

NURSE CALL INTEGRATION

Richard Jeffery Lyons

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Committee**

Sara Anne Hook, JD, MBA, MLS, BA

Ruth Walker, MIS, BA

Josette Jones, PhD, RN

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Dedication

I would not have been able to complete this work without the help of many people. This work is dedicated to:

my wife, Katie, you are the inspiration in my life. I could not have done this without your love and support. Thank you for just being there and everything you have done while I went to school in the evenings. This has been a long road, but I really want to say THANK YOU.

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ABSTRACT

Richard Jeffery Lyons

NURSE CALL INTEGRATION

Nurses today can choose from many different information systems that allow them to obtain vast amounts of information that relate to the treatment of patients, including bar-code medication administration, electronic medical records and radio-frequency identification devices (RFID). However, none of the current information system solutions include an instant communication device that offers nursing staff immediate access to information or addresses patients and their concerns. Nurse Call System Integration allows nurses this immediate access using the Vocera® badge, Emergin® software and the Responder IV® Nurse Call System.

The data used from the Responder IV® Nurse Call System was for the Progressive Care Units at The Indiana Heart Hospital and was from August 2007 and August 2008. A decrease in average response times was observed for two different Progressive Care Units as well as the combination of the two units. The Progressive Care Unit, 2TH resulted in a 21 second decrease, Progressive Care Unit, 3TH resulted in a 44 second decrease and both Progressive Units combined resulted in a 37 second decrease in response times. These results suggest that the use of Emergin® with Vocera® and the Responder IV® Nurse Call System facilitates the ability of nurses to communicate with their patients. It is not a replacement for communicating with a patient face-to-face; it is merely a tool to make the process faster and more efficient.

CHAPTER ONE: INTRODUCTION & BACKGROUND

Introduction of Subject

When working with patients, nurses are constantly challenged with how to share timely and accurate treatment and protocol information with one another. Sharing this kind of information can be crucial to providing the best patient care; it also helps to ensure that patient safety is not compromised (Kuruzovich, Angst, Faraj & Agarwal, 2008). Nursing staff can utilize many different aspects of information technology (IT), all of which are available to assist them in improving the flow of information and provide them with the flexibility that is necessary to get the information to the clinician faster via e-mail, text message or data that is communicated directly to an electronic device (Kuruzovich, Angst, Faraj & Agarwal, 2008).

Nurses today can choose from many different information systems that allow them to obtain vast amounts of information that relate to the treatment of patients, including bar-code medication administration, electronic medical records and radio-frequency identification devices (RFID). However, none of the current information system solutions include an instant communication device that offers nursing staff immediate access to information or addresses patients and their concerns. Vocera® and Emergin® are two new information systems currently on the market that help to bridge the gap between the nursing staff and their patients.

Instant communication is one of those concepts that should be easy to understand but is hard to attain. This is partly due to the wide variety of

floorplans found in the patient units of many hospitals, making it difficult for a nurse to respond to a patient's needs in an efficient, timely manner.

Many hospitals across the nation have designed a workflow for the nursing staff that can make it challenging for nurses to take care of their patients. Design solutions should strive for flexibility to accommodate developments in technologies and care processes (Joseph, 2008). In an article that discusses the safety of patients and nurses, it was found that hospital environments contribute to increased stress levels, frustration, fatigue, injury and errors (Stichler, 2007). Although the science of evidence-based design is relatively new, there is growing support to substantiate that specific design features can improve safety outcomes for patients and nursing staff members (Stichler, 2007). Specific design features enable nurses to have instant communication with patients. Instant communication technology can enhance the opportunity for interpersonal communication. Enhancement can occur as a result of efficiency, accountability, data aggregation, security, data completeness and anonymity (Simpson, 2008). (Appendix A)

Importance of Subject

In today's hospital environment, many nurses still rely on pagers, email, overhead paging and cell phones when sharing information. Timing is essential. Overhead paging and cell phone communication can be a technical challenge and safety issue when there is a delay in communicating a patient's case with nurses. Nurses are also limited in their communication. Current forms of communication may include, but are not limited to, overhead paging, cell phones (hospital or non-

hospital issued) and desk phones. Some of the reasons that overhead paging and cell phone communication may be considered challenging include their being in unreliable overhead coverage areas within the hospital, poor reception in some key areas, interference with radiology or MRI procedures, lost signals, lack of wireless cell phone coverage with non-hospital-issued cell phones and lack of overhead paging during nighttime hours. (Taylor, Coakley, Reardon & Kuperman, 2004). Another challenge that poses a risk to nurses is using wireless phones for instant communication. Due to the volume of equipment in hospitals, unless there is a robust, reliable wireless system in place, electronic devices could compete for wireless coverage or not connect to the wireless network, due to the large number of devices within range of the wireless access point. There could also be dead zones within the institution, such as closets, elevators and stairwells, that can impede a nurse being able to communicate with a clinician. There may be areas where overhead paging cannot be heard; therefore, the clinician may not return the call in a timely fashion, which could lead to patient injury or death (Taylor, Coakley, Reardon & Kuperman, 2004).

Due to all of these potential issues related to communication technologies, many companies are pursuing solutions that would address both internal and external communication methods. This study examines the use of a wireless communication system that was designed to help solve some of the problems with patient-clinician and clinician-clinician communication technologies within hospitals (Kuruzovich, Angst, Faraj & Agarwal, 2008).

Knowledge Gap

Vocera® is a new, hands-free voice-activated communication device that works on a wireless platform using 802.11b/g wireless infrastructure. The Vocera® badge enables the user to have instant, hands-free conversations with others in a working environment. The Vocera® badge contains a speaker, microphone, wireless radio and a high contrast organic light-emitting diode (OLED) display that shows caller ID, text messages and alerts. Vocera® redefines the way communication is handled in hospitals, hotels, retail stores and other building environments where mobile workers need to be able to constantly communicate with each other in order to fulfill their responsibilities effectively (Vocera, 2007). Vocera® was introduced to the public in 2002 and this hands-free voice-activated communication device became part of The Indiana Heart Hospital's (TIHH) communication technology in September 2006.

Emergin®, a middleware software created to help organizations redesign their communication strategies to enhance machine and human interactions (Emergin, 2007), enables other medical products, such as nurse call systems, to communicate with Vocera®. Emergin's® mission is to continuously improve work processes and optimize communication, safety and quality in large organizations (Emergin, 2007). Emergin® has created software that allows many systems to communicate with one another in a variety of environments. Emergin® has implemented this software in several hospitals, enabling it to be fully integrated with clinical applications. The implementation of Emergin®, along with Vocera® and a Nurse Call Integration System, would assist with

doctors and nurses in reducing medical errors, which may account for as many as 98,000 deaths per year in U.S. hospitals (Emergin, 2007).

Rauland-Borg designs nurse call communication systems. The company was started in 1922 by inventor and radio enthusiast E. Norman Rauland. In 1941, Rauland partnered with George Borg. Together they formed the Rauland-Borg company in 1948. In September 2004, Rauland-Borg released a product known as Responder Net. Responder Net is a user-friendly PC-interface that was developed to enhance the performance of its Responder IV Nurse Call Integration System, while leveraging a hospital's existing local area and wide area network (LAN/WAN) (Rauland-Borg, 2008). TIHH purchased the Responder IV interface to use as its nurse call system when the hospital opened in February 2003. TIHH began using the Responder IV technology in all patient care areas, the Emergency Department, Daybeds, Progressive Care, Medical Intensive Care and Surgical Intensive Care in 2003, and then upgraded to the Rauland-Borg software in 2005.

CHAPTER TWO: LITERATURE REVIEW

Background

Related Research

Integrating systems have been identified as a major priority in the healthcare field. Within this study, integration refers to the way that hospital systems connect to each other in a seamless fashion, even though they have been designed by different companies. A study conducted by St. Agnes Hospital in Baltimore, Maryland, examined the concept of “quantifying the impact of the Vocera® Communications System on inpatient care workflow and communications” (Turisco & Lund, 2004). This study indicated that there were “significant time savings and workflow improvements that were measurable and significant” (Turisco & Lund, 2004). The nurses, unit secretaries and nurse technicians rated Vocera® as the “tool of choice” for communication, instead of overhead paging. A majority of respondents also indicated that Vocera® had a positive impact on their ability to provide and deliver quality patient care (Turisco & Lund, 2004).

In a follow-up study, also conducted by St. Agnes Hospital in Baltimore, it was concluded statistically that the workload for unit secretaries could be significantly reduced by using the integrated communication systems (Kuruzovich, Angst, Faraj & Agarwal, 2008). This study also revealed that the Vocera Nurse Call Integration (NCI) system reduced the overall time for completing a patient’s request by up to 51%. Out of the 539 events that were recorded, using the Vocera Nurse Call Integration (NCI) reduced the mean time

of calls from 127 seconds to 62 seconds and the standard deviation from 177 seconds to 128 seconds; $p < .001$ (Kuruzovich, Angst, Faraj & Agarwal, 2008).

Not only are there studies showing a reduced overall time for completing a patient's request when using the nurse call integration system with Vocera®, but when Vocera® was used in a telemetry area, the response times required to communicate with the nurse were drastically reduced (Williams, 2008).

Telemetry units are areas within the hospital where patients are connected to a remote heart monitor. The monitor converts a patient's heart rhythm to an electronic signal. The electronic signal is then monitored in a remote location by telemetry technicians. In a study conducted at Beaumont Hospital in Royal Oak, Michigan, the Vocera® badge was used in the telemetry area to contact nurses on the floor when a telemetry alarm sounded. Telemetry technicians who monitor the alarms were located on the main floor of the hospital, while the nursing units were on other floors within the hospital. Prior to using Vocera, the telemetry technicians would send the alarm, patient room number and call-back extension to a pager worn by nurses. A nurse would then go to the patient's room and validate the information provided by the telemetry technician and contact the technician to terminate the communication process.

With the implementation of Vocera®, the process of notifying the nurses on the units changed significantly. As a result, the telemetry technicians now verbally communicate alarm messages to the nursing staff through Vocera®. Nurses merely have to say a verbal command or touch the badge to respond to the telemetry technicians. Information about the patient is then given to the nurse via

the Vocera® badge. Due to privacy concerns, the nurses were instructed to step into the hallway to complete a call. The nurse would then go into the patient's room and visually check on the patient. Since implementing the telemetry alarm notification with Vocera®, Beaumont Hospital has decreased the amount of time required for telemetry technicians to communicate information about telemetry alarms with floor nurses from 9.5 minutes to 39 seconds (Williams, 2008).

Communication technology can assist the nurses in a variety of ways. From decreasing response time to answering a patient's call light to telemetry technicians communicating with nurses, communication technology can assist in ensuring the safety of a patient on a daily basis. When looking at how to accomplish the typical day-to-day duties of a nurse, "wireless information technology has the potential to save nurses significant time" (Turisco, 2000).

Turisco's study supports the concept of using new communication technologies in the hospitals.

Current Understanding

All hospitals in the U.S. have a nurse call system. A nurse call system enables nurses or ancillary staff, such as a nurse's aide or secretary, to respond to a patient signaling them via a call light for such activities as helping the patient get to the restroom, obtain a glass of water, inquire about pain medication or indicate that the patient is having chest pain. (Appendix C) Normally, when a patient makes a request, he or she pushes a button on a handheld device located at the bedside, which activates a light just outside the patient's room and on a central console located at the nursing station. In addition to the activated light outside the

patient's door, an audible alarm is tripped, which alerts the nurses of a patient's alarm. The nurses then do one of two things: nurses can enter the patient's room, push another button to turn off the light and audible alarm and respond to the patient's needs, or they can go to a central console, push another button to cancel the light and audible alarm, call back to the patient's room and respond to the patient over a speaker located in the room.

Although the process of answering call lights has been a standard hospital procedure for many years, nurses can communicate with patients in a more efficient, timely manner with improvements in communication technology. A patient should no longer have to wait several minutes for a nurse to answer his or her call light. With the integration of Vocera® and a nurse call system that utilizes Emergin® middleware software, it can be hypothesized that response times can be significantly decreased.

Many hospitals are moving toward technology that allows nurses to have immediate, direct communication with patients. With the increasing ratio of nurses-to-patients in hospitals today, it can be difficult to respond to a patient's concerns in a reasonable amount of time. The Vocera®-Emergin®-Responder IV® Nurse Call Integration System enables a nurse to have immediate and direct communication with the patient.

This research evaluates many information resources, such as Internet sites, current case studies, data collected from electronic systems and subject matter experts on the Vocera®, Emergin® and Rauland-Borg Responder IV® Nurse Call Integration Systems. Other information resources include data that has been

collected and analyzed by the author, with assistance from subject matter experts to help interpret the data.

At TIHH in Indianapolis, Indiana, like many other cardiac care, speciality and general hospitals around the country, nurses are committed to the goal that every patient should have an excellent experience throughout his or her hospitalization. A set of core values and beliefs is what makes TIHH one of the premier hospitals in Indiana in regard to providing an exceptional patient experience (Thompson Healthcare, 2007). As a result of this corporate culture, there are many different initiatives being pursued within the Community Health Network, which includes TIHH, to maintain a high level of patient satisfaction. These initiatives include, but are not limited to, the use of a barcode medication management process, *Culture of Safety* philosophy and Vocera®-Emergin®-Responder IV® Nurse Call Integration System.

A patient's safety is one of the major initiatives in hospitals nationwide. There are many facets of patient safety, such as surgical time-outs to prevent errors, protocols to reduce the risk of falling, barcode medication administration, medication reconciliation and timely and efficient patient/nurse communication (Joint Commission on the Accreditation of Healthcare Organizations, 2007). The *Culture of Safety* program at TIHH was started in 2007 and is an important step towards reducing errors that result in harm to patients. The *Culture of Safety* program requires nurses to use specific actions and tools to change the behaviors of all members of the healthcare team. Another initiative being implemented is barcode medication administration. Barcode medication administration features a

handheld scanner at the bedside that is used to assist in the distribution of patient medications. The nurses use the handheld scanner to scan the patient identification bracelets to verify that they have the right patient. The nurses also scan the medication barcode. An electronic medical record is used to document the selection of the right drug, the right dose, the right amount and the right route.

Prior to implementation of the Vocera®-Emergin®-Responder IV® Nurse Call Integration System, nurses would answer the patient's call light in one of two ways: by physically walking over to a center console or going into the patient's room and answering his or her call light. This particular process could prove to be inefficient, based on the number of steps that the nurse must take to get to either the patient's room or the center console. The process would be as follows:

1. The patient pushes the call light located on the pillow speaker at the bedside.
2. A light and an audible alarm are activated just outside the patient's room and at the central console.
3. Two scenarios can occur at this time:
 - a. The nurse goes to the patient's room and responds to the patient's inquiry.
 - b. The nurse goes to the central console and speaks to the patient via the central console.
4. The nurse completes the transaction by turning off the call light in the patient's room or at the central console.

See Appendix C for an illustration of this process.

TIHH has implemented Emergin®, which provides nurses with a more efficient means of communicating with their patients. This initiative allows nurses to use a hands-free communication device, Vocera®, in conjunction with a type of software, Emergin®, to communicate with patients at the bedside through the Responder IV® Nurse Call Integration System. The way that this process works is as follows:

1. Nurses log into the Emergin® Orchestrator and assign themselves to specific patient rooms.
2. The patient presses the call light on the pillow speaker located at the bedside to request a nurse.
3. A message is sent from the pillow speaker to the Vocera badge via the Emergin® Orchestrator.
4. Lights and audible alarms are activated just outside the patient's room and at the central console.
5. The Vocera badge displays "Room Number Normal."
6. The nurse presses the button on his or her Vocera badge and says, "Play text message."
7. Vocera then responds, "Room Number Normal" and gives the nurse the option to "accept," "reject" or "callback."
8. If the nurse selects "callback," the badge then dials back into the patient's room using the Nortel PBX server, and the nurse can let the

patient know that he/she will immediately be available to assist the patient. This completes the transaction.

See Appendix E for an illustration of this process.

Research Questions

The purpose of this research is to demonstrate that there is a significant decrease in time required to respond to patients when using the Vocera®-Emergin®-Nurse Call process versus the Responder IV® Nurse Call Integration System. Internet research of previous evaluations will be conducted. A study will look at data from the Responder IV® Nurse Call Integration System to determine response times. This data will also be used to demonstrate to clinical and operational administrators of hospitals that using Vocera® and integrating it with a Nurse Call Integration System can save nurses valuable time and show a positive return on investment (ROI).

Intended Project

The goal of this study is to determine whether a nurse's response time in answering a patient's call light can be decreased by using the Vocera® Nurse Call Integration System. The author predicts that hospitals nationwide can use this study in conjunction with the St. Agnes study (Kuruzovich, Angst, Faraj & Agarwal, 2008) to streamline their communication processes, improve patient safety and increase patient satisfaction related to their hospital stay. The Vocera®-Emergin® Nurse Call Integration System has the potential to increase patient safety, enabling the nurses to respond to patients more quickly (Breslin, Greskovich & Tursico, 2004).

The cost of implementing the Vocera® Nurse Call Integration System needs to be evaluated, due to the vast number of projects that are implemented within an institution. By evaluating this type of communication system, a hospital will be able to determine whether this system is in line with its goals and objectives. A strategic planning process must take place prior to implementation of any new system or protocol. The steps involved in this decision making process are as follows:

1. Identification of goals and scope
2. Scanning the external and internal environments
3. Data analysis
4. Identification of potential solutions
5. Selecting a course of action
6. Implementation
7. Ongoing evaluation and feedback (Hebda, Czar & Mascara, 2005)

During the identification of goals and scope process, the methodology for calculating the ROI of the project must be clearly defined. The trend in IT is that millions of dollars are spent unwisely each year, resulting in a very low value or low ROI for IT (Turisco, 2000). An analysis of the financial implications of decreased response times when answering a patient call light on the Progressive Care Unit (PCU) at TIHH will demonstrate that by implementing the Nurse Call Integration System with Vocera®, the hospital will achieve a positive ROI.

The author proposes the following approach to calculating the ROI of implementing Emergin® with Vocera® and Nurse Call System. To determine the

amount of time that would be saved per nurse by implementing the Vocera® Nurse Call Integration System, the calculation would be as follows:

$$\frac{\text{Number of calls per day} * \text{Number of seconds saved}}{\text{Number of hours worked per year} * 60 \text{ Minutes} * 60 \text{ Seconds}} = \text{Numbers of hours saved per year per nurse}$$

The above formula indicates the number of hours saved per nurse per year. The following formula was written to show the number of seconds saved per day.

$$\frac{\text{Number of calls per month} * \text{Number of seconds saved}}{31 \text{ days}} = \text{Number of seconds saved per day}$$

Data results from this study were used to show how the above formulas would give hospital administrators the data to show a positive ROI. The data used for this process is below:

1. Average of 105 calls per day
2. Average of an average of 37 seconds saved
3. 3,262 calls for August 2008

When using the hours saved per year formula, the nurse would save 5.2 hours per year. When using the number of seconds saved per day formula, the result with using the above data is 38.9 seconds saved per day. An average salary of nurses on the unit would be gathered and multiplied by the total number of hours saved, and the result would be the ROI. The total number of hours saved strongly suggests that nurses can be more productive in their daily routines. If nurses were more productive, there is potential for increased patient and nurse

satisfaction, increased retention of nursing staff, increased time with patients and families and a decrease in nurse burnout.

CHAPTER THREE : METHODOLOGY

Overview of the Original Study

The original study included the Progressive Care Units and Daybed area at TIHH. However, due to data collection problems with the Rauland-Borg software, the study was revised to only include the Progressive Care Units. Vocera® badges have been used at this facility since November 2006, but Vocera® was redeployed in May 2008 due to improved technology with the badge. Emergin® was purchased and implemented in June 2008. Data was gathered from the Responder IV Nurse Call Integration System. The statistical data was retrieved from the Responder IV® Nurse Call Integration System for August 2007 and then again for August 2008. There were some problems when trying to collect data from the Responder IV® Nurse Call Integration System for the Daybed area for August 2008. The system could not retrieve any statistics for the Daybed area for August 2008. This was due to a malfunction in the nurse console on the patient unit. There was also an issue with the wireless access points during the later part of August 2008. During this time, nurses were not receiving Vocera® calls from other nurses or from the Responder IV® Nurse Call Integration System. Therefore, the Daybed area data is not included in the current study. There may be a need in the future to collect this data for the Daybed area and the Intensive Care Unit (ICU) to determine whether response times in answering a patient's call light would show a decrease in these areas of the hospital. It is important to note that the data retrieved from the Responder IV®

Nurse Call Integration System did not include individually identifiable patient or nurse information.

By using new communication technology, significant time can be saved when responding to a patient's call light when comparing August 2007 and August 2008 on the Progressive Care Units at TIHH. The average time required to answer a patient's call light decreased from 1 minute and 40 seconds to 1 minute and 3 seconds after implementing the Vocera® Nurse Call Integration System. The data showed an average 37-second decrease in responding to patients on the Progressive Care Units at TIHH. The decrease in response time is significant, because nurses are able to communicate with patients in a more efficient, timely manner.

Materials and Instruments

The author used data that was collected from the Responder IV® Nurse Call Integration System from August 2007 and August 2008 to calculate and compare the actual response times of nurses answering patient call lights. The data did not include any individually identifiable patient or nurse data and was collected from an electronic system. The data was then exported from the system into Microsoft Excel 2007®. The data was sent to a third party to have formulas written that would assist in splitting the combined date and time field into two separate fields. Once the formula was written, the data was filtered to retain only data from the Progressive Care Units at TIHH. This data was then divided into the 2nd (2TH) and 3rd (3TH) floor Progressive Care Units at TIHH. This data was filtered a third time to show only data being collected from rooms that were

visible in August 2007 and August 2008. This data was filtered a final time to show only “Normal” calls, which are calls that were initiated using a patient’s handheld call button, and “Transaction Completed,” when the nurse responded to the patient from the system. The data was validated by system administrators at Community Health Network. The administrator accompanied the author when data was retrieved from the Responder Net software occurred. The administrator was also shown the data after the formulas were written and the data was filtered. The administrator of the Responder Net system validated the data one final time.

The definition of “Transaction Completed” prior to implementation of the Vocera® Nurse Call Integration System would occur when the nurse turned off the call light. The definition of “Transaction Completed” after implementation of the Vocera® Nurse Call Integration System would occur when the nurse actually answered the patient’s call light through his or her Vocera® badge. Other formulas were written to show the actual response times in seconds and the average response times for 2TH and 3TH, individually and overall. Once the actual response times in seconds were calculated, the highest and lowest values were thrown out, then an average was taken of all the transactions that were completed.

Separate tabs were created on the Microsoft 2007 Excel® spreadsheet to show the Progressive Care Units individually. Several other tabs were created: Progressive Care Units 2TH Aug_07, Progressive Care Units 2TH Aug_08, Progressive Care Units 3TH Aug_07, Progressive Care Units 3TH Aug_08, Progressive Care Units Average Times Aug_07 and Progressive Care Units

Average Times Aug_08 and Progressive Care Units Average Times Aug_07_08. Formulas were written to show the actual average times, then information was used to create a bar graph to show the average response times. (See Appendix H for the graph of the data)

Samples and Subjects

There was no human subject intervention. All data was collected from an electronic system and was not tied to any individually identifiable patients or nurses. Data was gathered from two units within TIHH during August 2007 and August 2008. The units chosen were: Progressive Care 2nd floor (2TH) and Progressive Care 3rd floor (3TH). These are the units at TIHH that have call lights for the patients at the bedside and that are utilizing the Vocera®-Emergin®-Responder IV® Nurse Call Integration System.

Procedures

The data was queried by accessing the software program of the Responder IV® Nurse Call Integration System and viewing reports from August 2007, which is prior to implementation, and August 2008, which is after implementation of Emergin®. The data was then exported into Microsoft Excel 2007®. Formulas were written and data was filtered accordingly. Data was saved, then graphs were created to illustrate the results. The length of time that was evaluated was one month.

Statistical Analysis

The data from the Responder IV® Nurse Call Integration System was collected in a .cd file format. The data was saved, then converted to a Microsoft

Excel 2007® file. Once the data was converted to Microsoft Excel 2007®, the data was, as it initially was presented in a single cell. Individual cells were selected and the Data header was selected from the toolbar, then the Text to Columns icon was selected. The file type that was chosen was delimited, then the comma field was selected as the delimiter. The Finish button was selected to complete the process of texting the information to columns. A row was added to the top of the document, then the Headers were added in this order: Unit, Room, Call, Date/Time. The Date/Time column was separated by texting this information to columns. Formulas were written to show just the date and just the time in the correct format. The formulas were as follows:

=DATE(LEFT(E3,4),MID(E3,5,2),RIGHT(E3,2))---this is for the date column

=TIME(LEFT(F3,2),MID(F3,3,2),RIGHT(F3,2))---this is for the time column.

The Units column was filtered to show only 3TH and 2TH, which are the Progressive Care Units. All other units were deleted from the spreadsheet. In the Call column the data was filtered to only show the “Normal” calls and the “Transaction Completed” field associated with the “Normal” call. Data from August 2007 and August 2008 was compared for the same rooms. An additional column was added and labeled Seconds. The following formula was written to show the time difference in minutes and seconds from the Date and Time fields: =F3-F4. This formula calculated the actual number of minutes and seconds it took to complete a “Normal” call transaction.

Another sheet was created, and the 2TH and 3TH units were filtered, then copied to their own sheets within the original spreadsheet. Once this was

completed, a formula was written for each page of the spreadsheet to show the average time for nurses to answer a patient's call light. The formula was displayed as follows: =AVERAGE(I3:I1525). Another page was created to show the results of all the data on one sheet. Graphs were inserted to show the data in graphical form using data from the Average Times sheets from August 2007, August 2008, and August 2007 and August 2008 data combined. The Nurse Call Data Table (Table 1) illustrates the specific results.

Table 1

Unit	Room	Transaction	Date	Time	Seconds
3rd Floor	310	Normal	8/1/2007	0:11:06	
3rd Floor	310	***Transaction Completed	8/1/2007	0:11:19	0:00:13
2nd floor	208	Normal	8/1/2007	0:13:31	
2nd floor	208	***Transaction Completed	8/1/2007	0:14:08	0:00:37
2nd floor	208	Normal	8/1/2007	1:07:42	
2nd floor	208	***Transaction Completed	8/1/2007	1:08:15	0:00:33
3rd Floor	301	Normal	8/1/2007	1:09:01	
3rd Floor	301	***Transaction Completed	8/1/2007	1:09:24	0:00:23
3rd Floor	301	Normal	8/1/2007	1:17:55	
3rd Floor	301	***Transaction Completed	8/1/2007	1:18:14	0:00:19
3rd Floor	315	Normal	8/1/2007	1:46:51	
3rd Floor	315	***Transaction Completed	8/1/2007	1:47:05	0:00:14
3rd Floor	306	Normal	8/1/2007	2:00:54	
3rd Floor	306	***Transaction Completed	8/1/2007	2:02:44	0:01:50
3rd Floor	303	Normal	8/1/2007	2:43:09	
3rd	303	***Transaction Completed	8/1/2007	2:43:29	0:00:20

Floor					
3rd Floor	310	Normal	8/1/2007	3:26:19	
3rd Floor	310	***Transaction Completed	8/1/2007	3:26:43	0:00:24
3rd Floor	306	Normal	8/1/2007	3:40:39	
3rd Floor	306	***Transaction Completed	8/1/2007	3:42:19	0:01:40
3rd Floor	315	Normal	8/1/2007	5:21:30	
3rd Floor	315	***Transaction Completed	8/1/2007	5:21:56	0:00:26
3rd Floor	320	Normal	8/1/2007	5:33:52	
3rd Floor	320	***Transaction Completed	8/1/2007	5:34:08	0:00:16
2nd floor	207	Normal	8/1/2007	5:53:23	
2nd floor	207	***Transaction Completed	8/1/2007	5:54:05	0:00:42

Expected Results

The anticipated outcome of this research was that response times would be decreased when using a Vocera® badge, along with Emergin® and the Responder IV® Nurse Call System. Decreased response times were expected on the Progressive Care Unit 2nd floor (2TH) and the Progressive Care Unit 3rd floor (3TH).

CHAPTER FOUR: RESULTS

Sample Demographics

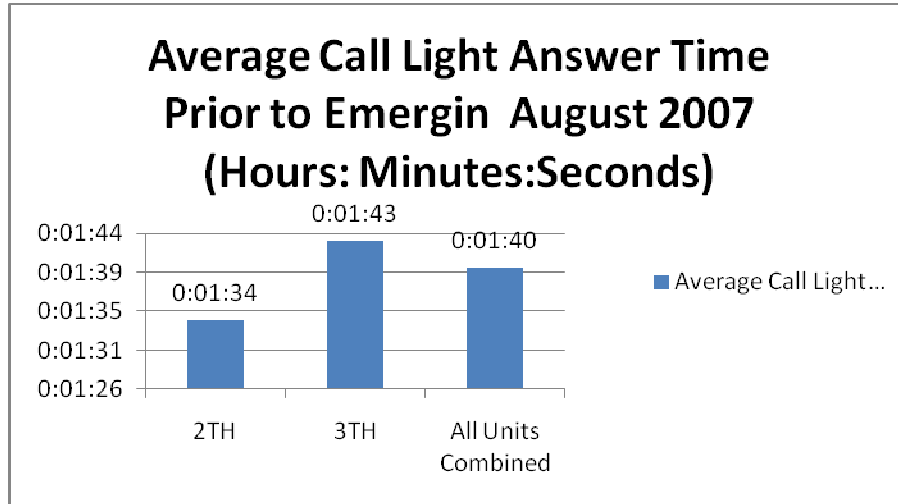
Information was collected from the Responder IV® Nurse Call System. The information shows transactions prior to and after implementation of the Vocera® Nurse Call Integration System. The definition of “Transaction Completed” prior to implementation of the Vocera® Nurse Call Integration System would occur when the nurse turned off the call light either at the patient’s bedside or in the patient room. The definition of “Transaction Completed” after implementation of the Vocera® Nurse Call Integration system would occur when the nurse actually answered the patient’s call light through the Vocera® badge. This information is what was used to determine the time period in minutes and seconds for a nurse to respond to a patient’s call light.

Summary of Findings

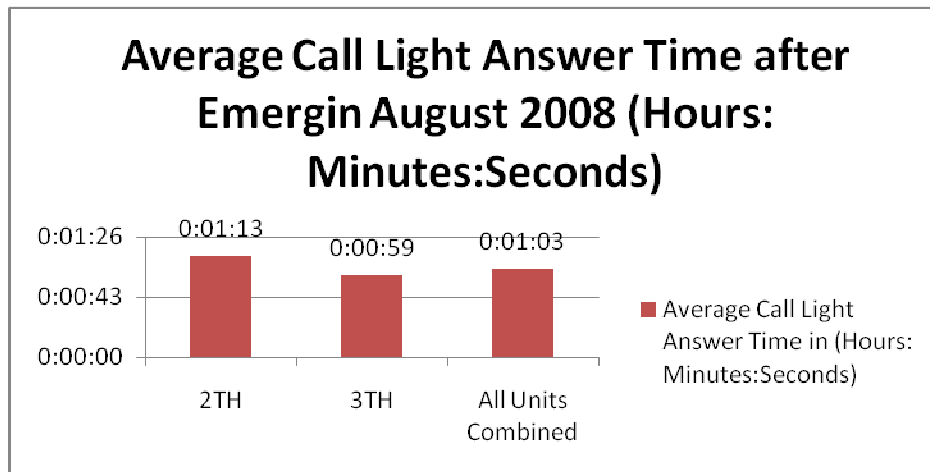
Data was collected at two different periods of time: August 2007 and August 2008. For August 2007, there were 762 “Transactions Completed” on 2TH and 1,441 “Transactions Completed” on 3TH. For August 2008, there were 1,041 “Transactions Completed” on 2TH and 2,221 “Transactions Completed” on 3TH. Overall, there were 2,203 “Transactions Completed” for August 2007 and 3,262 “Transactions Completed” for August 2008. There was an increase of 1,051 calls from August 2007 to August 2008. Data was filtered to include only rooms that were visible on the report from August 2007 and August 2008. By averaging the response times of these rooms, the data from August 2007 and August 2008 are comparable.

The average response time on Progressive Care 2TH for August 2007 was 1 minute and 34 seconds. For August 2008, the average response time was 1 minute and 13 seconds. This shows a decrease in response time of 21 seconds for Progressive Care 2TH. The average response time on Progressive Care 3TH for 2007 was 1 minute and 43 seconds. For August 2008, the average response time was 59 seconds. This demonstrates a decrease in response time of 44 seconds for Progressive Care 3TH. The average response time for Progressive Care 2TH and Progressive Care 3TH combined for August 2007 was 1 minute and 40 seconds. For August 2008, the average response time was 1 minute and 3 seconds. This shows a decrease in response time of 37 seconds for Progressive Care 2TH and Progressive Care 3TH combined.

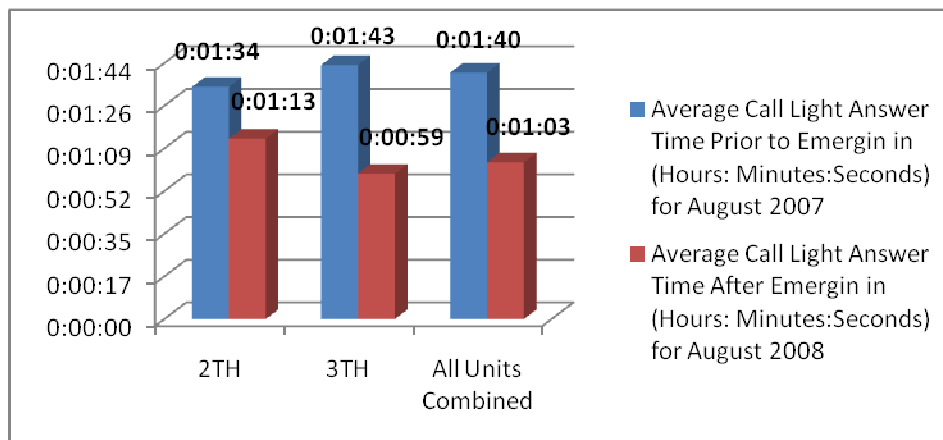
Graph 1



Graph 2



Graph 3



CHAPTER FIVE: DISCUSSION

Overview of Significant Findings

This data shows that, by using a Vocera® badge along with a Nurse Call Integration System, the Progressive Care Units at TIHH experienced a significant decrease in the amount of time required to answer patient call lights. The use of Emergin® with Vocera® and the Responder IV® Nurse Call System facilitates the ability of nurses to communicate with their patients. It is not a replacement for communicating with a patient face-to-face; it is merely a tool to make the process faster and more efficient. The decrease in response time could also result in an increase in patient satisfaction as well as improve the quality of care that a patient receives.

Consideration of Findings in Context of Current Knowledge

Although the research was limited to the Progressive Care Units at The Indiana Heart Hospital, the current research demonstrates a significant decrease in response times when answering patient call lights in the Progressive Care Units. It is likely that using the Vocera®-Emergin®-Responder IV® Nurse Call Integration System increased the awareness of the nursing staff when answering patient call lights and encouraged quicker response times, because the hospital already promotes an exceptional patient experience.

CHAPTER SIX: CONCLUSION

Limitations of the Study

It is acknowledged that several limitations exist in the current research design. There were problems with the Responder IV® Nurse Call System. Only data from the Progressive Care Units in August 2008 was visible in the report from the system. Another issue related to the Responder IV® was that not all rooms in the Progressive Care Units appeared on the report. Therefore, the research was limited to only showing the Progressive Care Units and only certain rooms for this particular study.

Recommendations for Further Research

Additional research should be conducted for other hospital units that might implement the Vocera® Nurse Call Integration System. One area of interest would be the Daybed area of a hospital. This is an area where patients stay prior to and after a diagnostic or surgical procedure, when their hospital stay is confined to 24 hours or less. At TIHH, the layout of the Daybed area is different from the Progressive Care Units. Thus, response times may not decrease as markedly due to the close proximity between patients and nurses. Another site that should be evaluated using the Vocera® Nurse Call Integration System would be the Intensive Care Units. Due to the level of care that these patients receive, with many who are connected to ventilators, it would be interesting to determine whether using Emergin® with Vocera® and the Responder IV® Nurse Call Integration System would result in a decrease in response times for answering patient call lights from patients or their families.

Another option for proving that the implementation of Emergin® with Vocera® and the Nurse Call System increases productivity would be the use of pedometers prior to and after implementation of the Vocera® Nurse Call Integration System. Nurses could wear pedometers that would measure their steps before and after implementation of the Vocera® Nurse Call Integration System. Data could be analyzed to determine whether there was a decrease in steps taken. If a decrease in steps could be shown, it would provide further supporting evidence that nurses were more productive after implementation of the Vocera® Nurse Call Integration System.

Additional ways to research the benefits of using the Vocera® Nurse Call Integration System might include the use of pedometers to measure other clinical units of the hospital. This research, along with the implementation of other communication technologies within a hospital, may greatly enhance the way nurses communicate with patients and each other.

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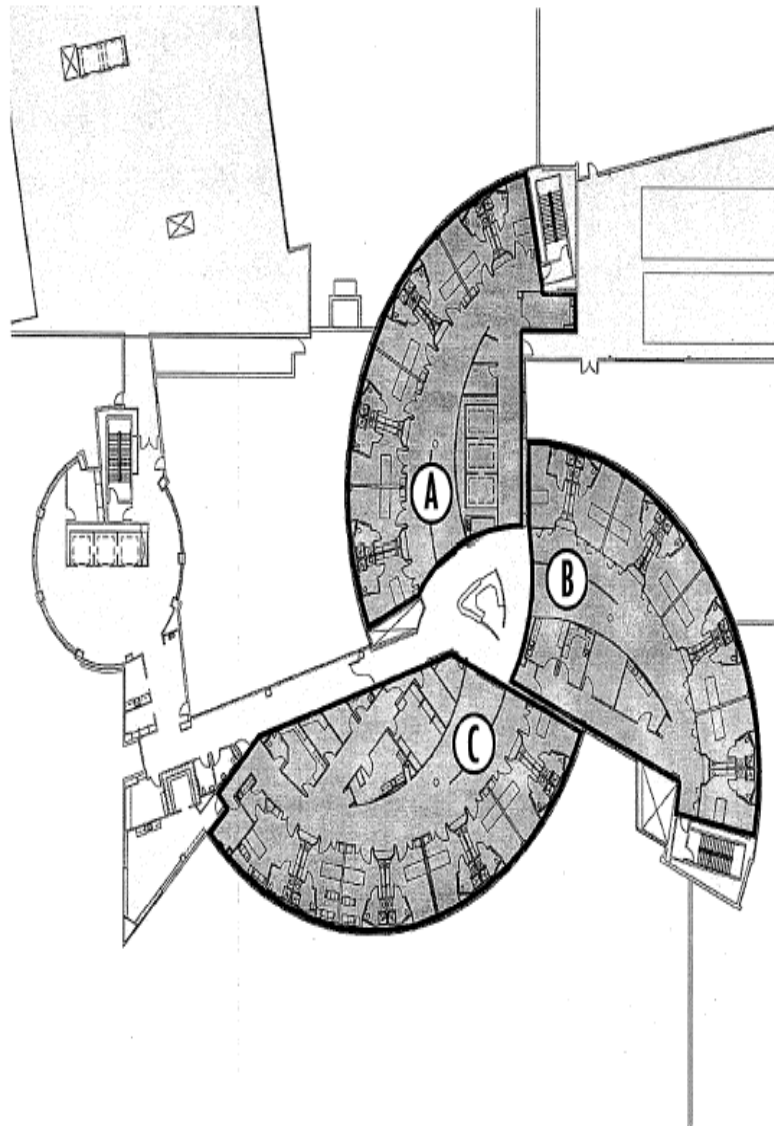
Appendix A

Table 1. Caring process implications of technology for interpersonal relations

Caring Process Factors in Interpersonal Relationships	Technological Capabilities	Implications
<ul style="list-style-type: none"> • Viewing all involved parties as fellow professionals and human beings • Being respectful of the opinions and being sensitive to the needs of all parties • Talking/listening to and being honest with all parties • Compiling, examining, and making use of complete information • Respecting and maintaining confidentiality when warranted 	<ul style="list-style-type: none"> • Efficiency • Accountability • Data aggregation • Security • Data completeness • Anonymity 	<ul style="list-style-type: none"> • Improved efficiency streamlines negotiations, saving time and minimizing the impact of interpersonal processes on individuals' lives • Audit trails support accountability and honesty • Comprehensive, complete data support better decision making, while minimizing misunderstandings; objectivity replaces subjectivity • Data security ensures and maintains confidentiality • Anonymity reduces or otherwise minimizes prejudice, eliminating such common hurdles to positive interpersonal relations as class, race, gender, and position

Appendix B

Floor Plan of the Progressive Care Unit (Second Floor) at The Indiana Heart Hospital

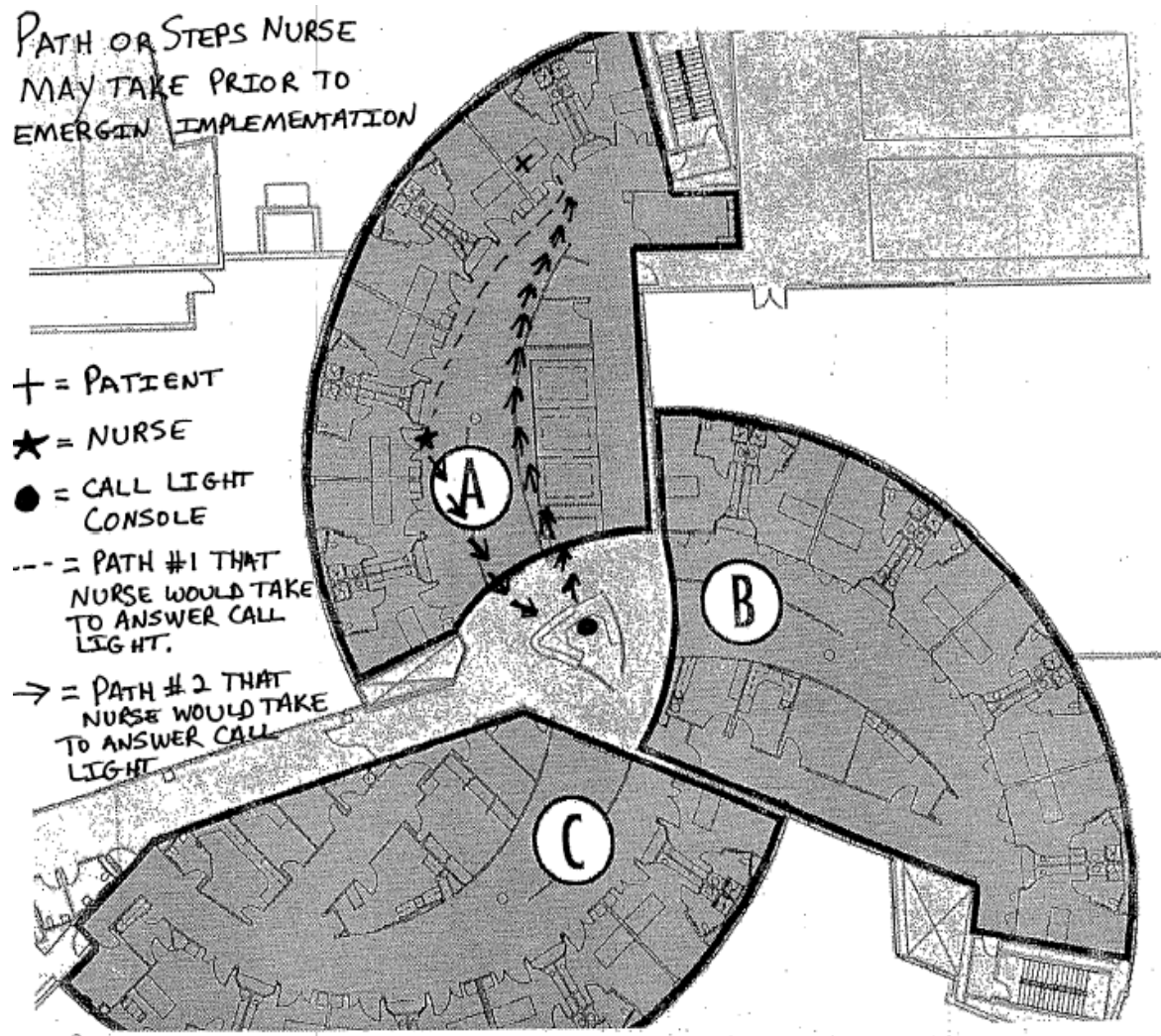


RTKL



Appendix C

Steps a nurse would take to answer a call light prior to implementation of
Emergin.



Appendix D

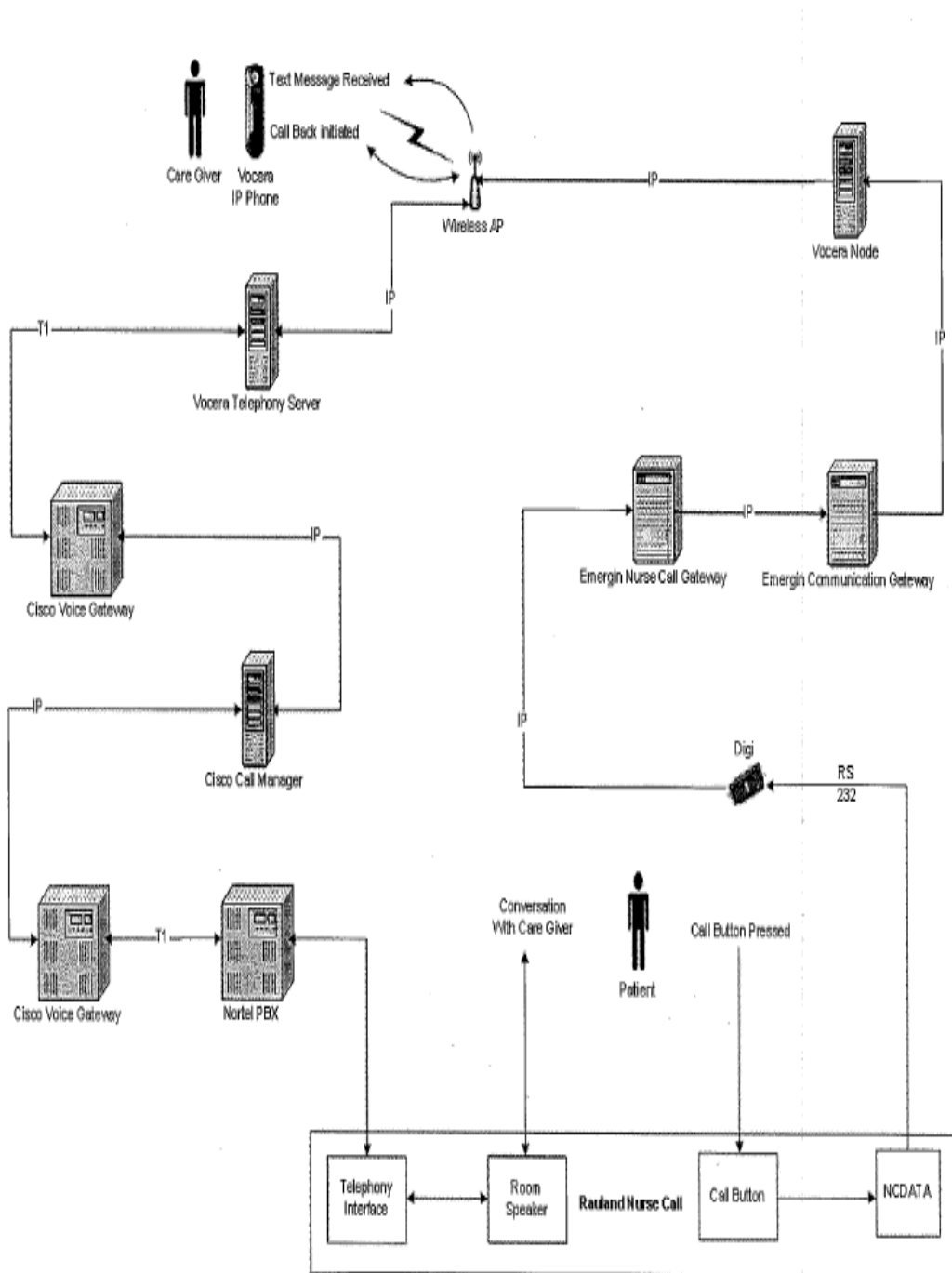
Nurse Call and Response Time Data

*Time Periods Included for All of August 2007 and 2008.

Unit	Number of Calls for August 2007	Number of Calls for August 2008	August 2007 Average Response Time Without Vocera®-Emergin®-Responder IV® Nurse Call	August 2008 Average Response Time With Vocera®-Emergin®-Responder® IV Nurse Call	Average Response Time Saved with Vocera®-Emergin®-Responder IV® Nurse Call
2TH	762	1041	0:01:34	0:01:13	0:00:21
3TH	1441	2221	0:01:43	0:00:59	0:00:44
All Units Combined	2203	3262	0:01:40	0:01:03	0:00:37

Appendix E

Vocera®/Emergin®/Responder IV® Nurse Call System Flow Diagram



Richard Jeffery Lyons
1211 N. Wallace Ave.
Indianapolis, IN. 46201

EDUCATION: Indiana University/Purdue University, Indianapolis
School of Informatics
Master's of Science in Healthcare Informatics
Expected graduation date: December 2008

Indiana University/Purdue University, Indianapolis
College of Liberal Arts
Registered Nurse to Bachelor's of Science in Nursing – December 2003

Marian College – Indianapolis, Indiana
College of Liberal Arts
Associate Degree in Nursing – December 1997
Received State Nursing License – February 1998

**INFORMATION TECHNOLOGY
EXPERIENCE:**

Community Business Innovations, Indianapolis, Indiana
Sr. Medical Informatics Consultant for The Indiana Heart Hospital (March 2008 to Present)

Performs all duties of Medical Informatics Consultant in addition to:
Instructs, directs, and assists in checking the work of other informatic consultants.
Formulates and defines systems scope for Centricity Enterprise project and objective based on user needs and a thorough understanding of business industry requirements.
Assisting in the design and build of Orders in new Electronic Medical Record.
Acts as team leader for projects with moderate budgets or of a short to intermediate duration, including Vocera at The Indiana Heart Hospital.
Considers the business implications of the application of technology to the current and future business environment.
Vocera administrator and assists in management of budget for Vocera.
Assisting in the design and implementation of Barcode Medication administration at Community North and The Indiana Heart Hospital.

Community Business Innovations, Indianapolis, Indiana
Medical Informatics Consultant for The Indiana Heart Hospital (October 2004 to March 2008)

Provides customer support, including physicians for Information Technology related issues in designated areas of the health care system.
Maintains a working knowledge of customer's daily operations to ensure superior technical support.
Rounds with Physicians to assist in workflow design for development of new Electronic Medical Record.
Identifies process improvements based on customer's needs and troubleshooting and providing client support for systems and applications.
Implemented Vocera 3.1.
Vocera administrator and management of Vocera equipment.
Support many applications including but not limited to: Vocera, GE's Clinical Information Systems, McKesson's Horizon Surgical Manager, Pathways Healthcare Scheduling systems, Vocera, Emergin and Microsoft products.
Primary Data and File Manager for the Society of Thoracic Surgeons Database

**HEALTHCARE
EXPERIENCE:**

The Indiana Heart Hospital, Indianapolis, Indiana

Registered Nurse, Operating Room (September 2002 to October 2004)

Circulated and scrubbed on a variety of cardiovascular surgical procedures.

Analyzes the information collected to determine patient's needs, diagnosis, and expected outcomes.

Completes thorough and ongoing assessments on assigned patient in a timely and professional manner according to the standards of care.

Information Technology liaison for the Operating Room which included: Training of all new employees on GE and McKesson systems, Support for all clinical documentation systems, Maintenance of all preference cards and resource maps in the McKesson documentation system.

Worked with main IT department to assist with upgrades and downtimes in the Operating Room.

Community Hospital East, Indianapolis, Indiana

Registered Nurse, Cardiac Intensive Care (February 1998 to September 2002)

Performs direct skilled nursing care.

Responsible for staffing and scheduling as charge nurse for 12 bed unit.

Cardiovascular recovery room experience.

Ventilator experience.

SWAN-GANZ catheter and Intra-Aortic Balloon Pump experience.

Assist patients and families in handling emotional issues associated with critical care.

Instruction and orientation of new Registered Nurses on the unit.

**MEMBERSHIPS -
AFFILIATIONS:**

Vocera User Group, April 2007 and May 2008

Member of the Society of Thoracic Surgeons National Database, April 2005--Present

McKesson User Group, April 2005

The Indiana Heart Hospital Employee Council, November 2004---Present

Interview Board, Cardiac Intensive Care, September 2001 – September 2002

Patient Satisfaction Committee, June 2001 – September 2002

Central Indiana Chapter of American Association of Critical Care Nurses

Treasurer Elect, June 1999 – June 2000

Publications Editor, June 1998 – June 1999

Associate Nursing Student Representative for Graduating Class of December 1997

**CERTIFICATIONS –
AWARDS:**

Vocera 4.0 Administrator Training, April 2007

Crystal Report 9.0 Certified, May 2006

Employee of the Month, Cardiac Intensive Care, November 2001