooms depending on location of the pod.

Each of the nursing pods is more or less similar in design and dimensions. All of them have a working counter top; a desktop computer, a filing cabinet and can seat one person. Five of the nine pods are equipped with electronic patient status monitors. These monitors track specific medical conditions of patients in each room. (See Figure 2.1, 2.2 and 2.3)

In addition to the nine regular nurse pods, there are five fixed individual alcove workstations on the floor (See Figure 2.3 and Photos in Appendix A). Between two alcoves there are about one to four patient rooms. Typically an alcove consists of only a single-person computer workstation and some linen storage space under the counter top. Physically, each alcove is situated in a recessed portion of the common internal wall between two adjacent patient rooms. Although the alcoves are only accessible from the central corridor, they are made with glass windows to allow visual access to patient rooms while working there.

The ICCU has two main access areas and one other emergency exit, which is rarely used. The unit also contains staff and visitor toilets, a pantry, water cooler area and a storage room (non medical equipment). Additionally a visitors' lounge, for those visiting patients in the ICCU, is located adjacent to the unit however it will not be considered a part of the unit for the purpose of this study.

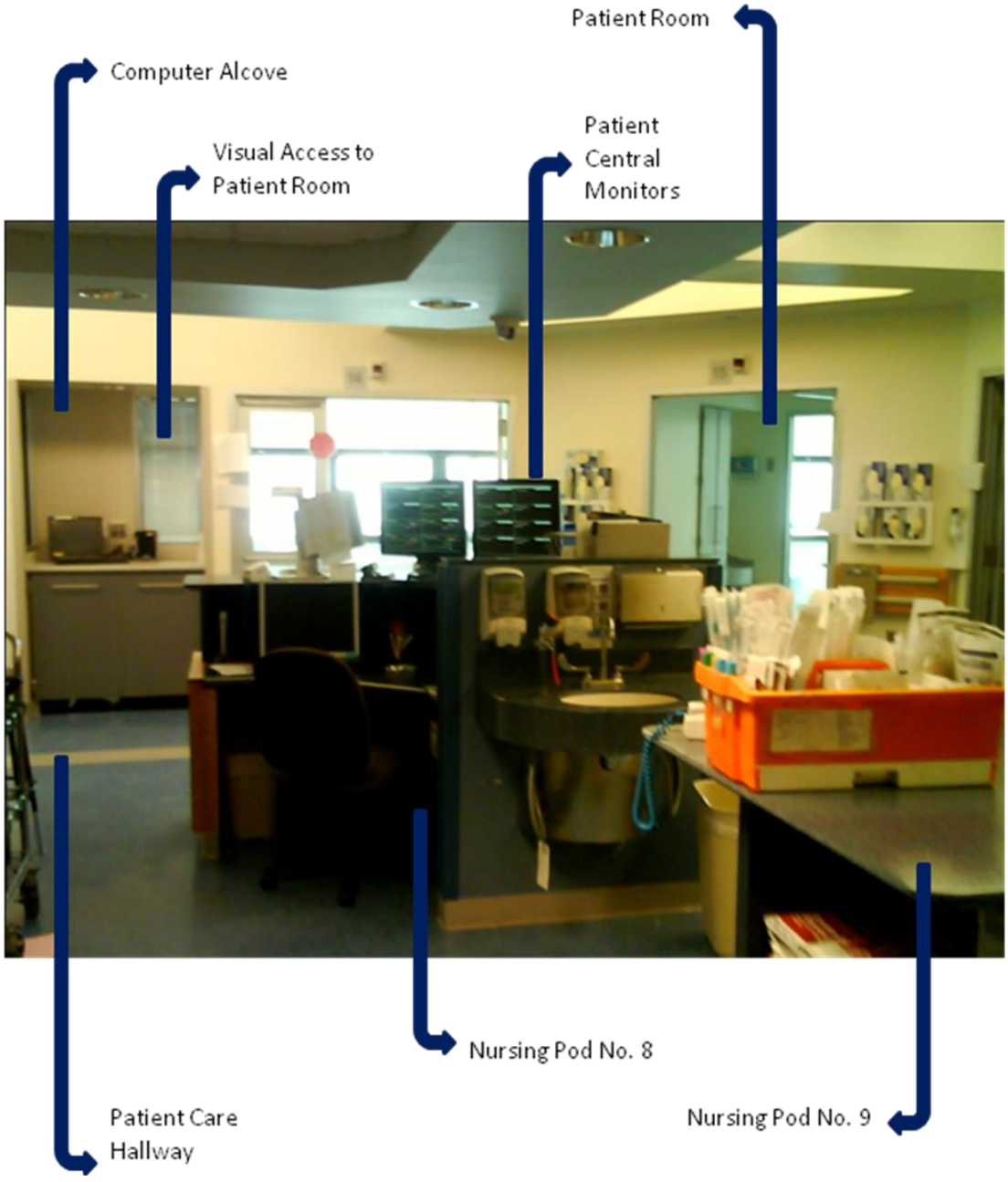


Figure 2-1: Pod 8 and Patient Rooms 15 and 16

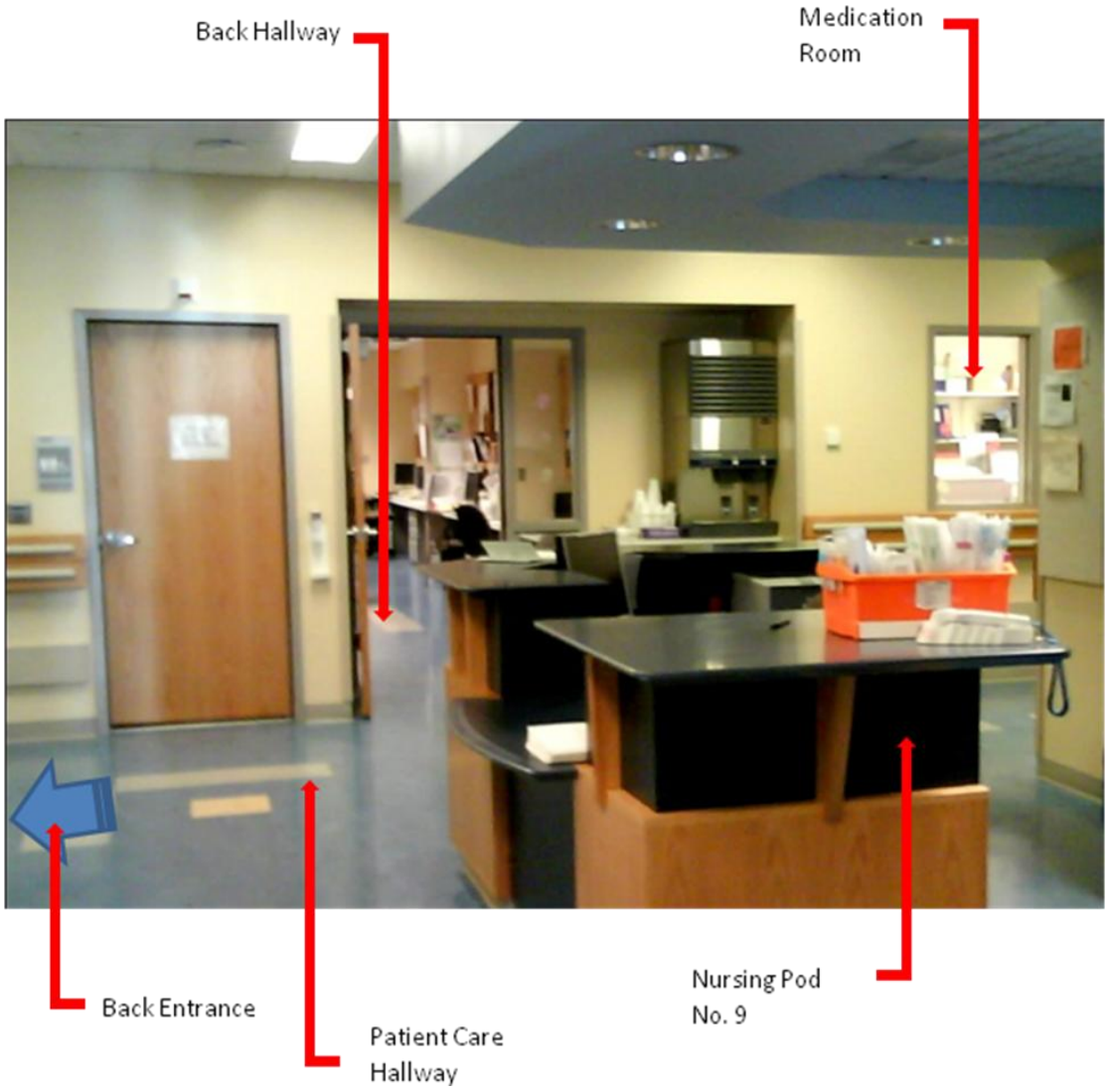


Figure 2-2: Pod 9 and Back Hallway

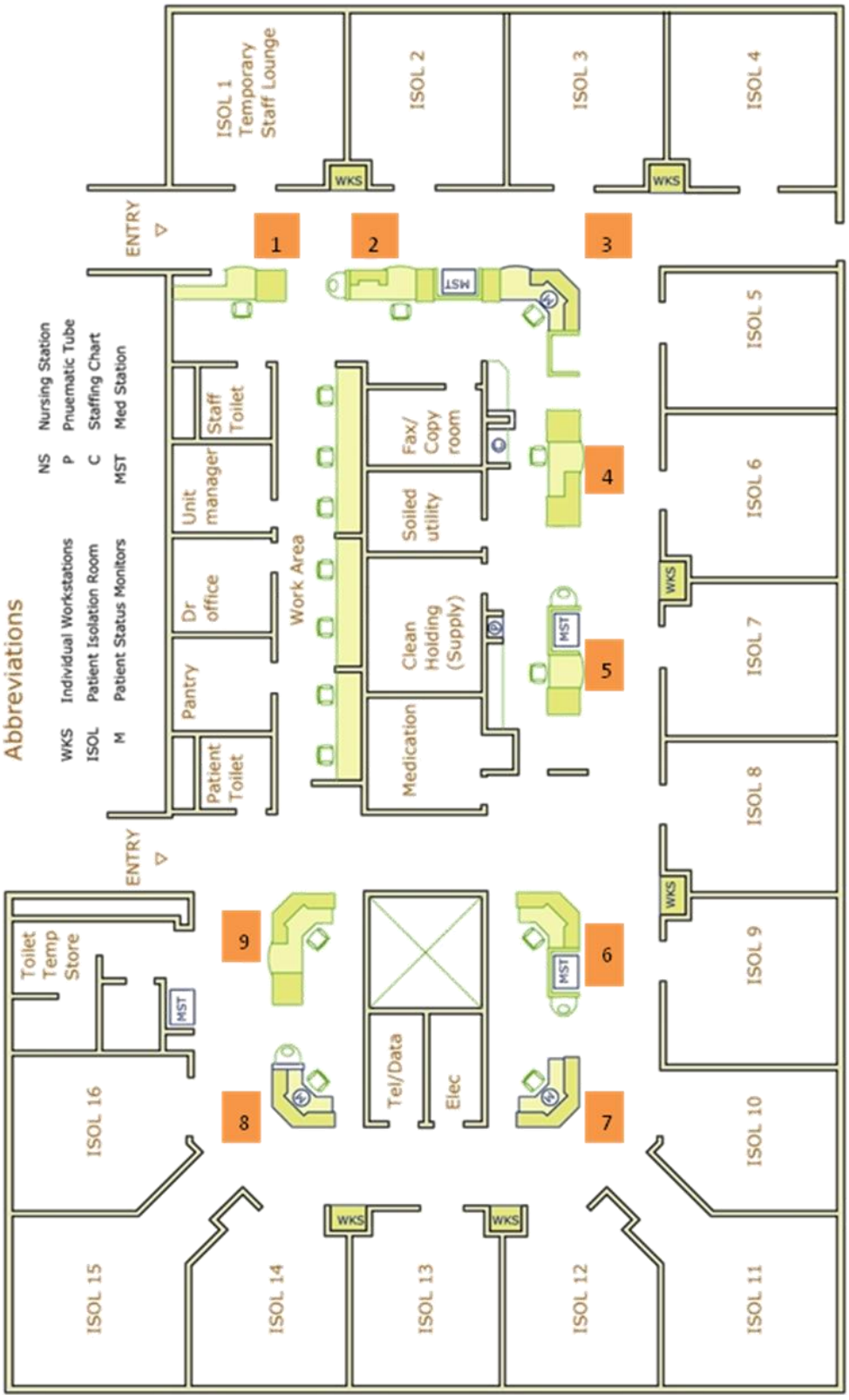


Figure 2-3: ICCU Floor Plan

2.3.2 Medical Systems and Technologies

The Cayuga Medical Center primarily utilizes the following communication systems and medical equipment in the ICCU ward:

Patient Monitoring System

- Five of the nine pods are equipped with high-tech patient monitoring systems.
- A Patient Monitoring System consists of a dedicated set of dual electronic screens, which display real-time data on specific medical conditions – heart rate, breathing, etc. – for each of the patients in the patient rooms.

Pneumatic Tube System

- The pneumatic tube system is a pressurized air transport system within the hospital. It is an efficient means of transfer and delivery of documents and material (e.g. medications, laboratory samples) within the hospital.
- Any document that needs to be transferred within the hospital or any medical samples that need to be delivered to medical laboratories are sent through this pneumatic tube system.

Nurse Call System

- The nurse call system is a patient status indication system that consists of three colored lights placed outside each patient room, as well as on the ceiling above the three nursing pods equipped with patient monitoring systems.

- There is white light, a red light and a blue light in each light fixture, each of which carries a status notification as below:

Color	Activated by	Significance
White Light	Patient	General all-purpose call
Red Light	Patient	Patient needs to visit the restroom
Blue Light	Nurse or other medical staff from within the patient room	Medical staff seeking assistance from other staff members

Medical Storage Systems

- Medical supplies are stored and transported across the ward on carts. There are two primary types of carts used in the ICCU at the Cayuga Medical Center:
    - Procedure cart: Only for medical and surgical supplies
    - Crash cart: Only for emergency medical supplies, red in color to distinguish from procedure cart
- A secure medication room, with a digital combination lock and security glass windows, is also provided within the unit. Within it is a secure medication dispensing system. This room has restricted access and can only be used by registered nurses and pharmacists. Certain medications require the presence of another nurse as a witness to confirm the order.

2.4 Sample Size and Selection

The Cayuga Medical Center has a consistent staff allocation in the ICCU for every shift. This allowed for the inclusion of a consistent staff size in observations for the

study. The sample size for each data collection period depended on the staff allocation per shift. The regular staff strength in the ICCU would be as follows:

- Unit Manager (Registered Nurse) 1
- Ward Clerks 2
- Respiratory Therapist 1
- Intensivist (Intensive Care Doctor) 1
- Registered Nurses 6
- Nursing Aides 2

The number of the regular clinical staff on duty would always be the same, as per the above list. Also, it should be noted that while the Unit Manager, Ward Clerk, Respiratory Therapist and Intensivist were the same individuals on most corresponding shifts, the registered nurses and nursing aides rotated during different shifts.

In addition to the above regular staff on duty, additional expert assistance would often be required in order to cater to the special medical needs of ICCU patients. Expert medical staff was always brought in on an ad-hoc basis, and as such there was no steady allocation for the presence of such visiting staff on the ICCU floor. Visiting medical staff members included (rarely all at the same time):

- Specialist Doctors
- Therapists (Physical Therapists, Speech Therapists, etc.)
- Nutritional Assistants and Dieticians
- Flex Nurses
- Nursing Students

Nursing students were sometimes used as extra 'aides' but never used to replace or reduce the full time nurses' aides on staff. Finally, non-medical support staff (see below) and visitors of patients were regularly present on the ward. Although the study does not focus on communication behaviors of these non-medical staff members and visitors per se, they were included in the observational data whenever interacting with regular clinical staff members. Such non-medical members would include but not be limited to:

- Case Manager
- Housekeeping Staff
- Technicians
- Patient Visitors, including family members
- Volunteers

2.5 Data Collection – Phase II

Observations were recorded during the time frame between 7:00 am to 7:00 pm. This was done in order to maintain comparability between the Phase I and II studies (see Section 2.7). Only the activities, which took place in the effective area allocated to the ICCU, were recorded. A single researcher collected data, using four main categories:

- Clinical Work Measurement (CWM) Tool [1]
- Surveys
- Observations
- Interviews

[1] This is a tool adapted, with permission, from the Health Informatics Evaluation Research Unit directed by Prof. Johanna Westbrook at the University of Sydney, Australia.

All of these were used to record observations of interactions involving the medical staff according to predetermined categories for the physical location, participant roles, and duration of interactions and nature of the conversation. A Personal Digital Assistant (PDA) was used as a clinical work measurement tool. It recorded the movement and communications patterns of the nurses in and around the ICU. The communication and interaction data was classified into the Where (e.g. nursing station, medication room), With Whom (e.g. Registered Nurse, Doctor), Duration (length of each interaction or activity) and what type (e.g. Consultation, Social) categories. These categories cover the primary locations, staff and types of communications in the ICU. The categories and their details have been included in Appendix C and D. They corresponded with the physical location, participant roles, duration and gender - categories from Phase I.

Data was collected, by shadowing ten nurses on the ICCU staff recording their activities and interactions. While following a particular nurse any interaction or activity taking place simultaneously in another part of the ICCU were ignored. The type of personnel with whom the nurse interacted with, was also recorded. Being visually familiar with the staff on the ICCU team, the researcher could distinguish between the staff, medical and non medical and the visitors. In addition to recording who was interacting, the nature of the interactions was also recorded in Phase II. Please refer to section 2.6 for further detailed categories.

A total of 30 hours of observations were conducted on different days of the week at different times resulting in a total of 1189 data points. Each of the ten nurses was followed for an average of 3 hours. In a pilot study of the PDA during Phase I it had been noted that an observation period of one hour on the PDA was long enough to

observe a dynamic movement and interaction pattern without losing concentration. It was also explained to the nurses early on that the data collected was limited to their movement and only professional interactions with related medical personnel. There would be no identifying information.

The total number of observed hours was also equally distributed among the nursing pods (referred to as nursing stations in Phase I). The unit is designed to have nine nursing pods and four of these have patient monitoring systems. The number of hours observed, were also equally divided among the most frequently used nursing pods. It was found that seven pods were in constant use and six of these were used by the nurses and one by the ward clerk. These have been marked and assigned numbers in Figure 2.1. During each observation period, a particular pod was selected to be observed depending on the duration of observations already conducted at the pod. Once a pod was selected to be observed, the nurse assigned to the pod was shadowed (wherever she conducted her activities) for the entire duration of observation.

Survey

A survey was also administered to the nurses and some tertiary staff on the ICCU. It was used to test job satisfaction, work related stress and teamwork between the staff. (See the survey in Appendix E)

A new question, not included in the Phase I Survey, was added in the Phase II survey. Using an activity matrix (see Appendix E), this question asked the nurses where they performed various activities/ interactions in the ICCU. Responses to this item were then compared with the CWM Tool data in order to examine whether there were differences between perceived and observed behavior patterns.

Field Notes

In addition to the formal data collection methods described above, the researcher maintained field notes on a regular basis. These notes captured personal observations about both interaction patterns and the use of space and equipment on the ICCU that were more nuanced and descriptive than the other forms of data collected.

2.6 Procedure – Phase II

At the start of every observation period the total number of patients and the corresponding staff on duty in the ICCU was noted. While taking this census the researcher took account of the beds empty and occupied and the different roles and number of staff present.

The researcher then chose the nurse to be shadowed depending upon – who was present, the last time they had been observed and the nursing pod that was their 'home pod'. 'Home Pod' was the nursing station where the nurse laid down files, paperwork and personal belongings generally after being assigned a patient. These assigned patient rooms were also noted. A combination of the location, type of interaction and type of staff was entered into the handheld PDA. The software automatically recorded the timing every time any new data was entered, thus giving the duration of each activity.

The definitions of the type of interactions are given below:

- Consultation: Discuss/negotiate patient care; seek/provide clinical advice or feedback
- Social: Discuss non-work issues

- Informational: Discuss/learn about the unit/hospital; administrative information.
- Educational: Teach or Learn new clinical information (e.g., techniques, medicines)
- Patient Interaction: Talk/work with patient

The 'type of staff' work categories were established as follows:

- Registered nurse
- Nursing Aide
- Intensivist
- Ward Clerk
- Nurse Director
- Allied Health Professional
- Patient
- Self

While shadowing a nurse, the researcher entered these parameters into the hand held device. During observations, the nurse was followed a distance that was close enough to observe her activity and understand the nature of interactions without interfering in her work. It was found that their work involved a lot of movements across the unit floor at a very fast pace and many interactions and activities took place while in motion. Most of these lasted for just mere seconds. All of these were captured as accurately as possible.

The boundaries of all the designated were clearly decided and hence the location of the nurse could be entered. Being familiar with the regular staff on the ICCU, the

researcher found it easy to identify whom the nurses interacted with. Most interactions constituted multiple staff members.

It was noted that many interactions could be classified as multiple types of conversations (e.g. Social, Informational etc). For example a nurse-doctor conversation could be 'consultation' and 'informational' simultaneously. If an interaction could not be classified completely as one category, the most predominant type/s was used. If a predominant type of classification could not be identified, combinations of the different categories were used.

After pilot testing the instrument a 'self' category was added. The researcher found that the nurses would often work by themselves moving around throughout the ICCU: for example, using the medication room or inspecting a patient room. The nurses would also interact with various health professionals throughout the hospital over the telephone. In such situations the 'self' category was selected in order to distinguish this interaction or activity from others, which involved face to face communication. Since this research also focused on the usage patterns, adding the 'self' category made possible for more accurate data collection. More specifically, the researcher was interested in:

- Locations of the nurse over the course of the observation period
- The duration of these activities
- The types of activities they performed
- Interactions with other participants

All data was then exported and analyzed in Microsoft Excel. It was further compiled and tabulated to analyze the relationships between various parameters.

2.7 Data Collection – Phase 1 (Dutta 2009)

A single researcher conducted systematic observations of the medical staff at the ICCU and all interactions were manually recorded according to predetermined categories for physical location, participant roles, gender and duration of interactions. (See Appendix B for Phase I Data Entry sheet). The eight-hour shift from 7 am to 3 pm was chosen as the daily timeframe for data collection. Interactions that took place within the floor area in which the researcher had permission to move about were recorded, while interactions that took place within enclosed areas were ignored in spite of being visible to the researcher. Such areas included the staff lounge, medication room and the patient rooms. Verbal interactions involving at least one medical staff member were recorded while those between visitors and/ or non-medical staff members were ignored as were those during medical rounds. After a total of 50 hours of observations conducted on different days of the week and during different times of the shift, 899 data points were obtained during Phase I of this study.

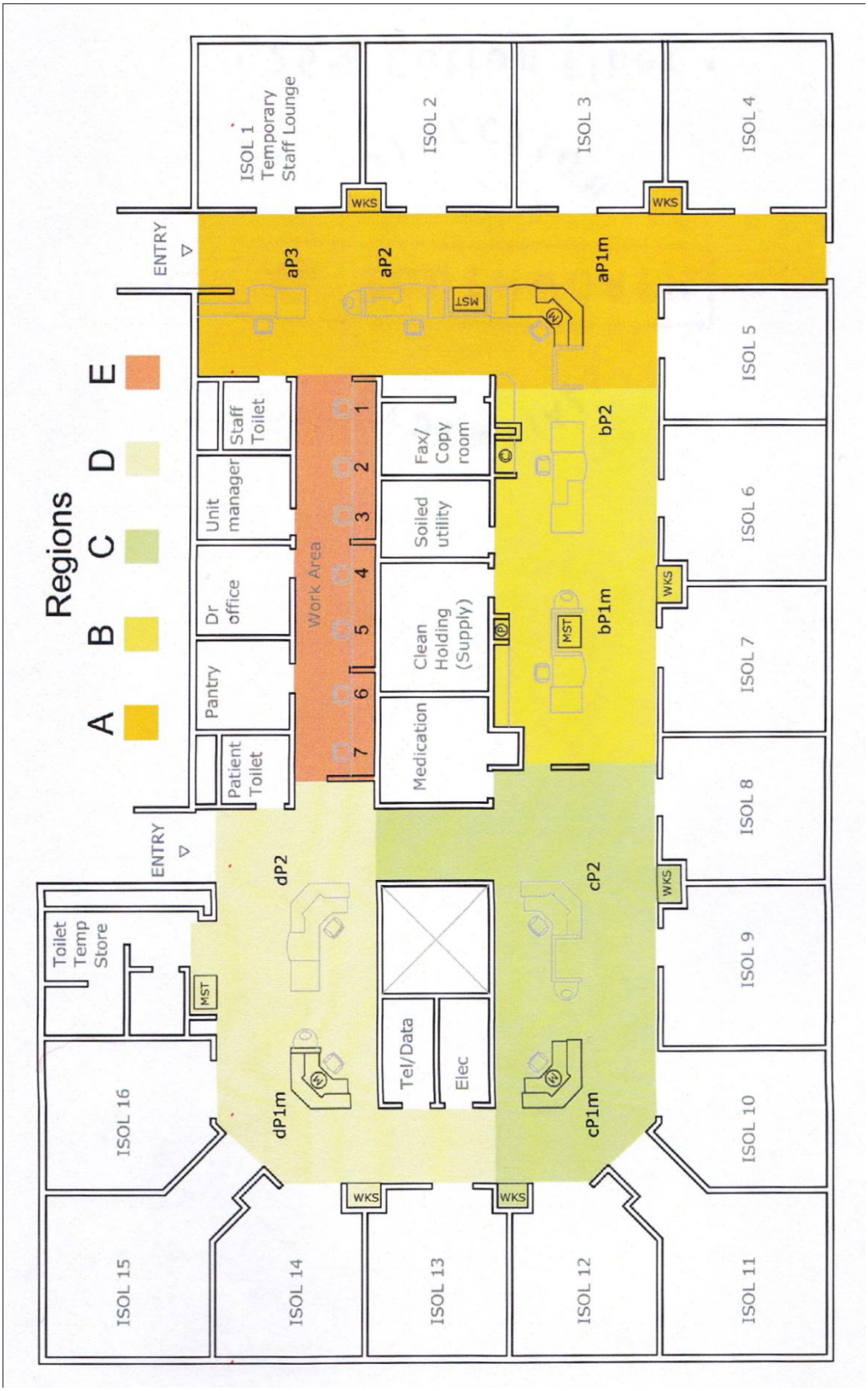


Figure 2-4: ICCU Floor Plan showing Observation Regions

2.8 Procedure – Phase I

During Phase I the ICCU floor was divided into five distinct regions A through E (Figure 2.2). Within each of these locations, areas of potential interest such as – chart locations, medicine storage charts, nursing pods, were identified. Equipment/ furniture within the area, which was perceived as a future communication hub, were also selected by the researcher. The left over space was considered as corridor area. Specific vantage points were chosen within each region that allowed uninterrupted visibility within that region. In some regions vantage points outside the areas were used for better observation. An interaction-taking place completely within the boundaries of a given region was considered valid and recorded while those taking place in other areas of the ICCU simultaneously were not. An interaction was coded as 'between regions' if the interaction was between people standing in two different regions.

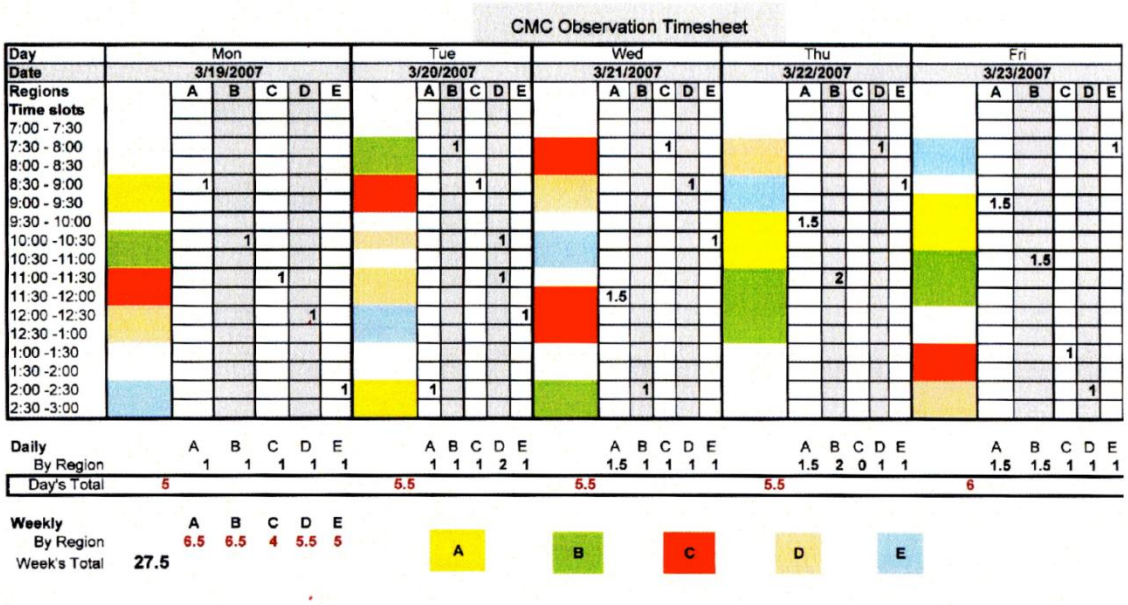


Figure 2-5: Typical Time Table for Observations Phase I

Data collection was carried out over different days and times in order to minimize any potential bias and get a representative picture of interaction patterns. Each region within the ICCU was observed several times over several weeks to counter for unequal total observations in each and paint a representative picture. Each region was observed serially A-B-C-D-E such that each region was observed for a similar time and day of the week. (Figure 2.3 - Typical Time table for observations). A region was observed from anywhere between one to three hours before the next area could be observed, noting the exact timing and date of the observations.

The content or nature of any communication was ignored while only the generic role, gender of the participants, the physical location and the duration were recorded. Additional descriptions and notes were also required at the time of data entry if required.

3. RESULTS

Results derived from Phase II have been outlined below. The results are presented in three parts. The first part focuses on the data obtained from Phase II. Part two compares the findings from Phase I and Phase II. In the third part, data from the activity matrix on the surveys is compared to the observed data and overall survey results have been presented.

3.1 Phase II Data Collection Summary

Table 3-1: Data Collection Summary

Nurse	Obs Time	Pod	Obs Time
1	209	1	0
2	232	2	297
3	153	3	281
4	167	4	304
5	180	5	42
6	155	6	295
7	168	7	288
8	173	8	257
9	164	9	0
10	163		
Total	**1763**	***in**	**Minutes**

Table 3-1 shows the observation time in minutes for each nurse and pod. These recorded minutes do not include any data from the pilot study conducted by the researcher in order to accustom her with the CWM tool. The total minutes also do not

include any outliers of twenty minutes each. A total of ten nurses were observed with an average of 176 minutes or approximately three hours for each nurse. The observation time was also divided according to pod. The ICCU consisted of nine pods including the ward clerk's desk. The average observation time per pod was 287 minutes or five hours. Pods 1 and 9 were either empty or used by allied healthcare staff while Pod 5 was the ward clerk's desk. Thus the average minutes per pod were calculated for Pods 2, 3, 4, 6, 7 and 8. It should also be noted that Pod 8 was generally avoided by the nurses and hence only 257 minutes of observation could be conducted at Pod 8.

3.1.1 Phase II – Time by Location

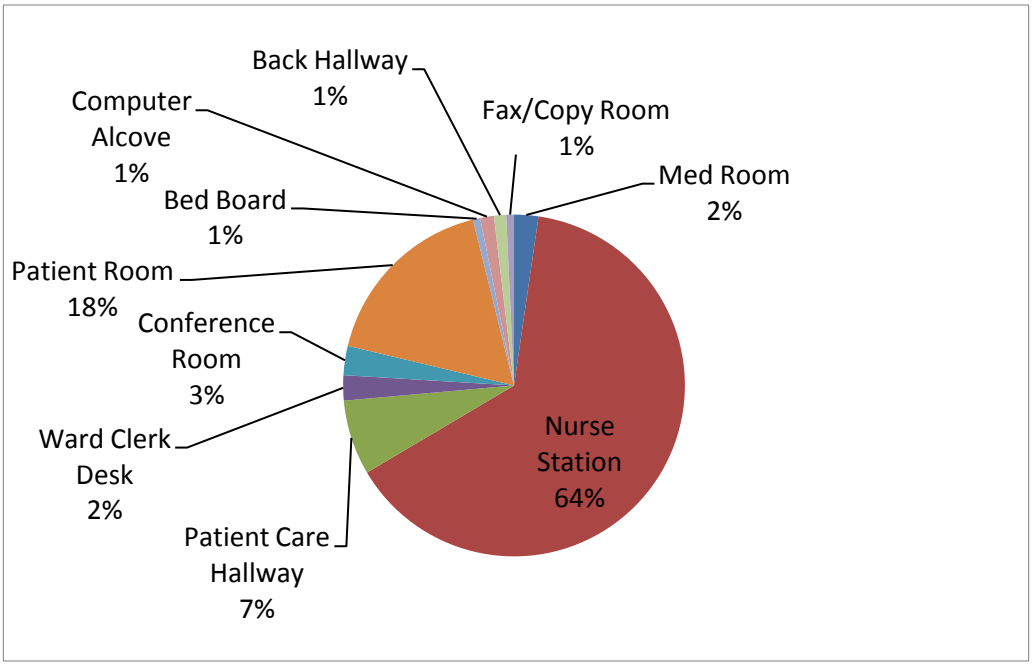


Figure 3-1: Percentage of Time spent by Locations

As seen in Figure 3-1, 64% of a nurse's time is spent at a nursing pod, 18% of the total time is spent in Patient Rooms while 7% is spent in the Patient Care Hallway. The

nurses were observed in the conference room for only 3% of the total time. The Conference Room was generally used for social activities and personal breaks. Note that the time shown in the above charts consists of both interactive and non-interactive events. Computer alcoves situated near patient rooms were used only 1% of the time. The computer alcoves were originally designed so that nurses could feed data into computer systems without having to return to their nursing pods. However, data suggests that the nurses have underutilized these alcoves.

3.1.2 Phase II –Type of Interaction

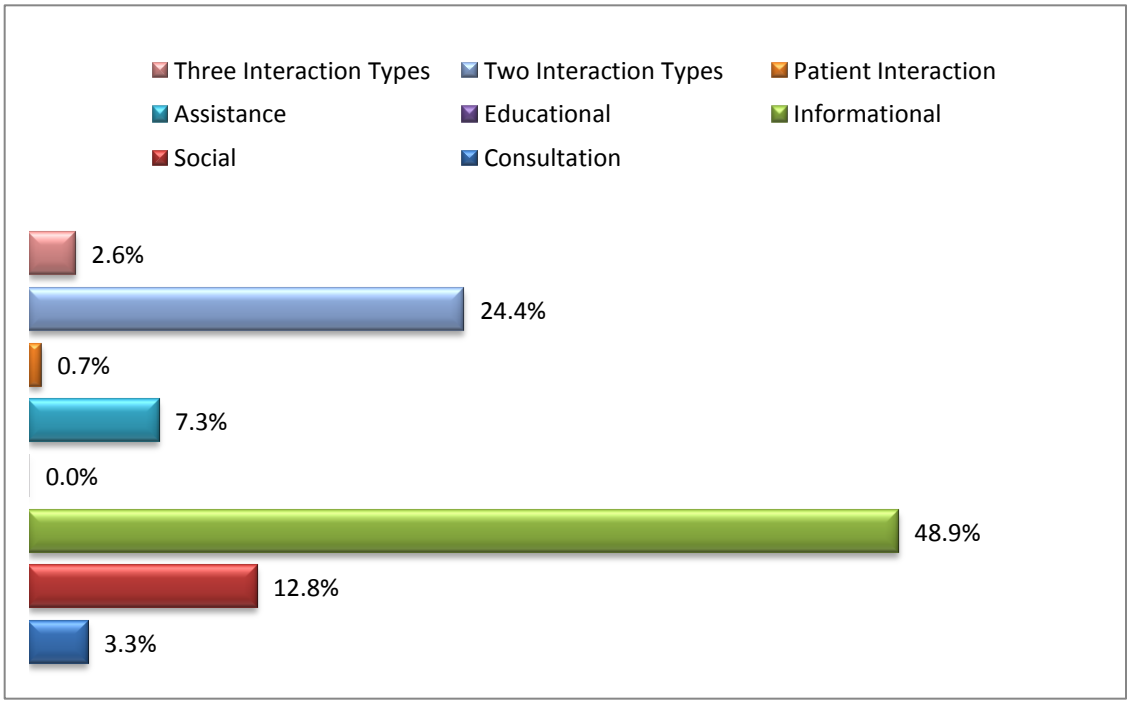


Figure 3-2: Percentage of time by Type of Interaction

Figure 3-2 shows that for almost 49% of the total observation time, the nurses were part of interactions that were Informational; while Social, Consultation and Assistance constituted 12.8%, 3.3% and 7.3% of all interactions respectively. Less than one half

of one percent of all interactions could be classified as Educational. Most interactions could not be classified as a single category (e.g., typically, in the same conversation nurses exchanged information and also socialized).

For an interaction to be categorized as a single category, it would have to be the predominant component of that conversation. Almost 27% of all activities were classified into two or more types of interactions – Two types (24.4%) and three types (2.6%). It should be noted that the 12.8% of Social interactions observed, occurred as a part of other interactions.

3.1.3 Phase II – Number and Type of Personnel

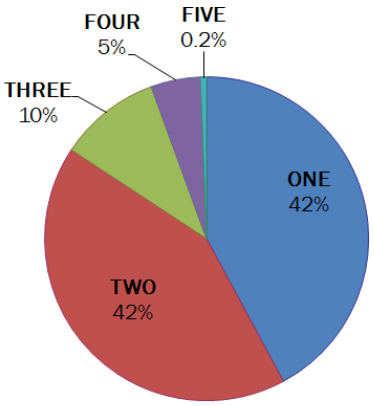


Figure 3-3: Percentage of Time by the Number of People

Figure 3-3 shows the proportion of time that a nurse spent by herself and with one to four other people. It can be seen that a nurse is typically involved in an activity by herself 42% of the time; an equal proportion is spent in an interaction with only one other person. We see that three people interactions constituted 10% of all interactions,

while four people and five people interactions constituted 5% and 0.2% respectively. Thus we can conclude that a nurse is involved in an interaction for close to 58% of the time, while she is by herself for the remaining 42%.

Figure 3-4 further analyses two-person interactions, those which involve a nurse and only one other person. As can be seen, the largest amount of time that a nurse spends with one other person is 15.2%, with another Registered Nurse. Nurses interacted with Nursing Aides for 9.3% of the time. It was also observed that a nurse spends about 9.3% of her time with Allied Health professionals, which include Occupational Therapists, visiting doctors, etc. Less than 1% of a nurse's interactions are with a Ward Clerk. A nurse also spent less than 1% of her time interacting with the Intensivist, who is the doctor assigned to the ICCU.

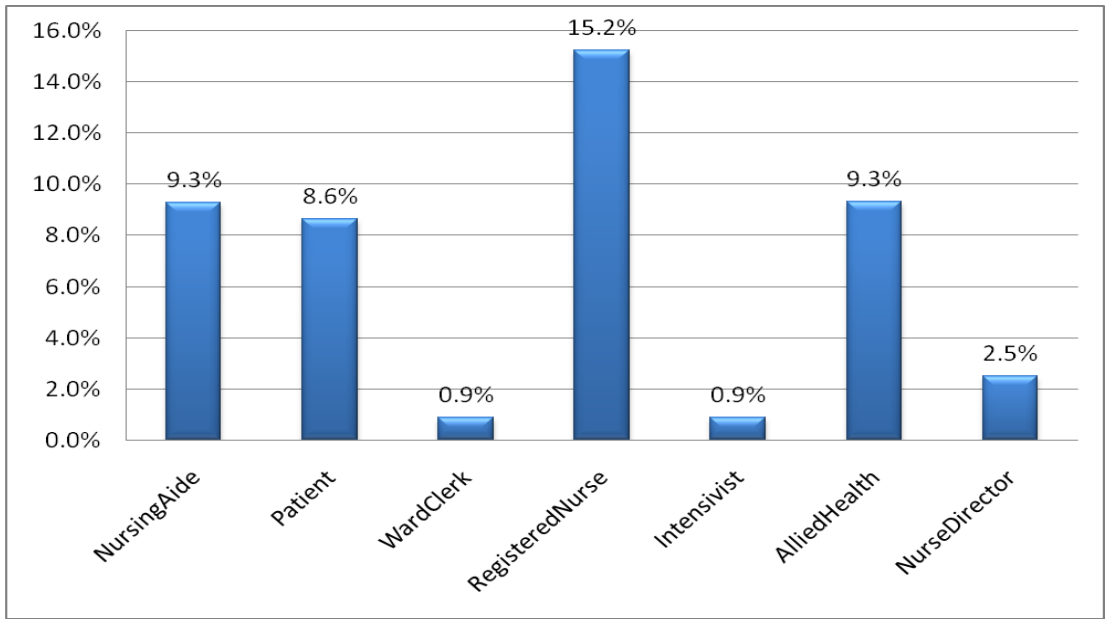


Figure 3-4: Percentage of Time by Role-Pair

Although it was seen in Figure 3-3 earlier that about 18% of a nurse's time is spent in Patient Rooms, this figure shows that only 8.6% of her two-person interactions occur

with a patient. This indicates that a nurse does not always interact with a patient when she is in a Patient Room.

3.1.4 Phase II – Interactions per Hour by Pod

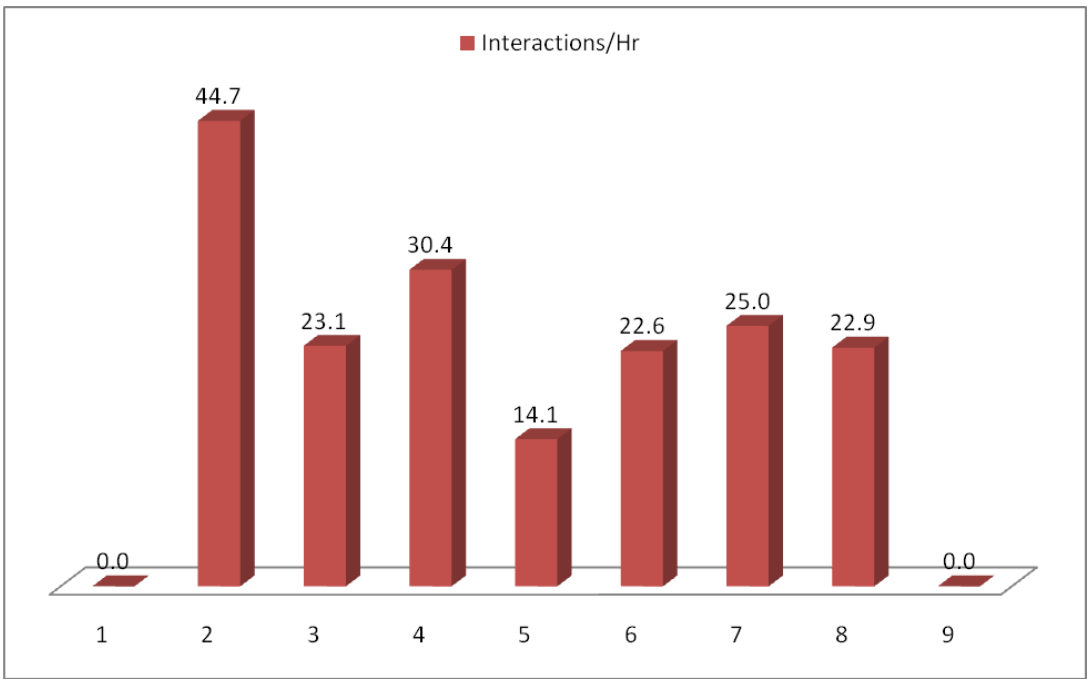


Figure 3-5: Average number of Interactions per hour by a nurse at each pod

Figure 3-5 above shows the average number of interactions per hour for a nurse at a particular pod. Nurses did not use pods 1 and 9 throughout the length of the observation period. Refer to Figure 2.1 for a plan of the ICCU and the location of each pod. These pods were situated near the entrances to the ICCU and originally designed as administration desks. They were generally observed to be unoccupied, but occasionally some of the Allied Health Professionals who required temporary workspace were observed to be using these pods. It was observed that a nurse at pod 2 had, on an average, 44.7 interactions per hour while a nurse at pod 8 had, on an average, 22.9 interactions per hour. The average interactions per hour for each pod

ranged from 44.7 at pod 2 to 14.1 at pod 5. It should be noted that pod 5 is the Ward clerk's desk and hence is not typically used as a nursing pod. A nurse was observed using Pod 5 as a nurses' station during just one data collection session, for a period of 20 minutes.

The average number of interactions per hour for a nurse who occupied pods 2 and 4 were significantly higher than a nurse at any of the other pods. There was also higher activity for a nurse stationed at pod 7. Pods 2, 3 and 4 seem to form a hub of activity, a statement that is supported by the results in the above figure. Pod 7 could be considered as the secondary hub.

3.1.5 Phase II – Type of Interaction by Location

The Figure 3-6 shows the total number of interactions taking place at different locations in the ICCU for each type of interaction. The graph can be read, for example, as – 35 instances of 'social' interaction occurred in the 'patient care hallway'. All of the five types of interactions occurred at the Nursing Pods. Only 'social' interactions (11 instances) took place in the Conference room. However, most social interactions (169) occurred at the Nursing Pods. Educational interactions were observed only at the Nursing pods and 37 instances of Patient interaction were observed in the Patient rooms.

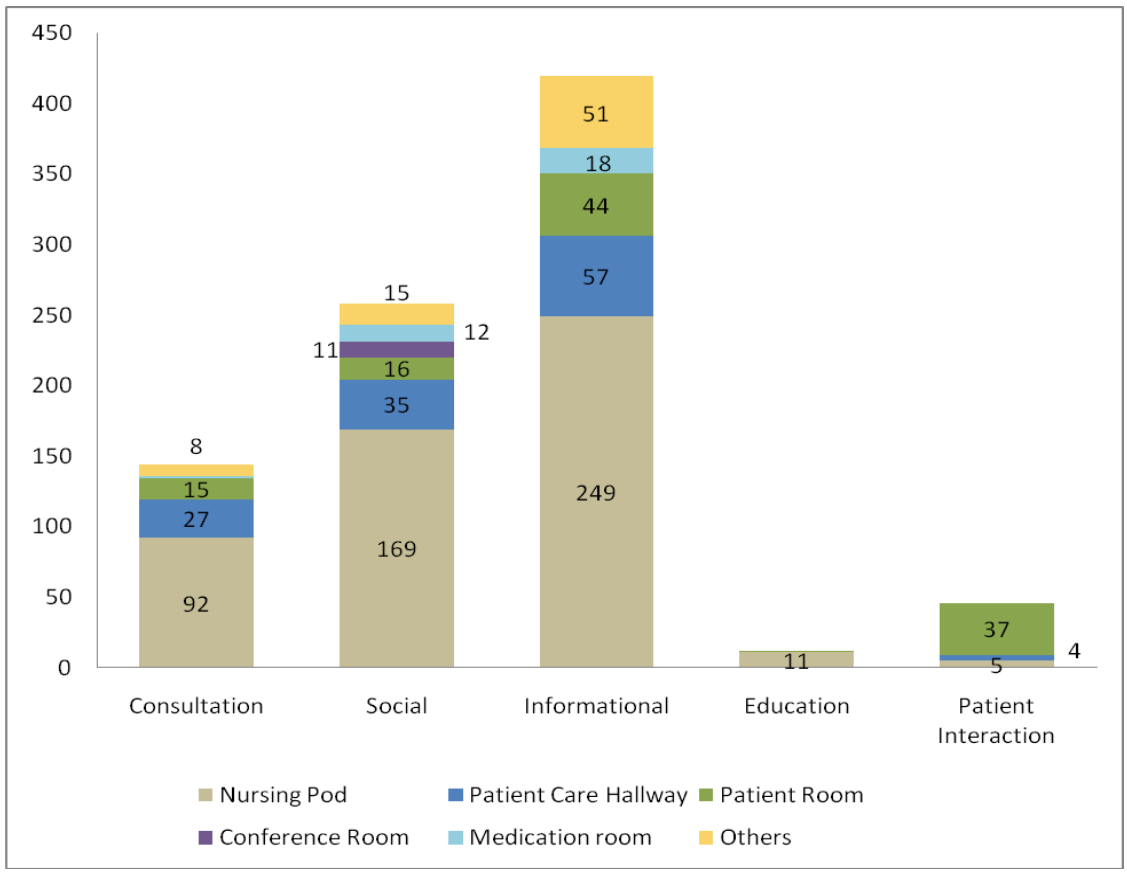


Figure 3-6: Total number of interactive events at various locations by type of Interaction

The instances illustrated in the graph above include only 'interactive' events and not the non- interactive ones (e.g. nurses working alone charting). They also do not include instances involving more than one type of conversations. The interactions in this section were purely of one category only. Though 'social' interactions were concentrated at the Nursing pods, 12 instances of social interaction were recorded in the 'Medication Room'. The medication room offers some level of privacy and the presence of more than one nurse could often lead to a higher number of social interactions.

3.1.6 Phase II – Interaction by Nurse

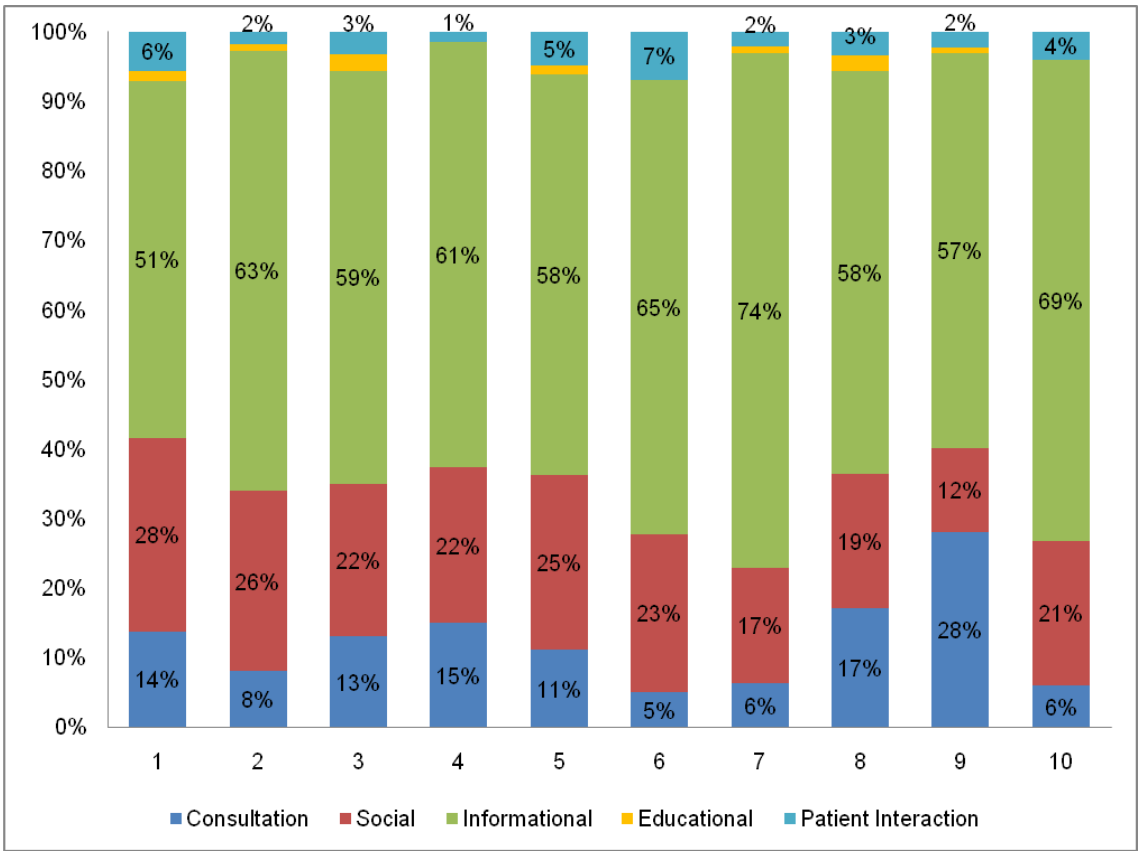


Figure 3-7: Percentage of each type of Interaction by Nurse

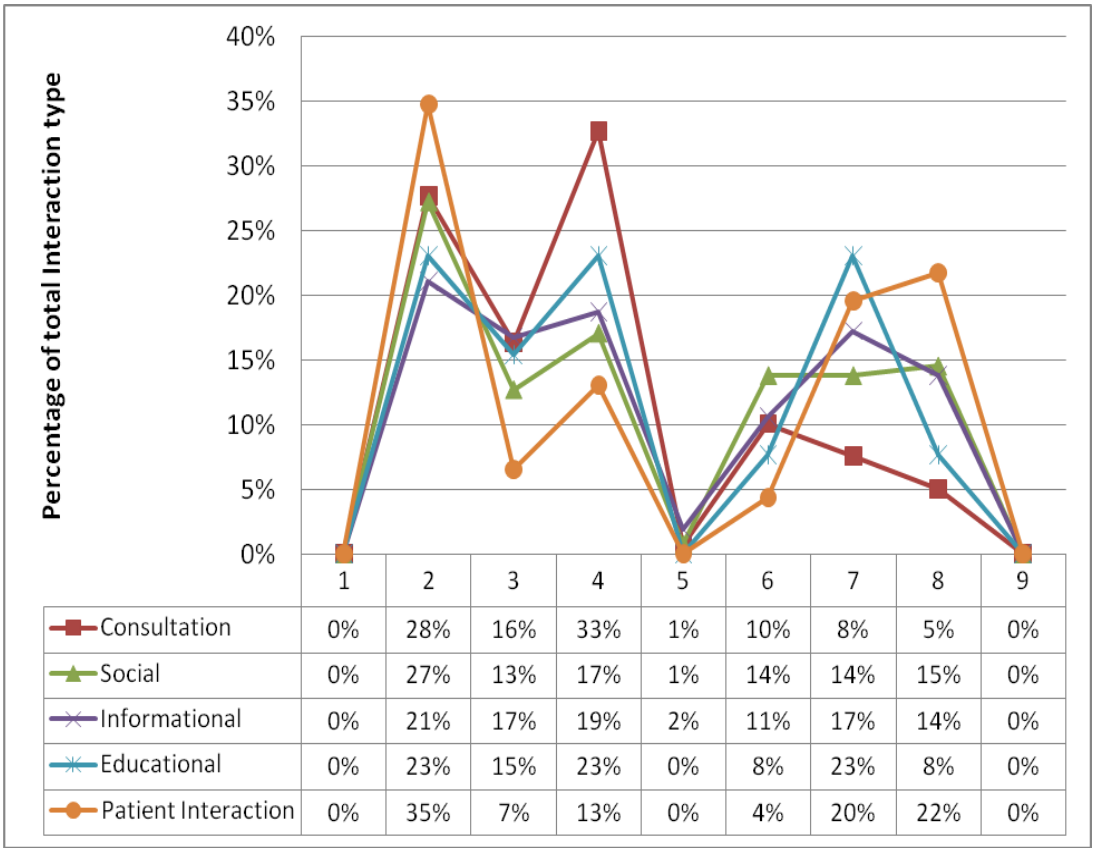
Figure 3-7 shows the proportion of each type of interaction recorded for each of the ten nurses that were shadowed. Informational interactions ranged from 58% to 74% of all interactions for each nurse. Educational interactions constituted less than 2% of all interactions for each nurse: while Patient Interaction ranged from 1% to 6%. The maximum variation was observed in 'Consultation' which ranged from a mere 5% to 28% of total interactions per nurse. However this may have been the result of a nurse's experience and position on the ICCU. For example a more senior nurse would be consulted far more often than a nurse with lesser experience. This difference could also arise from the nurses' location in the ICCU. Typically nurses at pods 2, 3 and 4

were closer to the entrance as well as to the critical patients with higher acuity, with the complexity of their condition leading to more interactions of a consulting nature. However, as Figure 3-7 shows, the overall proportions for each type of interaction for all nurses were similar with no major differences among the nurses. For that reason, the data for each nurse were averaged to generate an interaction pattern for one typical nurse for the purposes of this thesis.

3.1.7 Phase II – Interaction by Pod

Figure 3-8 shows the percentage of a 'type' of interaction observed for a nurse at each of the pods. For example, 10% of the total observed Consultation interactions involved a nurse stationed at Pod 6. Higher values were recorded for nurses at pods 2 and 4 for each of the five conversation categories. All the types of interactions peak at pods 2, 4 and again at 7 compared to any other pods.

Pod 8, which is located at the perceived 'back' of the ICCU, typically had patients with lower acuity and hence showed a high level of patient interaction – 22%. Pod 8 also has the lowest values for percentage of 'consultation' and 'educational' interactions (5% and 8% respectively). This could be the result of the acuity of the patients as well as the location of the pod on the ICCU. A nurse at pod 6 had fewer informational interactions but more social interaction instances than nurses at pods in its immediate vicinity. Pod 7 forms a secondary hub and typically has a higher level of activity than both pods 6 and 8. Nurses stationed at pods 2, 3 and 4 accounted for 77% of total Consultation, 57% of all Social interaction, 57% of all Informational conversations, 61% of all Educational activities and 55% of all Patient Interaction – thus, making them the busiest pods.

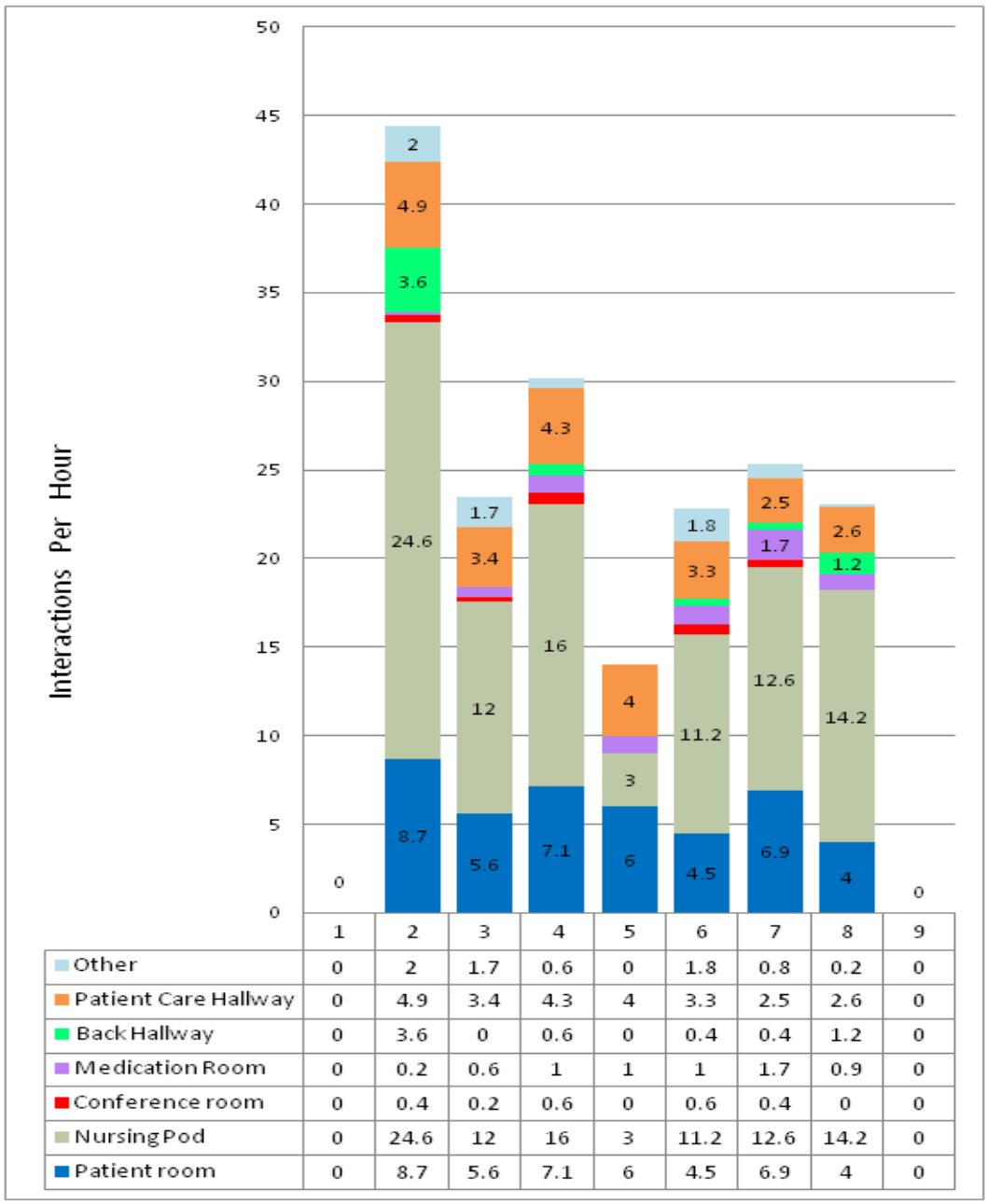


	1	2	3	4	5	6	7	8	9
Consultation	0%	28%	16%	33%	1%	10%	8%	5%	0%
Social	0%	27%	13%	17%	1%	14%	14%	15%	0%
Informational	0%	21%	17%	19%	2%	11%	17%	14%	0%
Educational	0%	23%	15%	23%	0%	8%	23%	8%	0%
Patient Interaction	0%	35%	7%	13%	0%	4%	20%	22%	0%

Figure 3-8: Percentage of Interaction type by Pod

3.1.8 Phase II – Interaction by Pod

Figure 3-9 shows the average number of interactions per hour, at various locations on the unit, for a typical nurse stationed at Pod 1 through Pod 9. Nurses at Pod 2 had the highest number of total interactions per hour closely followed by a nurses stationed at Pod 4. The number of instances recorded in the Patient care hallway and the Patient room for a nurse at Pods 2 and 4 are also higher than those observed at the other pods. Nurses stationed at any pod conduct, on an average, 50% of their interactions, per hour, at their own or another nursing pod.



	1	2	3	4	5	6	7	8	9
Other	0	2	1.7	0.6	0	1.8	0.8	0.2	0
Patient Care Hallway	0	4.9	3.4	4.3	4	3.3	2.5	2.6	0
Back Hallway	0	3.6	0	0.6	0	0.4	0.4	1.2	0
Medication Room	0	0.2	0.6	1	1	1	1.7	0.9	0
Conference room	0	0.4	0.2	0.6	0	0.6	0.4	0	0
Nursing Pod	0	24.6	12	16	3	11.2	12.6	14.2	0
Patient room	0	8.7	5.6	7.1	6	4.5	6.9	4	0

Figure 3-9: Location of Interaction by Pod

Nurses at pods 2 and 8 showed a higher number of interactions per hour in the Back Hallway (3.6 and 1.2) than nurses at any of the other pods. This could be explained by their proximity to the Back Hallway, which was used for private conversations. Similarly, interactions per hour located in the medication room were higher for nurses

at pods closer to it, 7, 6 and 4. Pod 5 had been assigned as the ward clerk's desk thus making it difficult for a nurse to occupy it. During the course of the observation period, only one nurse was recorded using the ward clerk's desk for 20 minutes.

3.2 Phase I and Phase II comparisons

Assumption: There will be no changes observed in the frequency and patterns of communication between Phase I and Phase II.

The above assumption was not supported wholly by the findings from this research. Analysis of the data according to the parameters of location, length of conversation, role pairs, number of people and type of events showed an overall increase in the number of interactions per hour. However the patterns (proportions) remained consistent. The Phase I and Phase II data was compared on a per hour basis as well as on the 'percentage of total interactions' basis in order to draw accurate conclusions. This would counter for the unequal observation periods and different methods in each phase.

3.2.1 Analysis by Location

The proportion of total interactions taking place at different locations soon after and one and a half years after the move to the new ICCU were compared. During Phase I, 74% of all interactions took place in the nursing pods, 11% took place in the patient rooms and the remaining 15% took place in the support areas. During Phase II, 64% of all interactions took place at the nursing pods, 22% in the patient rooms while the remaining 14% took place in the support areas.

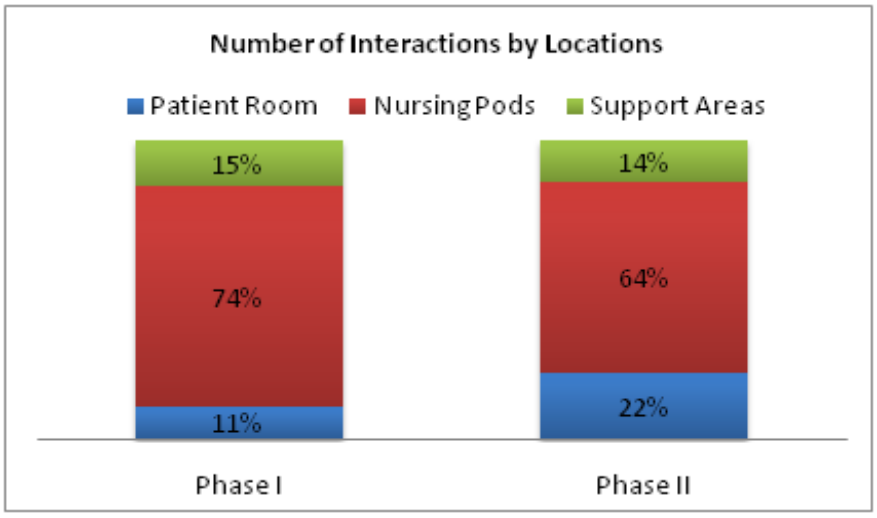


Figure 3-10: Comparison of Phase I and Phase II by Location

Figure 3-10 above shows that there is an 11% increase in the proportion of interactions taking place in the patient rooms. Also, the proportion of interactions taking place at nursing pods was lower than in Phase I. In order to coincide with the physical demarcations used in Phase I, for the purpose of this comparison, nursing pods in Phase II constituted both the actual pods and the corridor areas around them.

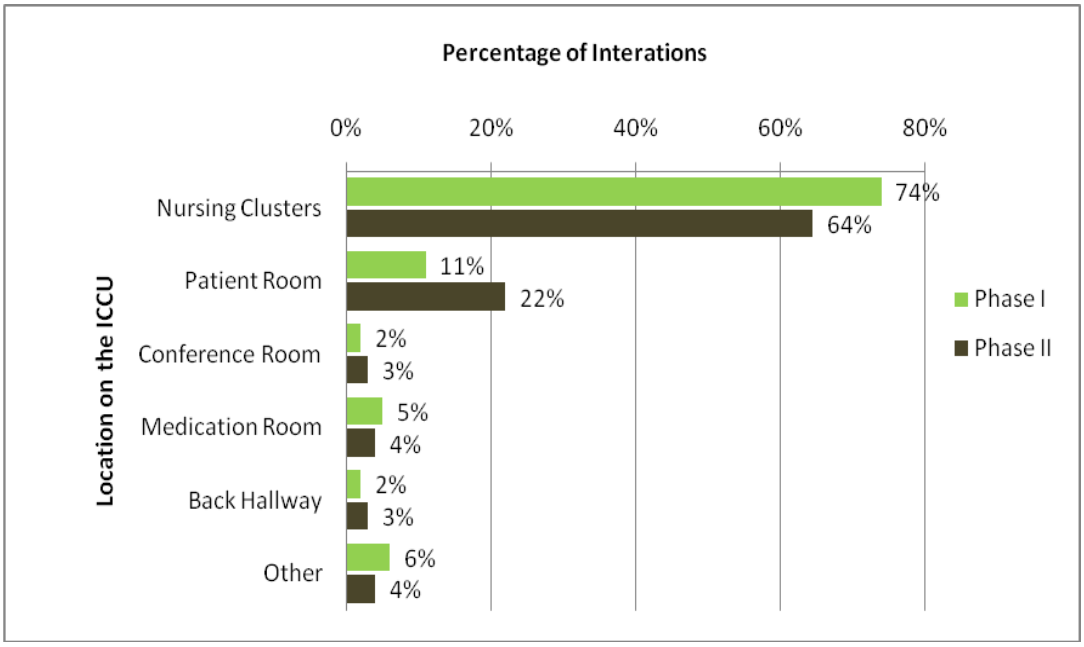


Figure 3-11: Comparison of Phase I and Phase II by Detailed Locations

Figure 3-11 shows, in further detail, that interactions in the patient rooms have increased by 11% while those in the other locations have shown very minor fluctuations. The basic pattern and proportion of interactions in each area remains the same. Since other data from Phase II shows that 80% of interactions taking place in the Patient rooms are with patients, it could be concluded that compared to Phase I the nurses have more interactions with patients in Phase II.

3.2.2 Analysis by Length of Conversation

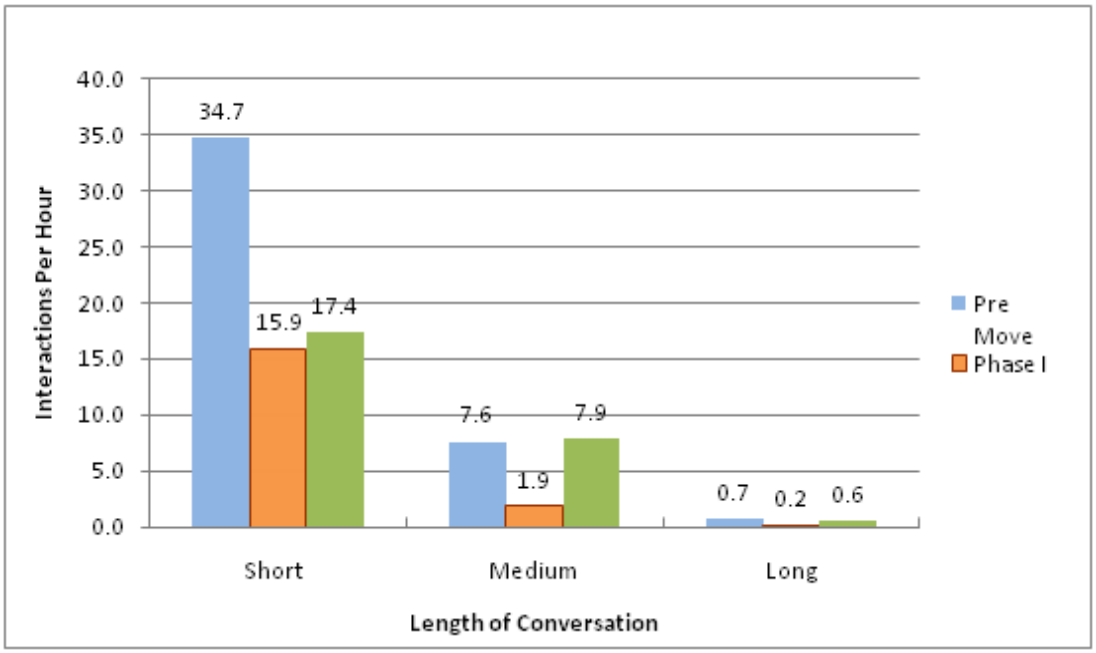


Figure 3-12: Comparison of Phase I and Phase II by Length of Conversation

Comparative analysis between data obtained from Phase I, Phase II and before the move (Figure 3-12) show that interactions per hour, for every length of conversation, were lesser during Phase I than any other Phase. More medium and long interactions took place per hour during Phase II than before the move to the New ICCU while pre-move phase recorded the highest number of short interactions per hour. It is interesting to note that for medium, long and extra long type of interactions Phase II figures are

very close to those obtained from the pre- move data. This data is also analyzed using 'percentage of total interactions' in Figure 3-1 below.

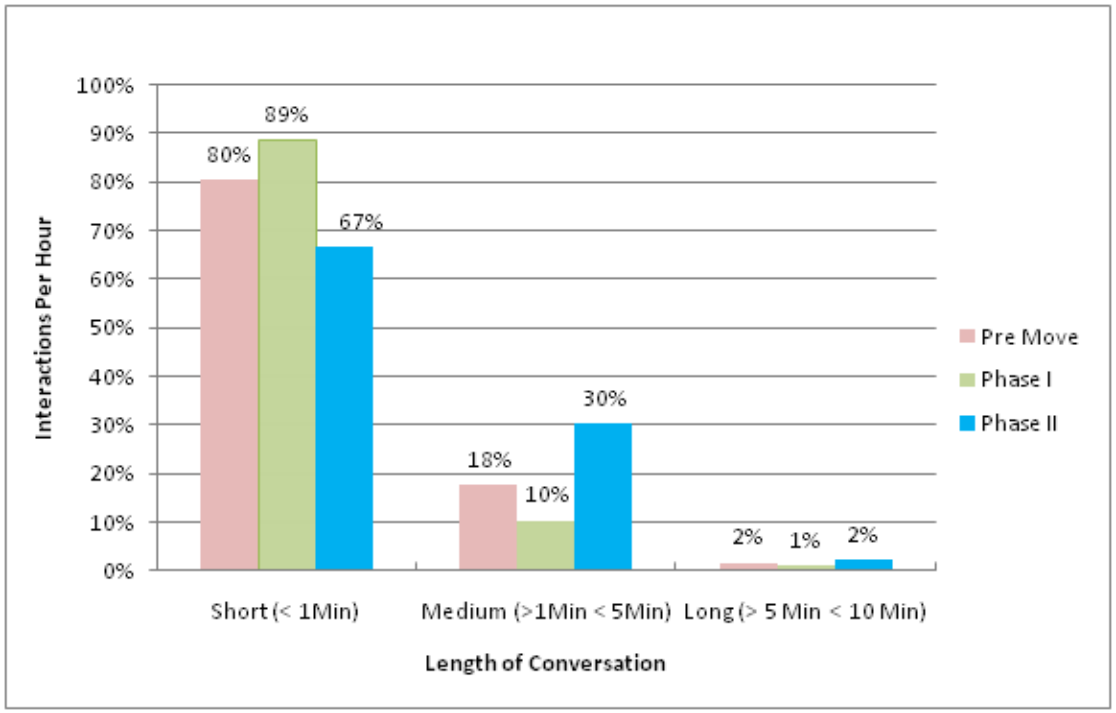


Figure 3-13: Comparison of Phase I and Phase II by Length of Conversation (as a Percentage of total Interactions)

Sixty-seven percent of the total interactions in Phase II were short. During Phase I however 89% of the total conversations were 'Short'. The proportion of 'medium conversations went up from 10 to 30% of total conversations from Phase I to Phase II. A larger percentage of total conversations were longer than a minute compared to any of the two earlier phases of data collection. The proportion of 'short' interactions decreased by 12% in Phase II from Phase I.

3.2.3 Analysis by Number of Persons in an Interaction

Figure 3-14 shows that the number of two people interactions per hour for both Phases is higher than any of the other interactions. Since Phase I the number of interactions per hour in all categories has increased significantly. Analyzing the same results on a 'percentage of total interactions' basis (Figure 3-15), it is observed that during Phase I of the data collection, two-people interactions constituted 89% of the documented interactions while in Phase II they make up just 74%. However there is an increase among the other categories.

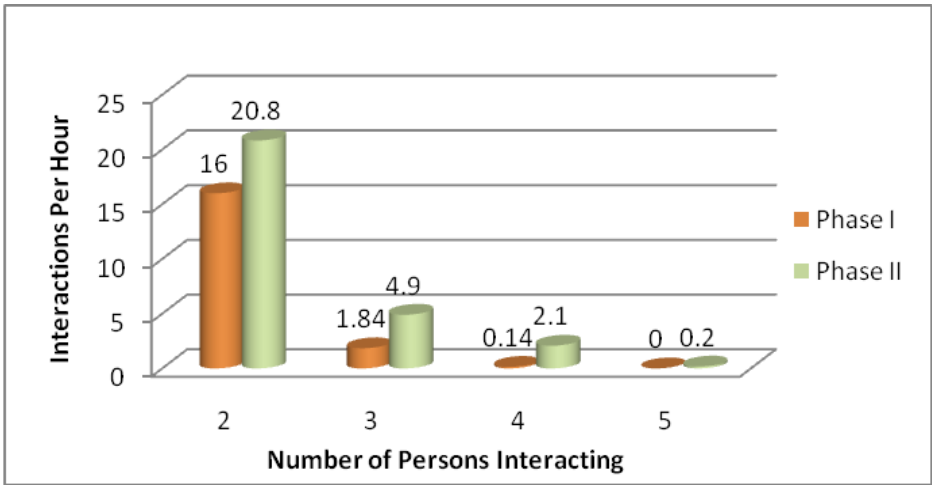


Figure 3-14: Comparison of Phase I and Phase II by Number of People Interacting

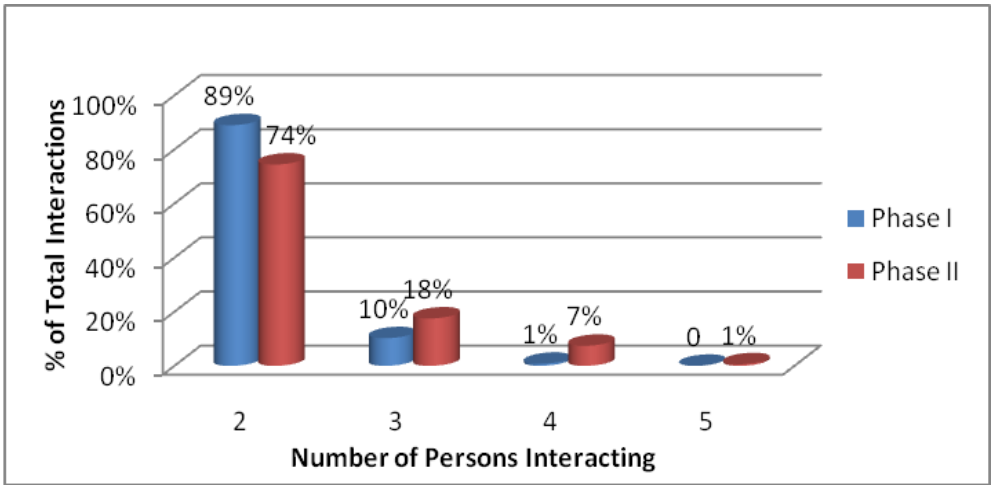


Figure 3-15: Comparison of Phase I vs Phase II by Number of People Interacting %

3.2.3 Analysis by Role Pairs

The professional roles of the people communicating have been analyzed in Figure 3-16. All two person interactions recorded during both phases, which included at least one Registered Nurse (RN) were analyzed. (Abbreviations have been explained in Appendix D)

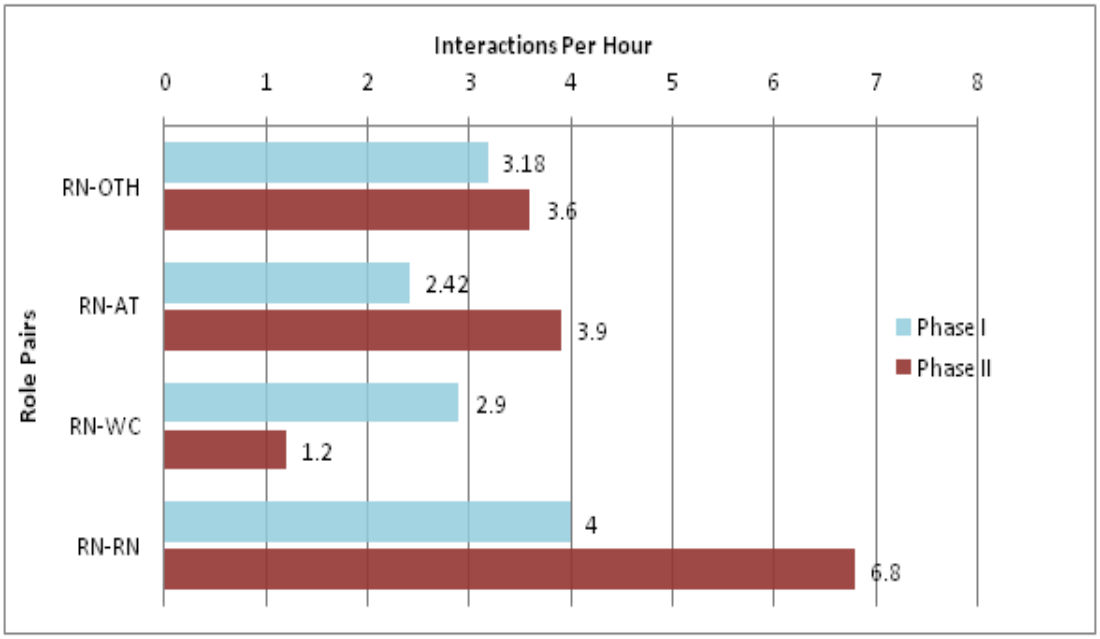


Figure 3-16: Comparison of Phase I and Phase II by Role Pairs

RN – Registered Nurse WC- Ward Clerk AT- Nursing Aide OTH – Other (Including Doctors)

The analysis shows that RN- WC interactions per hour decreased in Phase II while all others showed at least a 60% increase. There was a 70% increase in RN- RN interactions per hour in Phase II.

As seen in Figure 3-17, the proportion of interactions by each role pair is consistent between Phase I and Phase II. We can conclude that although the actual number of

interactions between the role pairs has changed from Phase I to Phase II, the relative proportion has stayed consistent.

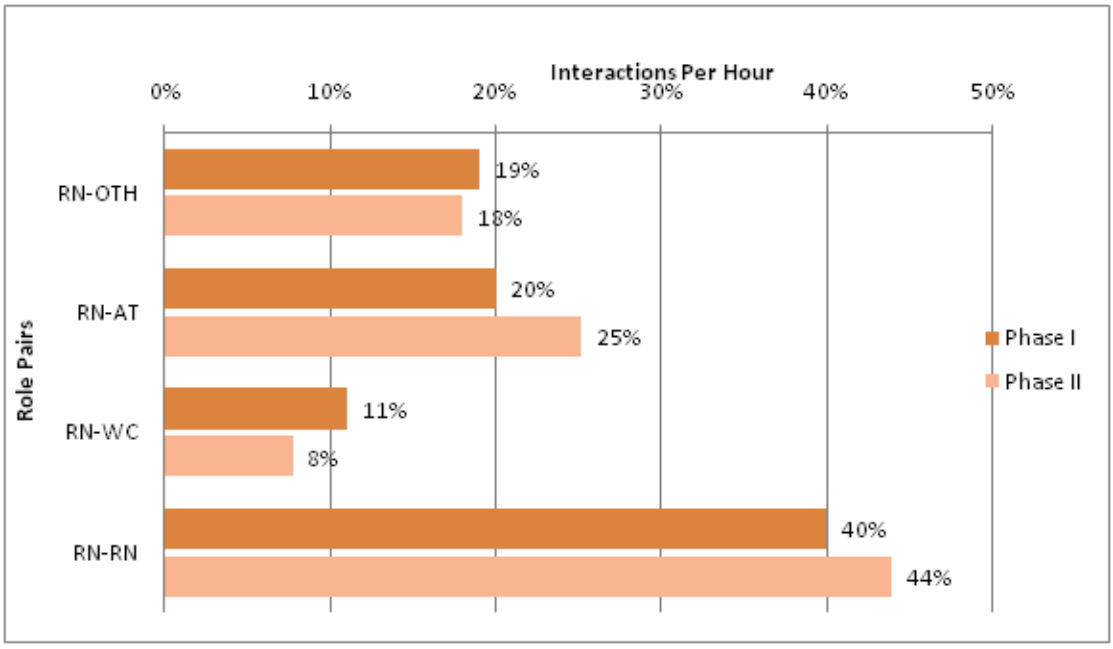


Figure 3-17: Comparison of Phase I and Phase II by Role Pairs (Percentage)

3.2.4 Analysis by Number of Interactive vs. Non- Interactive events

Of the total interactions recorded during Phase I, 57% (1040) were interactive events while 43% (782) were individual. During Phase II, 69% (822) of the event were interactive while 31% (368) were individual.

From Figure 3-18, it could be concluded that during Phase II the ICCU was a more interactive environment than during Phase I, since there was a lesser proportion of individual events.

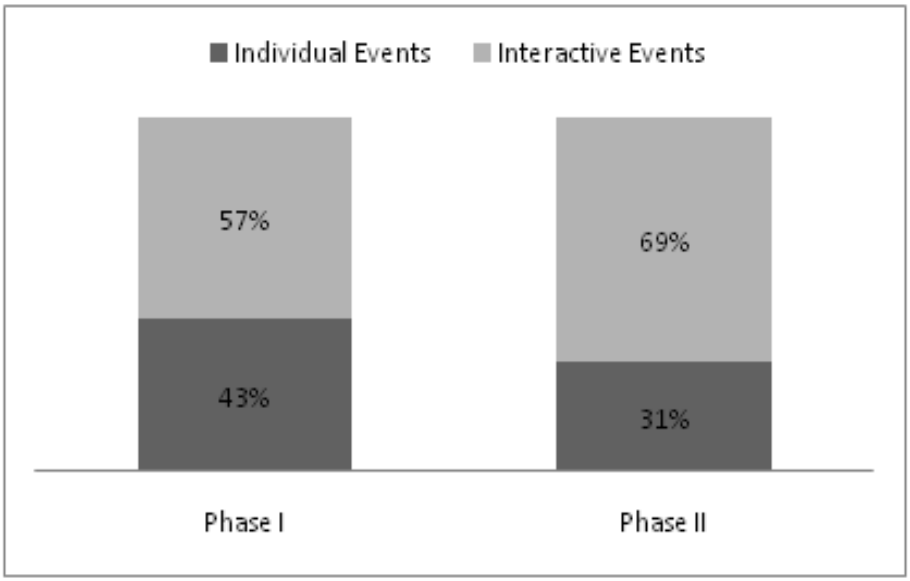


Figure 3-18: Comparison of Phase I and Phase II by Number of Interactive vs. Non-Interactive Events

3.3 Phase II Survey Comparisons

As explained in the Methods chapter, along with shadowing nurses in the ICCU, data was also obtained by administering a survey (Appendix E). The final item on this survey consisted of a matrix, listing all the locations on the ICCU against the five main types of interactions being analyzed – Consultation, Social, Informational, Educational and Patient Interaction. Each of these has been defined in Appendix D. The nurses were instructed to select locations they typically used for each category of interaction. The data from these surveys was then compared to the findings from the Clinical Work Measurement tool. The sub-sections listed below compare the CWM data to the survey findings for every interaction category. It should be noted that, though the unit of measurement is 'percentage', in the actual (CWM) section it signifies the 'percentage of interactions' for that type of interaction while in the perceived (Survey) section it denotes the 'percentage of nurses surveyed' who thought

the given type of interaction takes place at the location. Thus the numbers cannot be directly compared. However the relative trends observed in each set are described below.

3.3.1 Analysis - Actual vs. Perceived- Consultation by Location

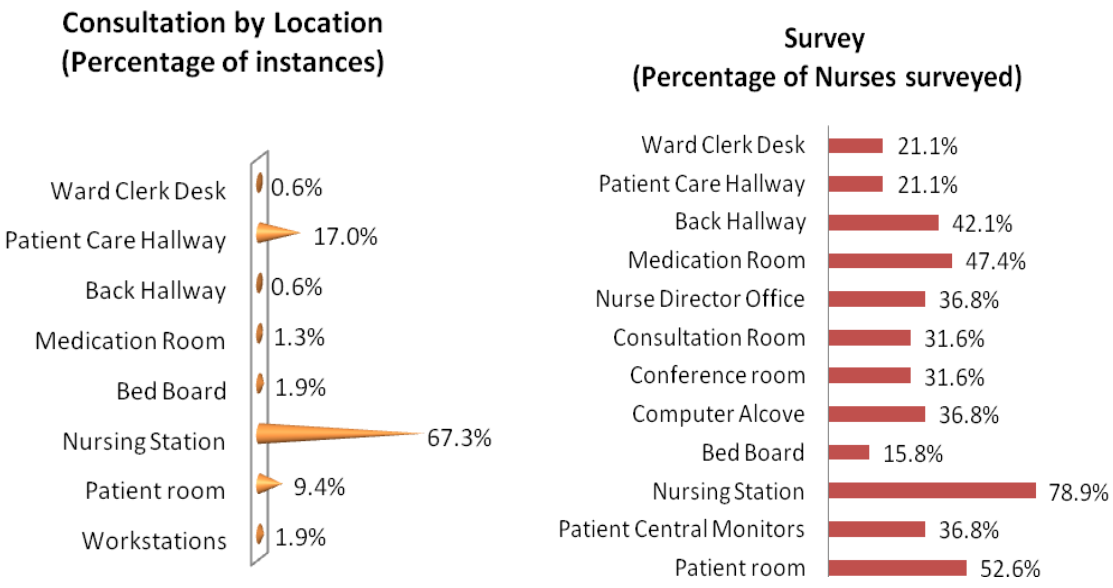


Figure 3-19: Comparison of Consultation by Location

Figure 3-19 shows – 1. The percentage of total consultation instances by location on the ICCU and 2. Survey results for consultation. 79% of the nurses surveyed selected the Nursing Station as an area used for consultation. (Nursing station here does not refer to a particular 'pod' or the home pod but a typical 'nursing station used by the nurses.) The patient room, medication room and the back hallway were other areas which had a higher than 40% nurse consensus. Observations show that 67.3% of all consultations occurred at the nursing station, 9.4% in the patient rooms while only 0.6% and 1.3% at the back hallway and medication room respectively.

Only 4 out of the 19 nurses surveyed selected ‘patient care hallway’ as a possible consultation location. However the observed data shows that 17% of all consultations took place in the patient care hallway. This discrepancy occurs because most of the consultations that take place in the patient care hallway are short and are often interspersed between consultations at other locations like the Patient Room and the Nursing Station. As such, since the patient care hallway is not designated as a consultation area, nurses might not perceive it as one.

3.3.2 Analysis - Actual vs. Perceived- Social Interaction by Location

According to the original ICCU design, the Conference Room is the designated place for social interactions. The observed data shows however that 62.2% of all social interactions take place at the Nursing Station, while only 9.5% of all social interactions occur in the conference room. It was also observed that the patient care hallway had a high percentage of social interactions – 12.7%. While 68% of the nurses thought that social conversations took place at the nursing station, a higher percent, i.e. 74% and 84%, agreed to social interactions in the back hallway and conference room respectively.

Observations show that 4.4% of social conversations occur in the medication room, in line with 63% of the nurses who perceived it as a place of social interactions. It should be noted that the medication room, conference room and back hallway – all three places that have a high percent of agreement in the nurses about having social interactions – are also the three places in the ICCU with a higher degree of privacy in the open design. So when the nurses plan to have a private conversation, scheduled breaks or any non-work related conversations they prefer to go to these locations. This

would explain the high consensus in the survey. However, most social conversations are often unplanned and occur as a part of other interactions – like consultation – and are very short, which is why these were observed at the Nursing Station. Figure 3-20 shows the results from the observations as well as the survey.

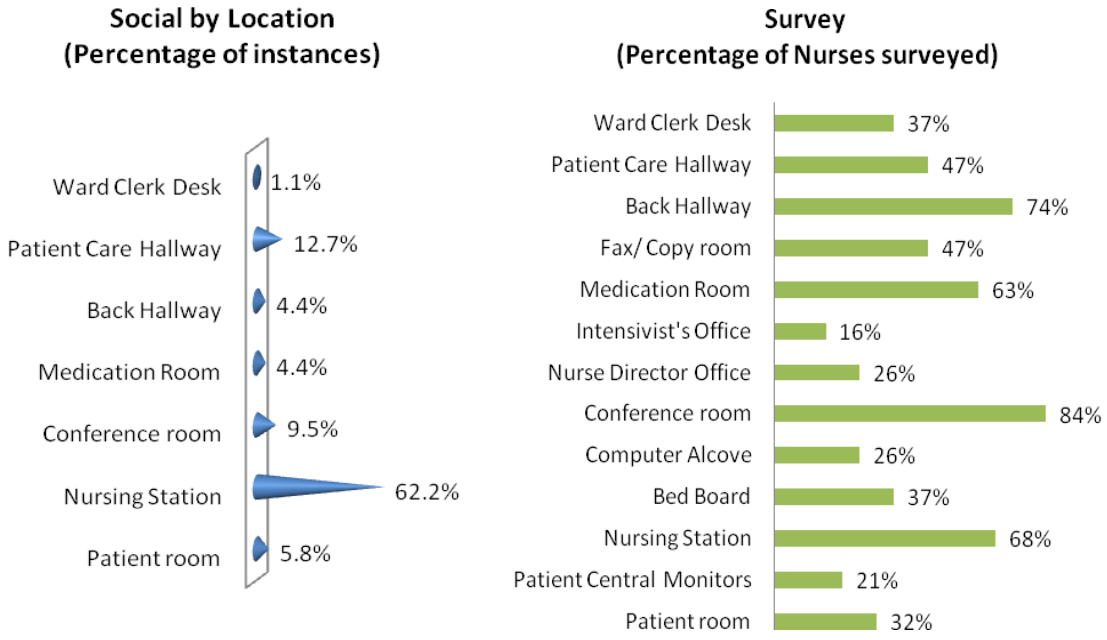


Figure 3-20: Comparison of Social Interaction by Location

3.3.3 Analysis - Actual vs. Perceived- Informational by Location

As seen in the observed data (Figure3-21), along with the nursing station, a high percentage of informational interactions also take place in the patient room (6.9%) and the patient care hallway (8.5%). The survey results show that fewer than seven of the 19 nurses surveyed perceived the patient care hallway and the patient room as locations for informational interactions.

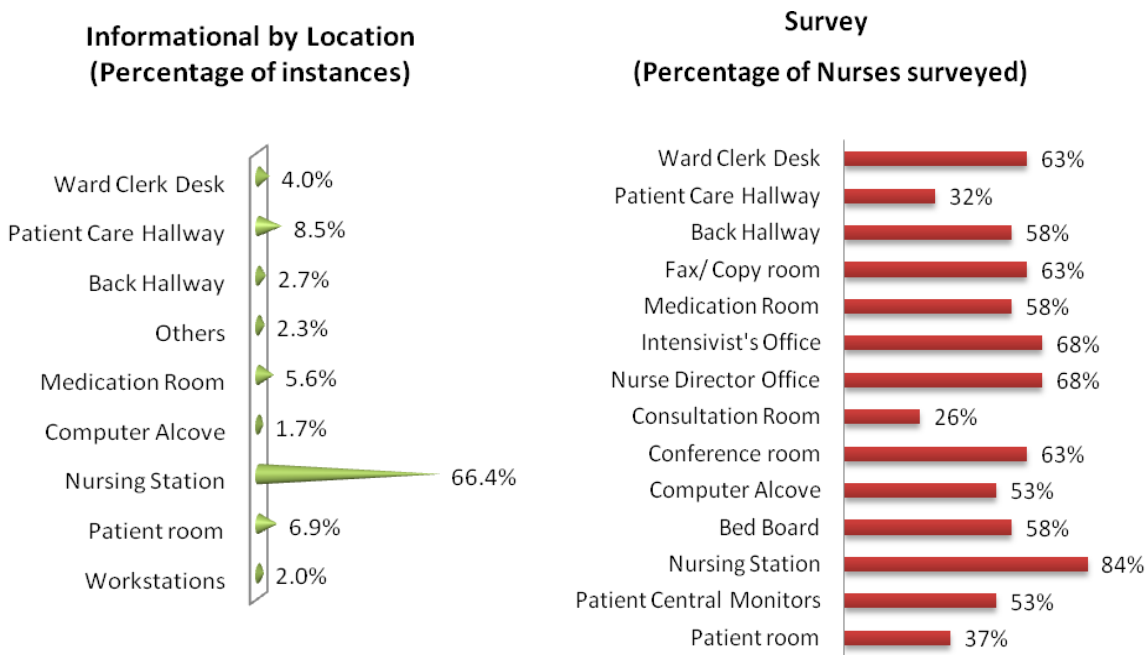


Figure 3-21: Comparison of Information by Location

3.3.4 Analysis - Actual vs. Perceived- Educational Interactions by Location

From post-survey interviews it was found that the nurses understood 'educational' as being taught by people in higher positions on subjects related to the field, ICCU or explaining new procedure and equipment. An information session by representatives from a drug company, explaining the working of their latest drugs, was also considered 'educational' – which explains the high percentage of nurses picking the conference room for educational interactions.

For the purpose of the CWM tool, educational interactions were those where the nurses either taught or learnt new clinical information (e.g. techniques, medicines). These did not necessarily take place as planned educational activities like seminars but rather as daily interactions. As seen in Figure 3-22, 84.6% of such educational

activities took place at the nursing station, while the medication room and patient room had 7.7% of the interactions each. None of the other spaces in the ICCU have any record of educational activities. This could be due to the absence of a planned seminar during the observation period.

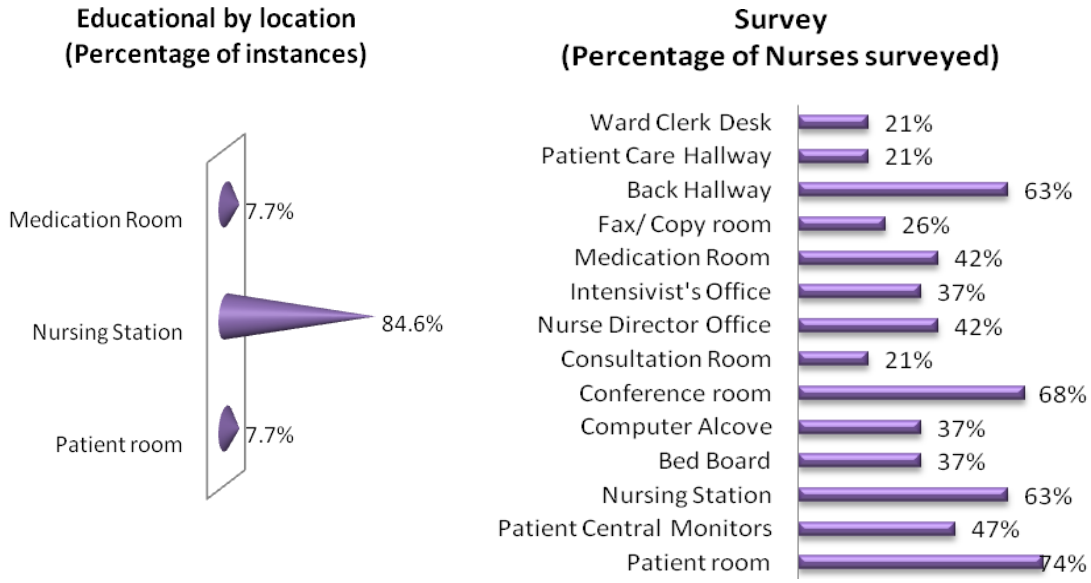


Figure 3-22: Comparison of Education by Location

3.3.5 Analysis - Actual vs. Perceived- Patient Interaction by Location

Patient interactions were observed to take place in the Patient Room (80.4%), Nursing Station (10.9%) and Patient Care Hallway (8.7%). These results, as seen in Figure 3-23, were significantly concurrent with the survey results, where all of the 19 nurses noted Patient Rooms as a location for patient interactions. Seven and six of the 19 nurses also selected patient Care Hallway and Nursing Station as possible locations for patient interactions respectively.

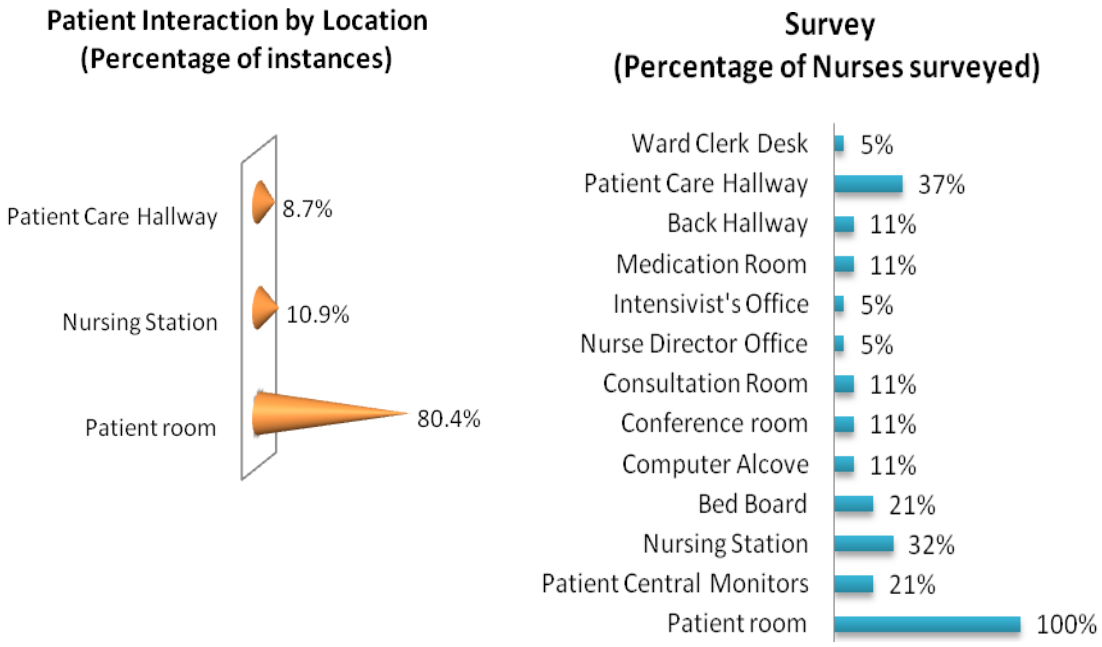
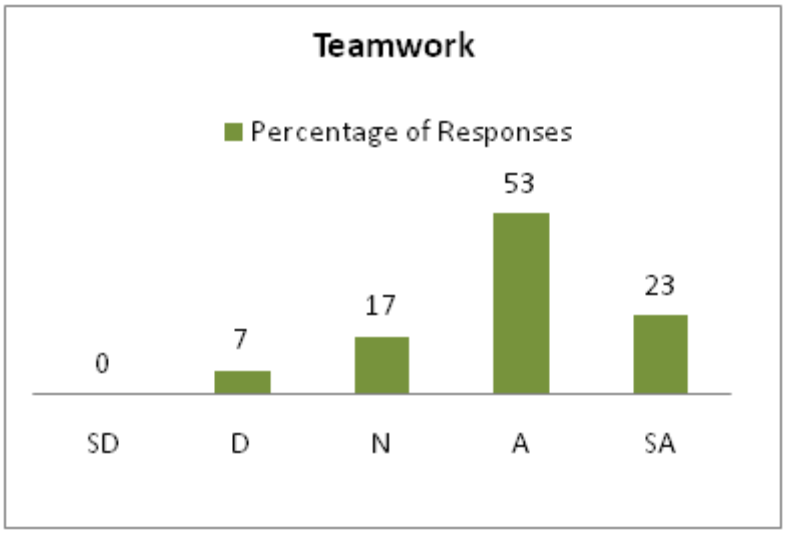


Figure 3-23: Comparison of Patient Interaction by Location

3.4 Survey Results

A survey about teamwork, job satisfaction, job stress, value addition and workplace design was administered to the staff of the ICCU. The survey had 19 respondents: 12 Registered Nurses, 3 Nursing Aides and 4 Allied Health members of the ICCU staff. A similar survey had also been administered during Phase I, however, the items are dissimilar and hence the Phase I and Phase II survey results cannot be compared. The summary of survey results in each category of questions has been outlined below. In each of the charts that follow, the adjacent key should be used. Positive responses are represented by Strongly Agree (SA) and Agree (A), while negative responses are represented by Strongly Disagree (SD) and Disagree (D), N represents Neutral responses.

Figure 3-24 summarizes the nurses' satisfaction with teamwork. All teamwork related questions were scored such that a higher score indicates more satisfaction. In conclusion, a total of 76% responses agreed that there was effective teamwork in the ICCU unit, while a fairly low percentage (7%) of responses indicated an absence of effective teamwork. Also, while 23% of the responses strongly agreed to the presence of effective teamwork, none of the responses strongly disagreed. Seventeen percent of the responses were neutral about effective teamwork.

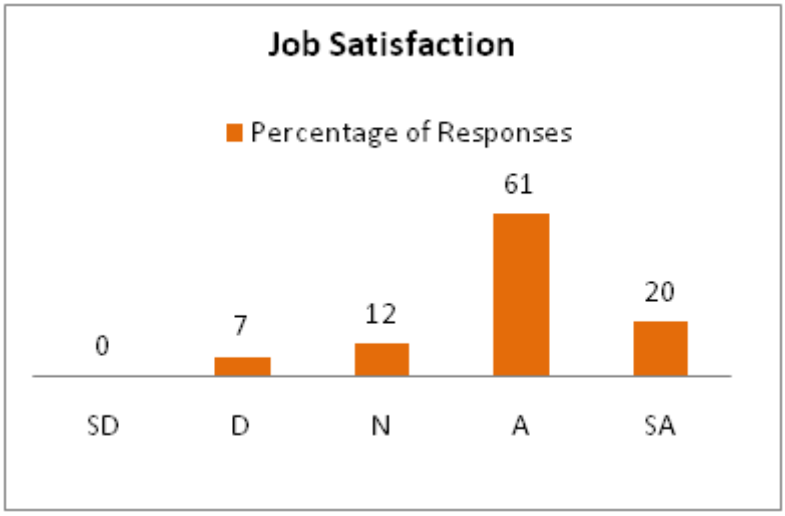


SD	Strongly Disagree
D	Disagree
N	Neutral
A	Agree
SA	Strongly Agree

Figure 3-24: Percentage of Survey responses - Teamwork

A similar process was followed for all survey items for each of the categories.

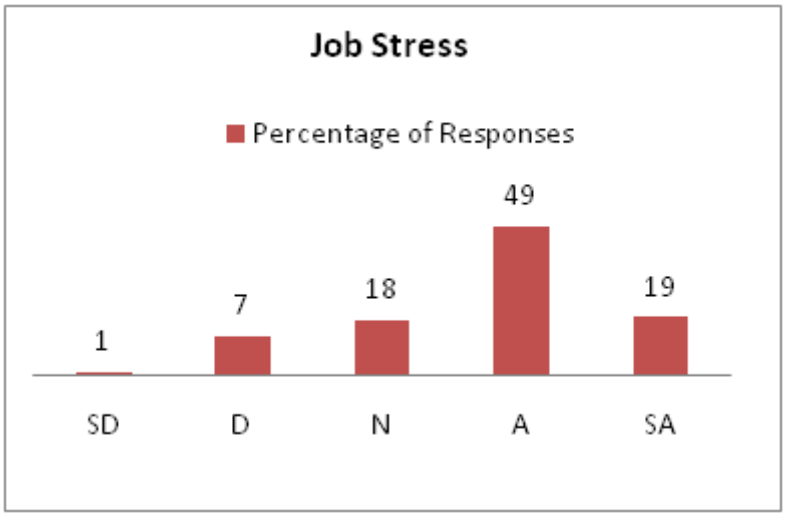
As seen in Figure 3-25, 81% of the responses indicate a high level of Job Satisfaction among the staff. Again, only 7% of the responses indicated a lack of Job Satisfaction, while 12% were neutral.



SD	Strongly Disagree
D	Disagree
N	Neutral
A	Agree
SA	Strongly Agree

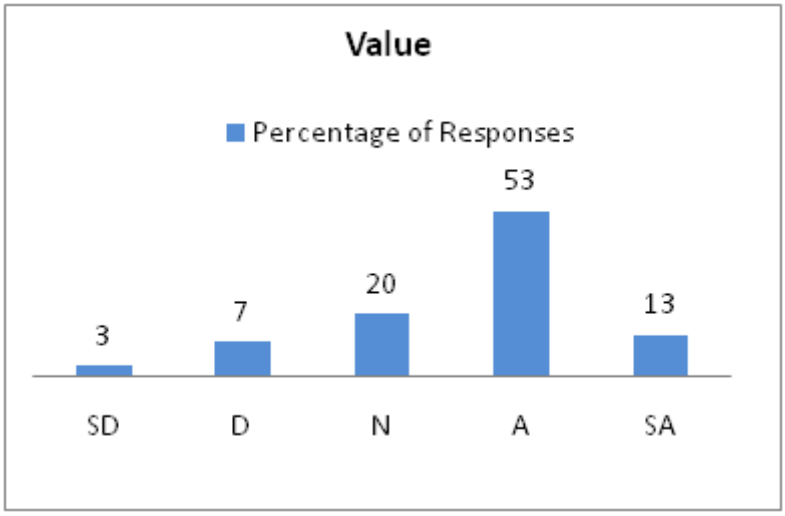
Figure 3-25: Percentage of Survey responses - Job Satisfaction

68% of the responses in Figure 3-26 indicate lower levels of Job Stress among the staff, while about 8% indicate that the staff experiences some amount of stress while at work.



SD	Strongly Disagree
D	Disagree
N	Neutral
A	Agree
SA	Strongly Agree

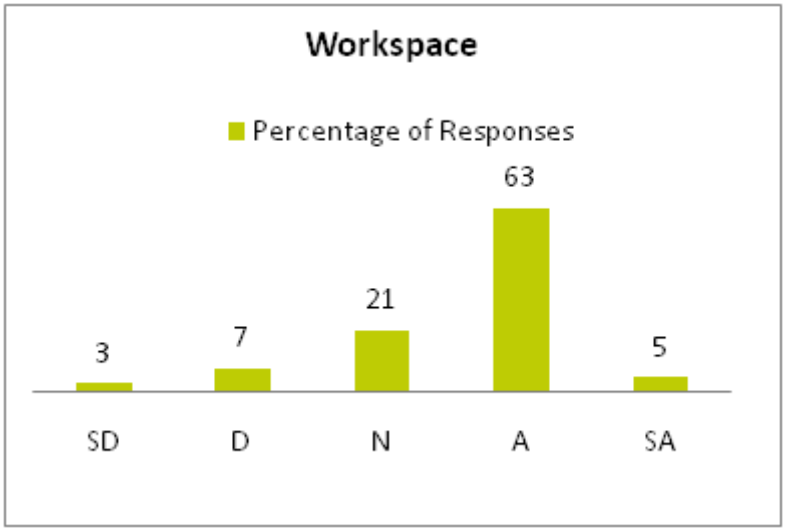
Figure 3-26: Percentage of Survey responses - Job Stress



SD	Strongly Disagree
D	Disagree
N	Neutral
A	Agree
SA	Strongly Agree

Figure 3-27: Percentage of Survey responses – Value

66% of the responses in Figure 3-27 indicate that majority of the staff feels valued at their job, or they feel that they add value to the ICCU. On the other hand, 10% of the responses show that some of the staff considered themselves as not valued. A fifth of the responses were neutral.



SD	Strongly Disagree
D	Disagree
N	Neutral
A	Agree
SA	Strongly Agree

Figure 3-28: Percentage of Survey responses - Workspace

In Figure 3-28, 68% of the responses indicated a high level of satisfaction with the design of the ICCU. However, it should be considered that only two of the survey items were related to this category. 21% of the responses were neutral while few staff members show some amount of dissatisfaction with the current ICCU design.

4. DISCUSSION AND CONCLUSION

This thesis sought to essentially replicate a study (Phase I) examining the effects on teamwork, communication and informal learning of a move from a more centralized to a more decentralized nursing unit design in an ICU. The original study was done approximately three months after the move to the new facility and the current study was conducted two years after the move. The intent was to examine whether the findings that occurred soon after the move to the new facility changed over time as the nursing staff became more familiar with the new work environment, and changes occurred in the hospital. Phase II findings indicated that while nurses' perceived job satisfaction and collaboration improved and stress decreased, the actual communication patterns remained unchanged. The remainder of this chapter explains all these findings and conclusions in further detail.

It was seen in Phase I that a decentralized nursing unit design reduced interaction among staff compared to a more centralized nursing unit design. It was also found that in spite of multiple nursing pods, interactions peaked around specific areas, thus creating informal, unplanned hubs. Two years after Phase I, Phase II showed similar results. However, several changes were observed in the frequency and patterns of communications between Phase I and Phase II. The sections that follow explore the variety of factors that appear to have influenced the staff's interaction patterns and their influence on healthcare quality and design.

4.1: Accessibility and Layout

In a de-centralized nursing unit design, Nursing Pods are distributed throughout the unit with the primary goals being to reduce nurses' walking distances (fatigue) and to increase the ability to monitor patients in their rooms (patient safety). Despite research described in the literature review showing that poor communication among care providers contributes to lower quality care, including more medical errors, little research has been done examining the effect of more decentralized nursing units on communication and interaction patterns among diverse care providers on a nursing unit.

Generally, a nurse occupies a Pod closest to where her patients have been assigned. At the CMC ICCU, nurses at most pods can observe up to three patient rooms without any visual barriers. Based on research on workplace settings, Becker (2007) suggested that visual proximity is necessary to support communication and collaboration. The results of the CMC Phase II research, in which nurses repeatedly stressed the importance of barrier-free visual access to each other during interviews, supports the importance of visual accessibility among care providers.

Specifically, on the ICCU at CMC, while Pods 2 through 7 had visual access to other nurses, Pod 8 was secluded and in an area that formed the 'back' of the ICCU. In spite of a design similar to every other pod and close proximity to patients, all nurses interviewed agreed that Pod 8 was never a desirable place to work at. This could be attributed to the lack of visual access to any other nurse. A nurse at Pod 8 would typically have to travel to the central part of the ICCU for almost all of her activities, including getting assistance and communicating with other nurses and care providers.

Thus, one of the prime goals of the decentralized nursing pod, to keep the nurse near and in visual contact with her patients much of the time, was undermined by nurses spending time away from the pod to engage with other staff. Kalisch & Begeny (2005) suggested that less visual proximity reduces the likelihood of chance encounters and the associated opportunities for staff members to provide assistance. The nurses who found Pod 8 undesirable because of the difficulty in getting help when needed support this finding.

Another feature of the ICCU unit design intended to increase patient safety and reduce walking distance for nurses, were computer alcoves located just outside patient rooms. These are small niches, with glass windows and a computer, outside every patient room providing visual access into the room. They were designed so that the nurses could observe patients while entering data standing at the alcove. However, while there was slightly more use of the alcoves in Phase II, the nurses almost always preferred to return to their pods instead of using the computer alcoves. While the pods did not offer the same amount of visual access to patients as the alcove they were close to patient rooms and had better computer equipment, seating and comfort.

As another means of enabling staff to enter information on a computer in close proximity to patients, a Computer On Wheels (COWs) was provided in every patient room. However, interviews with nurses revealed that few of the nurses trusted this technology due to prior bad experience using them. May nurses report in the interviews that they had lost data fed into the COWs and often had trouble connecting to the hospitals network. Hence they preferred to return to their Nursing pods to complete their computer related work.

4.2: Communication

A decentralized nursing unit attempts to make nurses more visible and accessible to patients. It is believed that such a nursing unit design leads to a higher degree of nurse-patient interaction. One of the goals of the de-centralized nursing unit in the ICCU at CMC was to increase nurse-patient time. However, it was observed that only 18% of the nurses' time was spent in patient rooms. Further, 20% of the interactions in Patient Rooms are not with patients but with other related personnel. It can thus be concluded that decentralized nursing pods do not seem to have made much of a positive impact on nurse-patient interaction.

Most interactions involving nurses occurred at the nursing pods. Social interactions were concentrated at the nursing pods and almost always occurred as a part of other interactions. While the conference room was intended, in part, as a location for social interactions only 11 instances of social interaction occurred there over the entire observation period. The fact that social interactions typically occur in the context of work-related interaction makes it unlikely that any single space can be designed primarily for social interaction. A nurses' lounge has been provided at an extreme corner of the ward for group interactions. However, few interactions were observed here. The inconvenient location of this lounge makes it unlikely for unplanned conversations to occur there. Interviews with nurses suggested that they did not consider this a suitable location for interactions, in part because it eliminated the nurse's contact with their patients.

Comparing Pre-move data with both Phase I and Phase II data demonstrates that the decentralized nursing unit design shows an overall lower number of interactions per

hour. The number of short conversations (less than one minute) per hour is the same in Phases I and II. However it is half of that observed in the Pre-move data. The number of medium conversations (one to five minutes) per hour was observed to be back up to the levels of Pre-move data during Phase II. This increase in communication could be a result of increased familiarity with the space and a higher level of teamwork.

4.3: Teamwork

Phase II has a higher number of medium length conversations than both Phase I and the Pre move Phase. However, although there was an increase in the number of interactions from Phase I to Phase II, the overall proportion of interactions remained consistent between Phase I and Phase II. There was an increase in the number of interactions involving more than two people. The greater number of medium length conversations and number of conversations involving more than two people may have contributed to the higher ratings of teamwork between Phase 1 and Phase II. However, the overall percent of longer conversations remained very small, as did the number of conversations involving care providers other than nurses. Shorter conversations are not conducive towards teamwork and a higher proportion of medium length conversations could lead to an increased level of satisfaction with their teams.

Also supporting an apparent increase in collaboration was, the increase in the number of interactions involving more than two people. However, although there was a distinct growth in the number of interactions from Phase I to Phase II, the overall proportion of interactions remained consistent. It is important to note that there was no change in the proportion of interactions between Phase I and Phase II.

From the interviews it was also seen that when speaking about teamwork the nurses seemed to typically include only other nurses and nurses' aides. The Intensivist or other health professionals and doctors were not considered a part of the team. Teamwork was generally perceived as 'nurses helping or looking out for other nurses and nurse aides'. The design reflects this concept of teamwork by segregating the nurses and doctors' working areas. This was reflected in the results in the low number of interactions between the nurses and the Intensivist and nurse director. This particular pattern was found both in Phase I and Phase II.

4.4: Design of Nursing Pods

After Phase I by Dutta (2008), it was concluded that nursing pods that were designed to seat only one person were not conducive to larger group interactions. This fact holds true in Phase II as well, where it was observed that the size of a single pod made it difficult for people to gather around comfortably. In spite of this, due to the absence of another area for congregation, maximum interactions of all types were observed at the pods. While some of the pods (2,3,4) had certain features that made them more comfortable for group discussions, they were not designed for congregations. (These pods have been further explained in Section 4.5)

A larger group at a pod would also lead to congestion in the corridor, subsequently leading to increased noise that could easily reach patient rooms. Despite the design not aiding larger congregations at a nursing pod, nurse interviews revealed that there had been patient complaints in the past about increased noise levels.

It was observed that a nurse typically spends about two-thirds of her time at a Pod. All types of interactions involving multiple numbers of people take place at a nursing pod. For each interaction category involving one or more persons, nursing pods recorded some of the highest number of interactions. This could be the case due to the lack of other appropriate spaces for communication. Hence it is essential that the design of the pod cater to every such activity that occurs there, while still considering patient proximity and nurse fatigue.

Pod Privacy Issues

Many nurses suggested during interviews that the pods did not provide adequate privacy for certain tasks. For example, patient related phone conversations and discussions at the nursing pod could be easily within an earshot of the patient. Not all pods had patient monitoring systems and other necessary equipment. While personalizing the pod is not an option, it might be a useful suggestion to design all pods as equal as possible. This will help the nurses to adjust quickly to a pod, every time they change patients or move. A prototype of a nursing pod could be developed that helps the nurses in performing each of their activities in the best possible manner.

4.5: 'Hub'

It was observed that three of the nursing pods (2, 3, 4) combined, by how the nurses used them, formed an unplanned hub where nurses congregated. It was not originally intended for such use in the design. While each of the nursing pods that formed this "hub" was essentially similar in design generally, at a micro level they were quite

different. This affected the way each pod functioned. Four of the nursing pods did not house any patient monitoring equipment.

The highest number of interactions for each type of interaction was observed at pods 2, 3 and 4. These three pods– while demarcated as separate pods – had one continuous desk that ran along their length. They also housed extra computers, medical equipment, chairs and the bed-board, a chart with all nurse- patient assignments. These factors, combined with the proximity of these pods to higher acuity patients, contributed to these pods becoming a defacto communication hub for the nurses.

As seen from the above observations and conclusions, all pods and alcove workstations were essentially similar in design. However, all pods did not generate the same number of interactions. This suggests that a few similar design factors do not necessarily aid interactions. Instead, it is the combination of various factors and micro-design elements that act together to create conditions conducive for interactions to take place. This helps in creating an integrated workplace strategy (Becker & Steele, 1995).

In Phase I, Ronojoy Dutta noted that the following factors lead to the creation of the unplanned, informal, communication hub:

- ✓ Physical Proximity
- ✓ Access to Technology
- ✓ Access to high-acuity patients
- ✓ Visual Proximity
- ✓ Medical Personnel

- ✓ Location

Phase II studies found that the above factors continue to support the formation of communication hubs. Additional factors that impact or are a result of the hub are: Micro-design of the hub, Overall increase in teamwork and Increased familiarity with the de-centralized design

4.6: Implications for Nursing Unit Design and Healthcare Practice

Modern healthcare practice is making a transition towards multi-disciplinary teams and communication is a critical factor in the effectiveness of these teams (Wood et. al., 2001). Extensive research has linked inadequate communication between members of healthcare teams to hospital errors. Phase I showed a decrease in interactions in the de-centralized ICCU compared to centralized pre-move ICCU and hence raised critical concerns about the significant reduction in communication.

While the presence of electronic communication systems and advanced medical equipment aids the healthcare team through various clinical decisions, it cannot replace face-to-face interactions. Many studies (Safran et. al., 1999) suggest that irrespective of the presence of electronics systems, there is a preference for informal communication and decision-making through interactions. Interpersonal informal communication leads to knowledge sharing between people and from this network of personal relationships arises co-operation, commitment and trust that helps team members in performing their job effectively (Becker, 2007).

The staff in the ICCU has satisfied this need for informal face-to-face communication by creating a hub, in spite of it not being included in the design. This reinforces the need to design environments that support rather than hamper interactions and communication. In the stressful atmosphere of an ICCU, frequent communication reduces stress, provides learning opportunities and increases teamwork. In spite of a decentralized nursing unit layout being currently considered "best practice" (Joseph, 2006) it is important to re-evaluate the design of nursing stations such that they cover not only factors like patient proximity and visual access, but also the underlying factors such as job satisfaction and informal learning.

The goal of the de-centralized layout is to increase functional efficiency by bringing staff physically and visually closer to the patients. Centralized nursing unit layouts were found to limit visual access to patient rooms, become chaotic and created high noise levels that were stressful for both staff as well as patients (Wade, 2007). Due to these concerns, there was a need for individual privacy, added support space and closer nurse-patient access. Decentralized nursing pods were seen as a means of addressing these issues. While there is some research that suggests that the current decentralized design solutions reduce staff walking and increase patient-care time, the current research suggests these outcomes are not necessarily associated with a decentralized approach. Further, consistent with other research, such design approaches appear to reduce the amount of observed communication. The increased in reported teamwork and job satisfaction, along with decreased self-reported stress, are positive. However, because there was no direct assessment of these factors before the move (Phase I asked nurses to compare their immediate post-move experience to their pre-move experience after moving to the new facility), it cannot be determined whether the Phase II survey responses are higher or the same as prior to the move; or

only higher that immediately following the move. Most interactions at Phase II were of the informational and consultation type, which support on-the-job learning. However, the number of interactions recorded during Phase II was still lower than the number of interactions recorded during the Pre-move Phase. It is difficult to identify which type of interactions showed changes during Phase II, since neither Phase I nor the Pre-move Phase classified interactions into various categories – social, educational, informational, etc. A design approach that balances functional efficiency with other factors like interaction opportunities and stress reduction is needed.

During Phase II, it was observed that there was an overall increase in interactions between all staff members. Survey results and field notes showed that there was higher employee morale and job satisfaction in the ICCU, as compared to Phase I. A distinct increase in the level of perceived teamwork in the ICCU was also observed. Most interactions were of the informational and consultation type, which support on-the-job learning. However, the number of interactions recorded during Phase II was still lower than the number of interactions recorded during the Pre-move Phase. It is difficult to identify which type of interactions showed changes during Phase II, since neither Phase I nor the Pre-move Phase classified interactions into various categories – social, educational, informational, etc.

In spite of the self-reported improvement in teamwork and communication during Phase II, it needs to be noted that the nurses perceived a "team" as a team of their fellow nurses rather than a multi-disciplinary or an inter-departmental team. While there is an increase in interaction between non-nurse members of the staff we do not know how much of the interaction is 'effective' communication within the team. There is an urgent need to re-configure nurse's perception of "team" to include all

types of professionals. While the overall atmosphere during Phase II was much more positive as compared to Phase I, a change in perception will only lead to a better quality of care for the patients and a higher sense of job-satisfaction for the nurses.

Conclusion

As concluded in Phase I, the design challenge is to create a solution that works on many levels – increasing visual access, promoting communication, and reducing nurse fatigue. Phase I recommended the use of 'multi-hub' units that create opportunities for unplanned interactions. These might create a deliberate functional inefficiency, but can lead to higher informal learning (Becker, 2007).

Such a 'multi-hub' should not only provide the users with comfort, visual access and current technology but also cater to their needs other than the functional essential. Factors such as the 'micro-design' elements, location in the larger scheme of things, conduciveness to interaction and support for informal learning should also be considered in the design of such a hub. These factors though not quantifiable are easily influenced by design.

It is essential that a medium between decentralized and centralized nursing unit design be achieved, as neither can be currently recommended as best practice.

Study Limitations and Future Research Direction

During Phase I, observations were conducted within a short time of the ICCU moving into the new space. This raised the possibility that their interactions were affected by

unfamiliarity and could resemble pre-move ICCU if given a sufficient time to adapt. Phase II that was conducted two years after this move and it is found that almost all of Phase I conclusions still hold true.

Since data was collected by shadowing nurses, lower utilization of some areas might not be a good indicator of the actual usage of the areas. Those areas showing a lower usage by nurses might be used by other personnel of the ICCU staff, or by nurses for other activities post their shift. In the future it would benefit if it were observed how a space is used, as well as how different professionals use it in order to design a better layout.

In the absence of observed data regarding how frequently nurses use pods other than their home pods, conclusive statements cannot be drawn about overall pod usage for a typical nurse. In the future it might help to categorize various spaces within the ICCU in a more detailed manner to collect data specific to each space, rather than generalizing multiple spaces into a single category. For example, it might help to note the exact pod at which the nurse being followed spends her time, instead of only recording "Pod" as the place of interaction.

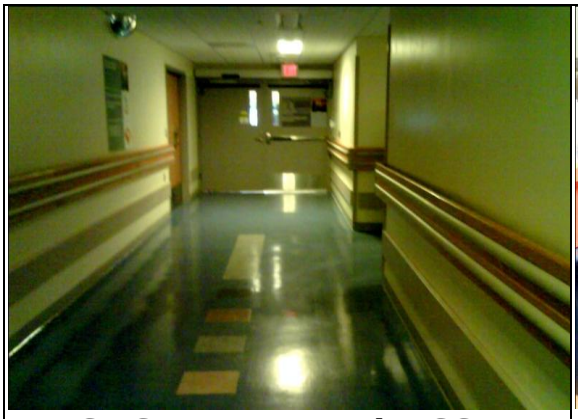
Future research could be conducted by observing planned team interactions; for example, medical rounds, and staff meetings, in order to observe the dynamics of ICCU teams. Additional research which studies how the quality of care, patient satisfaction and number of hospital errors have changed between the Pre-Move Phase, Phase I and Phase II could be conducted to further understand the impact of nursing unit design on healthcare.

Since nursing pods recorded the highest number of interactions, it would benefit to study a single or typical nursing pod in further details and record every activity that takes place at a pod. This would help in understanding the different factors that constitute an effective pod design.

Further research that helps in explaining the effects of different types of nursing unit design, not only on interaction, but also on job satisfaction and knowledge sharing will contribute to improved quality of healthcare.

APPENDIX A

ICCU Photos Phase I and Phase II

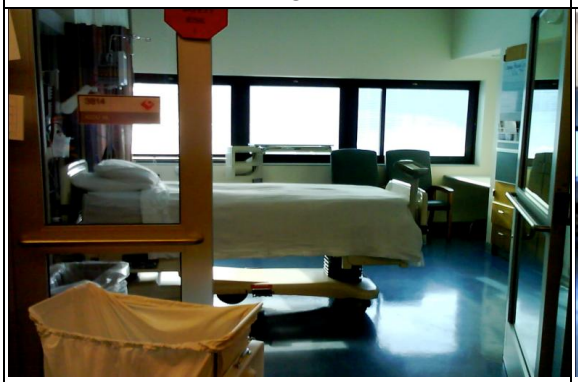


CMC 1: Entrance to the ICCU

CMC 2: Pod 9 Detail

CMC 3: Pod 8 and Patient Rooms 15, 16

CMC 4: Pod 9 and Back Hallway



CMC 5: Patient Room Detail

CMC 6: Outside Medication Room

APPENDIX B

Phase I Data Entry Sheet

Time :	start		Date		Region	A	B	C	D	E
	stop									

Staff RN_____ AT_____ WC_____ Patient rooms unoccupied ____________________ (rm nos)

Other ____________________

RN	m	RN	m	RN	m	other	RN	m	RN	m	RN	m	other
CN	m	RN	m	RN	m		CN	m	RN	m	RN	m	
FN	m	MD	m	MD	m		FN	m	MD	m	MD	m	
MD	m	MD	m	MD	m		MD	m	MD	m	MD	m	
NS	m	RT	m	RT	m		NS	m	RT	m	RT	m	
AT	m	AT	m	AT	m		AT	m	AT	m	AT	m	
NA	m	NA	m	NT	m		NA	m	NA	m	NT	m	
WC	m	WC	m	CM	m		WC	m	WC	m	CM	m	
NS	m	HK	m	HK	m		NS	m	HK	m	HK	m	
D	m	PF	m	PF	m		D	m	PF	m	PF	m	

length of conv. S M L XL | length of conv. S M L XL

location P1m P2 corridor | location P1m P2 corridor

other __________ | other __________

RN	m	RN	m	RN	m	other	RN	m	RN	m	RN	m	other
CN	m	RN	m	RN	m		CN	m	RN	m	RN	m	
FN	m	MD	m	MD	m		FN	m	MD	m	MD	m	
MD	m	MD	m	MD	m		MD	m	MD	m	MD	m	
NS	m	RT	m	RT	m		NS	m	RT	m	RT	m	
AT	m	AT	m	AT	m		AT	m	AT	m	AT	m	
NA	m	NA	m	NT	m		NA	m	NA	m	NT	m	
WC	m	WC	m	CM	m		WC	m	WC	m	CM	m	
NS	m	HK	m	HK	m		NS	m	HK	m	HK	m	
D	m	PF	m	PF	m		D	m	PF	m	PF	m	

length of conv. S M L XL | length of conv. S M L XL

location P1m P2 corridor | location P1m P2 corridor

other __________ | other __________

RN	m	RN	m	RN	m	other	RN	m	RN	m	RN	m	other
CN	m	RN	m	RN	m		CN	m	RN	m	RN	m	
FN	m	MD	m	MD	m		FN	m	MD	m	MD	m	
MD	m	MD	m	MD	m		MD	m	MD	m	MD	m	
NS	m	RT	m	RT	m		NS	m	RT	m	RT	m	
AT	m	AT	m	AT	m		AT	m	AT	m	AT	m	
NA	m	NA	m	NT	m		NA	m	NA	m	NT	m	
WC	m	WC	m	CM	m		WC	m	WC	m	CM	m	
NS	m	HK	m	HK	m		NS	m	HK	m	HK	m	
D	m	PF	m	PF	m		D	m	PF	m	PF	m	

length of conv. S M L XL | length of conv. S M L XL

location P1m P2 corridor | location P1m P2 corridor

other __________ | other __________

RN	m	RN	m	RN	m	other	RN	m	RN	m	RN	m	other
CN	m	RN	m	RN	m		CN	m	RN	m	RN	m	
FN	m	MD	m	MD	m		FN	m	MD	m	MD	m	
MD	m	MD	m	MD	m		MD	m	MD	m	MD	m	
NS	m	RT	m	RT	m		NS	m	RT	m	RT	m	
AT	m	AT	m	AT	m		AT	m	AT	m	AT	m	
NA	m	NA	m	NT	m		NA	m	NA	m	NT	m	
WC	m	WC	m	CM	m		WC	m	WC	m	CM	m	
NS	m	HK	m	HK	m		NS	m	HK	m	HK	m	
D	m	PF	m	PF	m		D	m	PF	m	PF	m	

length of conv. S M L XL | length of conv. S M L XL

location P1m P2 corridor | location P1m P2 corridor

other __________ | other __________

APPENDIX C

Cornell Work Measurement Tool Categories

Locations
Workstations
Patient room
Patient Central Monitors
Nursing Station
Bed Board
Computer Alcove
Conference room
Consultation Room
Nurse Director Office
Intensivist's Office
Medication Room
Fax/ Copy room
Back Hallway
Patient Care Hallway
Ward Clerk Desk

Interaction Types
Consultation
Informational
Social
Educational
Patient Interaction
Assistance

Interaction Categories: Detailed Descriptions and Examples

Consultation: Discuss/negotiate patient care; seek or provide clinical advice or feedback

- Any medical opinion/view provided
- Seeking consultation is not a separate category
- Eg. Questions about procedures, discussion about the transferring patients, distributing patients among nurses etc

Social: Discuss non-work issues

- Everything other than work related
- Eg. Talking about other staff members

Informational: Discuss/learn about the unit/hospital; administrative information

- Most phone conversations fall into this category
- Eg. Transferring patients, asking about equipment, inquiring about a patients chart
- All work performed alone also falls into this category
- Different combinations of 'informational' with the other types of communication could help differentiate between them further.
- Eg – "where are these papers"- inform
- Eg. – "this patient is stable enough to be moved out of the ICU. Do we need more lab results…" – inform +consult

Educational: Teach or Learn new clinical information (e.g., techniques, medicine)

- Educational activities (seminars etc)

- Eg. Asks for or gives help with a procedure with the idea that the person seeking help will do it on their own the next time or is having difficulty doing it
- Very different from consultation since an opinion is not asked.
- Eg "could you help me with the I.V. for this case again I don't seem to be getting it right" – educational
- As opposed to "could you help me with the patient in room no. 8 he needs a new bandage" – inform
- "Do you think the patient in room 8 needs a new bandage"- consult

Patient Interaction: Talk/work with patient and patient family

APPENDIX D

Staff Role Abbreviations Phase I and Phase II

Codes	Roles
RN	Registered Nurse
FN	Flex Nurse
CN	Charge Nurse
MD	Doctor
D	Dietician
RT	Respiratory Therapist
AT	Nurse Aide
PF	Patient's Family
NT	Intensivist
NA	Nutrition Assistant
HK	Housekeeping Staff
NS	Nursing Students
CM	Case Manager
OTH	All Others

Codes	Roles- PHASE II
RN	Registered Nurse
MD	Doctor
RT	Respiratory Therapist
AT	Nurse Aide
OTH	All Others
CN	Charge Nurse

APPENDIX E

Survey

Cornell University
College of Human Ecology

Staff Healthcare Workplace Survey

This survey is one of several methods being used to collect data as part of the study on "The Ecology of Patient Care Teams". The only people who will see completed surveys are members of the Cornell research team. No names will appear anywhere in any reported data analysis, publications, or reports. All data will be reported at an aggregate level, with no personal identifying information. All participation is voluntary. The goal of the study is to improve the design of health care facilities for staff, patients, and visitors. If you have any questions, please contact,

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Thank you very much for your participation. It is greatly appreciated.

Please answer all of the following questions by selecting one appropriate response for each
Note: In the following questions, by "unit" we mean the CMC - ICU.

		Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree
1	A feeling of unity exists within my unit.	SD	D	N	A	SA
2	The staff on my unit are likely to help each other on tasks.	SD	D	N	A	SA
3	I know what I have to do on my job.	SD	D	N	A	SA
4	There is little encouragement to learn new skills.	SD	D	N	A	SA
5	The nursing personnel on my unit are likely to pitch in and help one another when things are in a rush.	SD	D	N	A	SA
6	Physicians and staff on my unit have a good working relationship.	SD	D	N	A	SA
7	There is a strong climate of trust within my unit.	SD	D	N	A	SA
8	I feel bothered or upset when I am at work	SD	D	N	A	SA
9	My job makes good use of my skills and abilities.	SD	D	N	A	SA
10	We are encouraged to speak our minds, even if it means disagreeing with a doctor	SD	D	N	A	SA
11	New and innovative ideas about patient care are encouraged on my unit.	SD	D	N	A	SA
12	I would be likely to recommend this unit as a good place to work.	SD	D	N	A	SA
13	I feel like a valued member of this unit.	SD	D	N	A	SA
14	Nurses on my unit work with me to solve problems.	SD	D	N	A	SA
15	Different departments work better together on this unit than in other units.	SD	D	N	A	SA
16	I know exactly what is expected of me on my job.	SD	D	N	A	SA
17	I feel unhappy when I am at work.	SD	D	N	A	SA
18	My ideas and suggestions are seriously considered by other members on my unit.	SD	D	N	A	SA
19	Members on my unit are likely to share their special knowledge and expertise with one another.	SD	D	N	A	SA

20	I feel comfortable approaching others on my unit for help and advice.	SD	D	N	A	SA
21	I am satisfied with my job.	SD	D	N	A	SA
22	Different levels of this unit communicate effectively with each other.	SD	D	N	A	SA
23	I enjoy working with my coworkers.	SD	D	N	A	SA
24	I feel worried when I am at work.	SD	D	N	A	SA
25	My workspace enhances my ability to get the job done.	SD	D	N	A	SA
26	The nursing personnel on my unit are not friendly and outgoing	SD	D	N	A	SA
27	I feel satisfied with my unit's performance.	SD	D	N	A	SA
28	I understand what is expected of me.	SD	D	N	A	SA
29	The people I work with give me useful feedback.	SD	D	N	A	SA
30	I feel contented when I am at work.	SD	D	N	A	SA
31	There is a lot of "rank consciousness" on my unit. Nursing personnel mingle less with others of a different rank.	SD	D	N	A	SA
32	The staff on my unit accommodate my needs.	SD	D	N	A	SA
33	I feel frustrated when I am at work.	SD	D	N	A	SA
34	There is a lot of teamwork between nurses and doctors on my unit.	SD	D	N	A	SA
35	I feel relaxed when I am at work	SD	D	N	A	SA
36	I frequently collaborate with my unit's members to come up with mutually acceptable decisions	SD	D	N	A	SA
37	I feel well-informed about the current activities on my unit.	SD	D	N	A	SA
38	Unit members know what task-related skills and knowledge they each possess.	SD	D	N	A	SA
39	Doctors at this hospital generally understand and appreciate what the nursing staff does.	SD	D	N	A	SA
40	I feel tense when I am at work.	SD	D	N	A	SA
41	The doctors show respect for the skills and knowledge of the nursing staff.	SD	D	N	A	SA
42	I exchange ideas with others on this unit frequently through face-to-face communication.	SD	D	N	A	SA
43	There is effective teamwork and collaboration between different levels of the nursing staff.	SD	D	N	A	SA
44	I am satisfied with my workspace.	SD	D	N	A	SA

Please provide the following information

Job Title (choose one option): RN Other
Gender: O Male O Female
Age: O 18-25 O 26-35 O 36-45 O 46+
How long have you been working in this unit:
O Less than one year O 1 to 2 years O 3 to 5 years O More than 5 years

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Location on unit	Types of Communication				
	Consultation	Social	Informational	Educational	Patient Interaction
Workstations					
Patient room					
Patient Central Monitors					
Nursing Station					
Bed Board					
Computer Alcove					
Conference room					
Consultation Room					
Nurse Director Office					
Intensivist's Office					
Medication Room					
Fax/ Copy room					
Back Hallway					
Patient Care Hallway					
Ward Clerk Desk					

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