

BAR CODE MEDICATION ADMINISTRATION WORKAROUNDS:
A LEARNING EXPERIENCE

by

Lynda Marie Gullett

A professional paper submitted in partial fulfillment
of the requirements for the degree

Master

of

Nursing

MONTANA STATE UNIVERSITY
Bozeman, Montana

November 2015

©COPYRIGHT

by

Lynda Marie Gullett

2015

All Rights Reserved

DEDICATION

I dedicate this clinical project and paper to my family; especially Aaron, Nate, Kalyn and my mother. Thank you for your support, encouragement and love throughout this entire process. To Dr. Linda Torma, I couldn't have asked for a better person to guide, encourage, support and share this journey to its completion with me.

TABLE OF CONTENTS

1. INTRODUCTION 1

 Background 1

 Local Problem 6

 Purpose 7

 Patients 7

 Professionals 8

 Processes 9

 Patterns 14

 Purpose/Aim 16

2. METHODS 17

 Ethical Issues 17

 Setting/Sample 17

 Procedure 20

 Data Analysis 22

3. RESULTS 24

 Root Cause Analysis 24

 First Category 24

 Second Category 25

 Third Category 25

 Fourth Category 25

 Medication & Patient Scanning Compliance 26

 Observational Survey 27

 Variation in BCMA Process 28

 Pre and Post Tests 30

 Qualitative Results from Workshop Survey 32

4. DISCUSSION 34

 Knowledge of BCMA Policy and Procedures 34

 Engaging Frontline Nurses 35

 Nursing Implications 38

 Limitations 39

 Recommendations 39

 Scanning Reports 40

 Trust and Respect 40

 Policy and Procedure 41

TABLE OF CONTENTS - CONTINUED

Teamwork	41
5. Conclusion	43
Summary	43
REFERENCES CITED.....	45
APPENDICES	48
APPENDIX A: BCMA Process Flow Map	49
APPENDIX B: Observational Survey	51
APPENDIX C: Nurse Information Sheet	53
APPENDIX D: Workshop Pre-Test.....	55
APPENDIX E: Workshop Post-Test	58
APPENDIX F: Workshop Survey	61

LIST OF TABLES

Tables	Page
1. Nurse Satisfaction with Current BCMA Process (N=23).....	27
2. Average Number of Variances.....	28
3. Pre and Post Test Results.....	31

LIST OF FIGURES

Figure	Page
1. Current BCMA Process Flow Map.....	12
2. Age of Workforce	18
3. Nursing Education Breakdown.....	18
4. Years of Nursing Experience	19
5. Types of Work Experience	19
6. Fishbone Analysis.....	26
7. Pre-Intervention BCMA Process Flow Map.....	29
8. Post-Intervention BCMA Process Flow Map	30

LIST OF GRAPHS

Graphs	Page
1. Core and Support Process Survey Results	10
2. Medication and Patient Scanning Compliance	27

Abstract

The Institute of Medicine (IOM) created a report “To Err is Human: Building a Safer Health System” in 1999, bringing to light the scope of Adverse Drug Events (ADE). Ranked one of the most common types of medical error, medication administration errors harm at least 1.5 million people every year, while only 2% of ADEs are caught before reaching the patient. Thirty-eight percent of ADEs occurred during medication administration by nurses that could have been prevented. Bar Code Medication Administration (BCMA) is considered the gold standard, adding an additional layer of security, ensuring quality and safety during the process of medication administration. A microsystem assessment was conducted and the perception of BCMA by the nurses was a process that “worked well”, however many workarounds occurred during BCMA, which increased the risk for ADEs. The purpose of this project was to improve awareness of BCMA workarounds amongst the nursing staff on the medical floor. The global aim of this project was to engage the direct care nursing staff in a root cause analysis (RCA) to identify reasons why workarounds occur on the unit during BCMA. The specific aims were to improve overall nursing compliance rates for medication and patient scanning by at least 1% and overall knowledge of BCMA policy and procedures by 20%. Background and rationales for BCMA, agency policy and procedures governing the process, and flowcharts depicting the workarounds observed during the assessment were reviewed prior to engaging the staff in a root cause analysis. The RCA focused on finding out the cause(s) of the observed workarounds. The results included meeting the specific aims with a 31% increase in overall nursing knowledge of the policy and procedures for BCMA, as well as having greater than 1% increase in scanning compliance. Feedback from the RCA resulted in a new awareness from nursing staff in how thinking in a problem solving fashion forces them to evaluate how and why they manage their workflow in the manner in which they do.

CHAPTER 1

Introduction

Background

Technology has advanced so much in the last twenty-five years, with the development of smart phones, tablets, laptops, and bar coding scanners that healthcare agencies, including hospitals, have sought the help of new technologies to assist in improving patient safety (Work, 2005, para. 1). Medication administration processes have become one of complexity and prone to errors. (Early, Riha, Martin, Lowdon, & Harvey, 2011, para. 1). The old style of medication administration included the physician handwriting an order in the patient's chart, the unit secretary or nurse would send the paper copy to pharmacy, and the primary nurse or charge nurse transcribed the order to the paper MAR after comparing it to the written order. The nurses used the paper medication administration record (MAR) to determine what medications were to be administered and when (Poon et al., 2010). Finally the paper MAR would be printed out at midnight by the pharmacy for nurses to complete a double check, during the twenty-four hour chart check for the next day.

The Institute of Medicine (IOM) created a report in 1999 called, "To Err is Human: Building a Safer Health System" that brought to light the scope of adverse events (medical errors) in the US Healthcare delivery system.

An adverse event is defined as an injury sustained by medical management rather than the patient's condition. An adverse event attributed to error is considered a

“preventable adverse event” (Institute of Medicine et al., 2000, p. 28). Preventable adverse events (medical errors) are the leading cause of death in the United States, and they have a higher percentage than cancer, motor vehicle accidents or AIDS (Institute of Medicine et al., 2000, p. 26). The most common type of adverse events are medication errors, which frequently occur in hospitals, and harm at least 1.5 million people every year and cost approximately 3.5 billion dollars annually (Institute of Medicine et al., 2000, p. 33; Dubin, 2010, p. 212). Adverse drug events (ADEs) are an injury sustaining from a medical intervention related to drug therapy (Institute of Medicine et al., 2000, p. 33).

In a hospital setting, the risk for an adverse drug event increases for each patient depending on the number of medications that patient takes (Institute of Medicine et al., 2000, p. 34). There is a direct correlation between the risk of an adverse drug event and the number of medications a patient current takes. For instance, if a patient only takes two medications the risk is relatively low. If a patient takes twenty medications, the risk for an adverse drug event is much higher.

Nurses play an important role in preventing medication errors. One study noted that 38% of ADEs that occurred during medication administration were attributed to nursing error (Patterson, Rogers, & Render, 2004, p. 355). Traditionally, nurses were expected to verify the 5 Rights of medication administration (the right patient, right drug, right dose, right time, and right route) whenever delivering medications to a patient. However, studies show that only 2% of ADEs and 34% of dispensing errors are caught before the patient receives the medication (Hook, Pearlstein, Samarth, & Cusack,

December 2008, para. 1). In another study it was stated, “6.5 adverse events related to medication use per 100 inpatient admissions; more than one fourth of these events were due to errors and were therefore preventable” (Poon et al., 2010, para. 1.)

One way to help try to decrease the risk of an adverse drug event is with the use of an advanced technology such as Bar Code Medication Administration (BCMA). In 2004 the Food and Drug Administration required hospitals to put linear bar codes containing the National Drug Code number on unit dose medications, blood, and blood products (Patterson et al., 2004, para. 355). This change required the pharmacy to repackage medications individually that had 1) previously been administered from stock meds, 2) brought to the hospital by the patient, 3) did not already have a bar code, 4) had been pre-mixed, like antibiotics that are reconstituted or IV fluids containing potassium or 5) were not compatible with the hospital’s scanning devices/software (Hook et al., December 2008, para. 18) BCMA is a revolutionary system using bar codes to provide a form of electronic verification, assuring the “5 Rights” of medication administration are being confirmed and is an effective strategy for preventing medication errors (Work, May/June 2005, para. 2; Rack, Dudjak, & Wolf, July/September 2012, p. 232; McNulty, Donnelly, & Iorio, 2009, p. 31; Gooder, 2011, para. 8; American Society of Health-System Pharmacists [ASHP], 2009, p. 588; Early et al., 2011, p. 160).

Bar Code Medication Administration is currently the gold standard and recommended by the National Patient Safety Foundation, The American Society of Health-System Pharmacists, Institute of Medicine and the National Alliance for Health Information Technology (Patterson et al., 2004, p. 355). BCMA was created to ensure

quality and safety for patients when performing medication administration. Its use adds an additional layer of security and safety by requiring the nurse to scan not only the patient, but also the medications to be given (Poon et al., 2010, para. 6). Integrating BCMA with other automated advance technology systems such as Electronic Medication Administration Records (eMARs) and Computer Physician Order Entry (CPOE) can reduce the risk of adverse drug events by preventing transcription and administration errors. However, this will only work if the technology is used as intended (Poon et al., 2010, para. 26, 29.)

The use of technology like BCMA allows hospitals to focus on the IOM's six aims for improvement care that is safe, effective, patient-centered, timely, efficient and equitable care, to improve overall quality care (Institute of Medicine, Committee on Quality of Health Care in America [IOM], 2001, p. 3). Observed benefits of using the BCMA include 1) reduced number of adverse drug events, 2) improved patient safety, 3) increased nurse staff satisfaction, and 4) improved patient satisfaction. All of these outcomes generate good relationships between the organization and the people it serves in the community (Work, May/June 2005, para. 12).

The procedure for BCMA is modeled on best practice of medication administration (McNulty et al., 2009, para. 31; Patterson et al., 2004, p. 361). New medication orders appear on the patient's eMAR once pharmacy has verified the order for the nurse to administer (Poon et al., 2010, para. 8). BCMA utilizes either a hand held scanner or a tethered scanner to scan the patient's unique bar coded wristband and any medication the patient is to receive (Early et al., 2011, p. 160; Patterson et al., 2004, p.

361). Most times the BCMA is integrated with the patient's eMAR to automatically document the administration and time with the use of the scanner (Early et al., 2011, p. 158; Patterson et al., 2004, p. 362; Poon et al., 2010, para. 9; ASHP, 2009, p. 589). After scanning the patient's barcoded wristband, if the scanned medication barcode data does not appear on the eMAR for what was actually ordered, an alert message will appear regarding the discrepancy (Patterson et al., 2004, p. 361; Poon et al., 2010, para. 9; McNulty et al., 2009, p. 31). This will lead the nurse to seek clarification of the order with pharmacy, nurse educator, and informatics to find a solution (Patterson et al., 2004, p. 361).

Proactively conducting continuous improvement for use of a particular system is an excellent way to promote compliance with BCMA policy and procedure (Patterson et al., 2004, p. 356). Building a "*community of knowledge*" allows nurses to have resources to use when troubleshooting issues with equipment failure such as barcoding or scanning (Patterson et al., 2004, p. 359). This "*community of knowledge*" develops from the resolution of known issues (Patterson et al., 2004, p. 359). The information can be placed on the facility's intranet for easy access when dealing with problems that can lead to workarounds during medication administration (Patterson et al., 2004, pg. 359). Creating a "*culture of safety*" by improving communication and collaboration between the nursing staff and pharmacist, also improves efficiency in the delivery of care including medication administration (Early et al., 2011, p. 158; Hook et al., December 2008, para. 25). Utilizing various healthcare technologies designed and focused at different parts in

the medication administration delivery process creates an opportunity to prevent ADEs (Early, Riha, Martin, Lowdon, & Harvey, 2011, para 4).

Local Problem

A comprehensive assessment of the microsystem for a 38-bed medical floor in an urban Northwest US Hospital was conducted utilizing microsystem assessment workbook developed by The Dartmouth Institute for Microsystem Assessment (Nelson, Batalden, & Godfrey, 2007). This workbook guided the assessment of a particular microsystem to identify needs for improvement in one or more of the six areas of improvement targeted by the Institute of Medicine's "To Err is Human: Building a safer Health System" in 1999 (safety, timeliness, patient-centeredness, efficiency, effectiveness, and equitable). The assessment focused on the five Ps (purpose, patients, professionals, patterns and processes) of a given microsystem. A well-developed and functioning microsystem has a precise purpose or mission, possesses keen knowledge about the patients they serve, and professionals who provided the care. The microsystem also has key processes that are used to provide care. Lastly, every microsystem has patterns (good and bad) that are reflected in the overall quality and function of the microsystem. These patterns can be observed in scheduled meetings, discussions and plans that are developed to address the needs of patients. They are also evident in quality reports, cost analyses and safety reports (Nelson et al., 2007, Chapter 13)

Purpose: The mission of the microsystem that was the focus of this project is framed and suspended on the wall for all patients, families, visitors and staff to view. It reads: *“Pursuing excellence in the delivery of innovative, safe practice, from infants to geriatrics.”* This is interpreted to mean they provide patient centered care that is efficient, effective, timely, equitable and safe for all patients throughout their lifespan. The medical floor includes a thirty-eight bed general medical floor, a four room Pediatric Unit, a six bed Progressive Care Unit (PCU), a Hospice Family Focus Suite, and twenty-seven general medical beds which also serve persons undergoing surgery and/or chemotherapy.

Patients: In 2012, this microsystem served over 7,700 patients, 59% females and 41% males, ranging in age from just a few months to over ninety years of age (V. Groeneweg, personal communication, March 11, 2013). The majority of inpatients were seventy-six years or older. The average daily census was approximately 26.4. This facility had a 30-day readmission rate of 13% in 2012, however it was unknown how many were specific to this unit. The average length of stay (LOS) for all types of admissions was 4.0 days. Most admissions to the floor were via the Emergency room, followed by inter-department transfers ending with direct admission from physician offices. Patient satisfaction scores, with their overall hospital experience, were rated excellent by 70% of the patients reporting. Satisfaction with the discharge experience was 82% according to the HCAHPS and AVATAR data surveys.

Professionals: A patient may encounter a wide spectrum of professionals from various disciplines in this microsystem. There were over 130 physicians who have admitting privileges at this facility. This included hospitalists, family practice physicians, surgeons, oncologists, pediatric doctors, and specialty physicians like pulmonologists and urologists. The nurses who work on this multi-faceted floor are required to be cross-trained to care for patients of all kinds and of all ages.

There were twenty-eight full time RNs, two full time LPNs, five full time nurses' aides and two full time unit clerks. Additionally, there were seventeen RNs, no LPNs, four nurses' aides and two units clerks who were employed part-time. The Casual Call staff included ten RNs, no LPNs, six nurses' aides and one unit clerk. No agency nurses were utilized at this facility. On a typical day shift there were at least one Team Leader, at least one PCU nurse and at least one Pediatric nurse. The remaining team members were medical/surgical nurses. Typically 10 nurses were scheduled, however core staffing fluctuated with patient census.

The social workers accounted for 1.5 FTE allotted for the medical floor, and they provided services every day of the week. The nurse educator assigned to this microsystem was available only on a part time basis. The unit was fully supported by outside departments such as Respiratory Therapy, Cardiology, Laboratory, Pulmonology, Radiology, Physical Therapy, Speech Therapy, and Occupational Therapy.

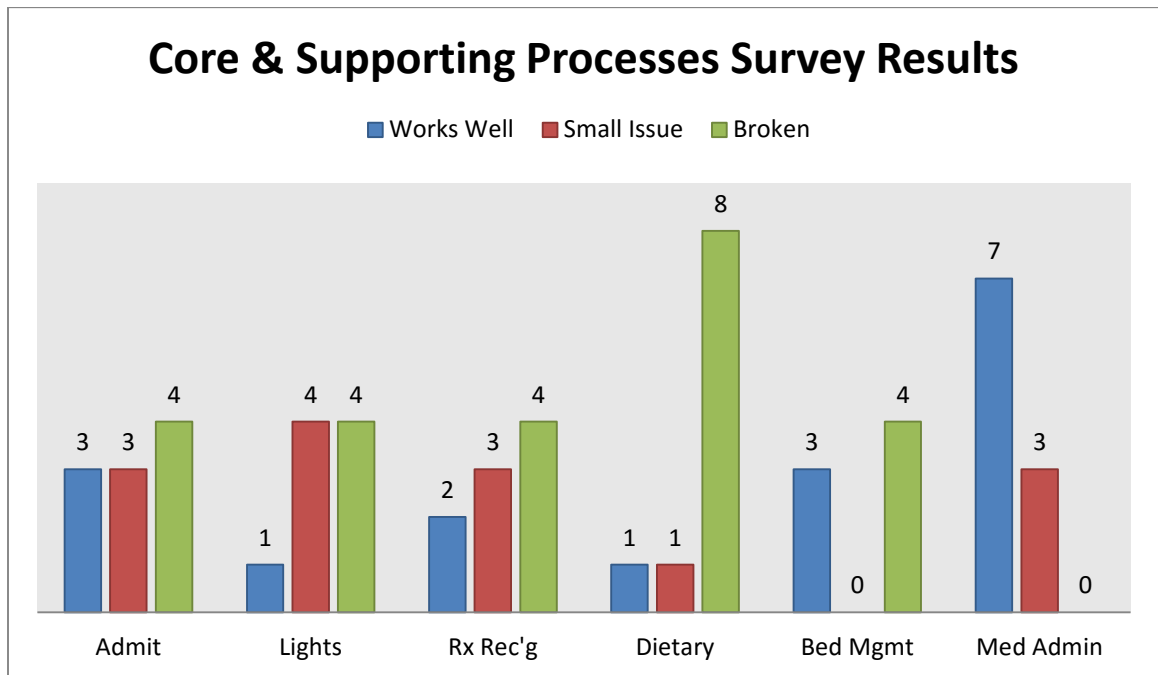
Other supporting departments included Palliative Care, Pharmacy and Oncology. According to the Gallup Survey – employee satisfaction was approximately 93% of the staff recommend this facility as a good place to work and only 8.8% of employees were

dissatisfied due to stressful work conditions (V. Groeneweg, personal communication, March 11, 2013). Patient satisfaction scores for nursing care averaged 74%, satisfaction with physicians averaged 76% and patients' biggest disappointment was with pain control at only 69% satisfaction. The majority (73%) were happy with their environment and care (V. Groeneweg, personal communication, March 11, 2013).

Processes: Thirty-three key processes were reviewed during this microsystem assessment. A survey was used to gather information about the nurses' perceptions to which processes were working well and which processes were broken. Refer to Graph 1 below for the results of the survey conducted by the author with ten day-shift nurses.

The results of the survey, during this microsystem assessment, indicated six major processes that were a real problem/totally broken. Forty percent of nurses reported the following processes of admission: answering call lights, receiving medications from pharmacy, bed management and having materials and equipment to complete their duties as not working. Eighty percent of nurses during this survey reported the dietary process was totally broken. However, 70% of nurses surveyed, reported Medication administration worked well.

Graph 1. Core and Supporting Processes Survey Results



After the survey was completed, it was shared with key hospital personnel. It was requested by administration to further observe the medication administration process, even though the nurses did not identify this as one of the processes that was a problem.

Medication administration was observed during this microsystem assessment as nurses went about their daily routine. The author observed ten nurses over a two-day timeframe complete medication administration with patients during this microsystem assessment. The nursing staff in this microsystem used BCMA in conjunction with eMARs to deliver medications to their patients.

The current procedure for medication administration is displayed in Figure 1. The expected procedure was designated by the straight arrows connecting each step in the procedure. Workarounds are defined as “actions that do not follow intended workflow,

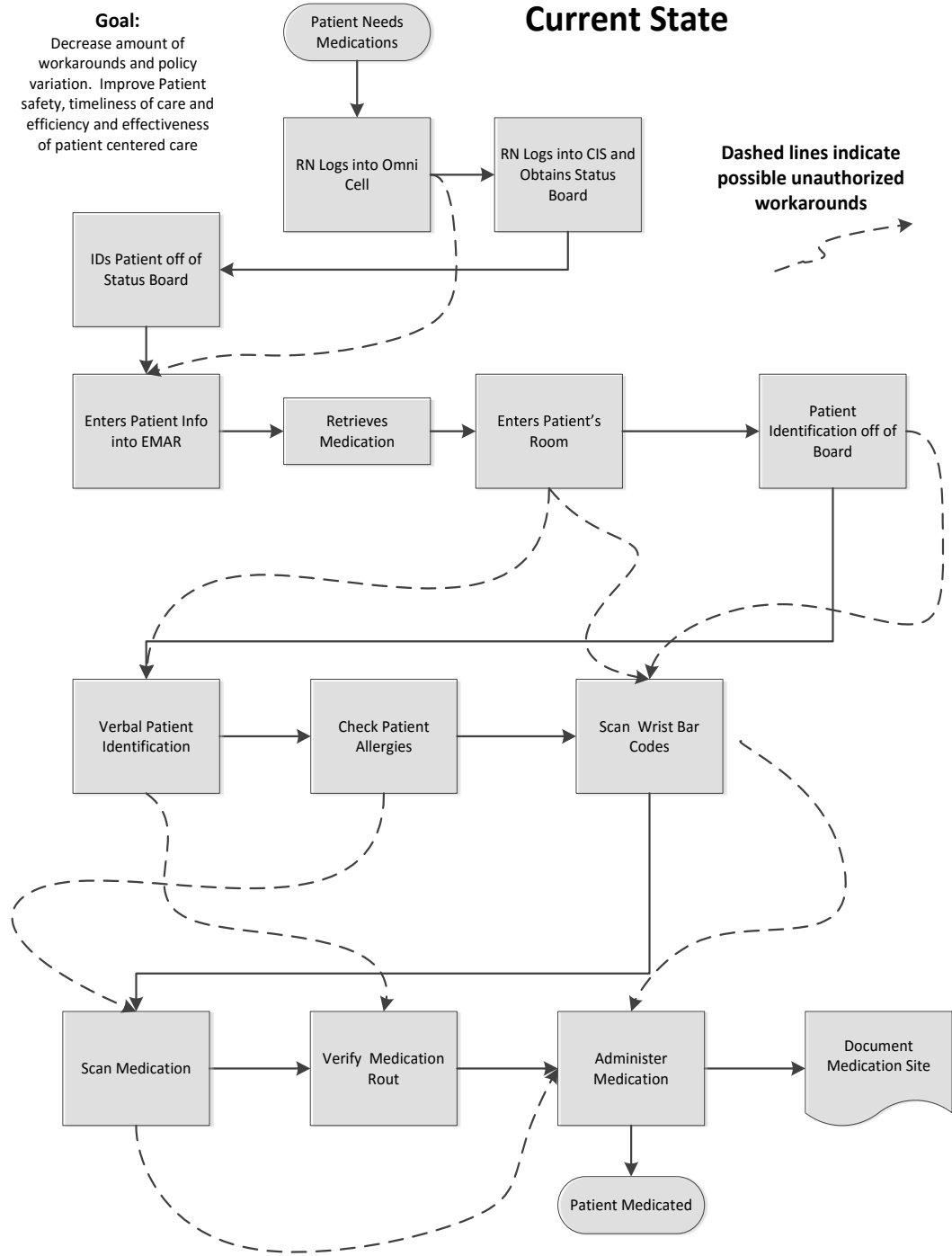
assumptions, workflow regulations, implicit rules or intentions of the system design” (Koppel, Wetterneck, Telles, & Karsh, 2008, p. 409).

Workarounds observed were noted by the curved, dotted lines in the flowchart. The process began when the nurse logged into the computer system, “Meditech”, and located their status board, finding the patient name they entered into the patient’s eMAR. Then the nurse logged into the Omni Cell, the secured medication distribution center, to obtain the patient’s profiled medication list. The nurse then compared the profiled list with the eMAR to determine which medications needed to be administered at that time. The nurse removed the medications from the Omni Cell and logged out of both systems.

The nurse then entered the patient’s room, logged back into “Meditech”, and located their status board. The nurse found the patient’s name and entered it into the patient’s eMAR. The nurse then scanned the patient’s unique barcoded wristband to identify the patient, and verified the information by asking the patient to identify his/her name, date of birth and allergies. The nurse compared the medications removed from the Omni cell to the eMAR; scanned the medications, verified the correct medication, dose, route and time to be given. If there were no discrepancies indicated, the nurse administered the medication, and finally submitted the transaction so documentation of the medication administration was completed in real time.

In Figure 1, there were workarounds that bypassed essential steps in the medication process, such as 1) the user logged only into the secured medication distribution center and did not log into the computer information system, “Meditech” to verify the patient’s profiled medications to the patient’s ordered medications.

Figure 1. Current Medication Administration Process Flow Map



2) The user did not verify patient's identity by having them verbalize their name, date of birth and allergies prior to scanning the patient's medications and administering them. 3) The user administered the medication to the patient without reviewing parameters for the intended medication. 4) The user did not scan the patient's unique barcoded wristband prior to administering medications. 5) The user had administered the medication without scanning the medication barcode to confirm the right medication, right dose and time. These examples presented are not unique to this microsystem, but in fact were noted in a study that observed nurses in two hospitals, along with hospital leaders and staff that were interviewed in five hospitals, participated in BCMA staff meetings and in one hospital were able to participate in a "failure-mode-and-effect analyses" (Koppel et al., 2008, p. 408). The themes were the same whether in a small urban facility or large metro teaching hospitals across the nation.

Staffing was another process in this microsystem that was assessed. It involved the Team Leader, every four hours, to assess the current census to determine staffing needs due to admissions and discharges that occurred throughout the day. During the day, between 7a-3p there were 10 nurses scheduled, between 7p-11p there were 8 nurses scheduled and 6 nurses were schedule during the night between 11p-7a. Nurses were put on call or given low census as per contract, when patient census was low. The nurses on this floor had a workload that fluctuated depending on where they were working. For instance, if a nurse was working with pediatric patients they cared for a maximum of four patients. If a nurse was working in the PCU, they cared for a maximum of three patients. If a nurse had any chemo patients, actively receiving chemotherapy, they cared for a

maximum of four patients, and finally if a nurse was working with medical or surgical patients, they cared for as many as 5 patients on days and 6 patients on nights (D. Grinshaw, personal communication, March 5, 2013).

Patterns: Patterns are evident in the daily workflow within any care environment. They can offer insight into potential areas to make improvement. It was said leadership, formal and informal, can build a knowledge of patterns, habits, and traditions that support learning and creativity. These attributes empower everyone to focus on improving processes for optimizing patient outcomes and creating the exceptional patient experience while hospitalized (Nelson et al., 2007).

The staff and leadership in this microsystem were actively engaged in other aspects of improvement work and were particularly proud of some patterns that demonstrated the effectiveness of this work. This facility had a 30-day readmission rate of 13% in 2012. To address this trend, the leadership within this microsystem had begun to address the issue of readmissions with the Congestive Heart Failure patient population. This was especially relevant to this microsystem as CHF was the most frequently identified admission diagnosis, followed by pneumonia. These two leading diagnoses are both core measures that CMS monitors, due to payment reimbursement changes that were coming, with pay for performance that had and will have an impact on the financial aspect of this microsystem. At this facility they had created a Transitional Care Team (TCT), comprised of department managers, cardiac rehab, quality department, case management and the CNO. The TCT created a tool to identify patients at high risk for

developing CHF, called the Lace Tool (V. Groeneweg, personal communication, March 11, 2013).

Another program identified as successful in this microsystem was the Falls Prevention Program and Hourly Rounding. In this initiative the nurses identified patients' at risk of falling based on a Falls Score greater than 3. If a patient had a score greater than three, the patient received a purple falls kit (purple bracelet, socks, blanket, falling stars sign, and a purple magnet) to uniquely identify the patient as needing assistance with any out of bed needs. The patient's bed alarm was activated to give an early warning sound if the high-risk patient attempted to get out of bed. Hourly Rounding ensured patient safety by anticipating their needs every hour during the day and every two hours at night. The 12 steps of Hourly Rounding included the RN/aide inquiring about pain, toileting assistance, comfort/repositioning; making sure the call light, telephone, TV remote, tissue box and bedside table all within reach (Kalman, Nigolian, & Olrich, 2012, table 1). The RN/aide asked if there was anything else the patient needed because they had time and gave a time when they would return. The microsystem conducted an audit from January 2012 to May 2012. The fall rate was 4.5 falls per 1000 patient days prior to initiation of these programs, and decreased to 1.9 falls per 1000 patient days during the audit (K. Kujawa, personal communication, March 18, 2013).

Hand hygiene was another program instituted in this microsystem named "Wash In, Wash Out". It was developed because an audit revealed less than 50% compliance rate on the medical floor. After implementation of the Wash In, Wash Out program,

audits were conducted daily around the unit to observe staff behaviors when entering and exiting patient rooms. This unit had a current compliance rate of 100% for all staff on the unit (B. Dyk, personal communication, March 11, 2013).

The microsystem administrators also monitor BCMA patterns/compliance and generate a monthly scanning report. The pharmacy director generates this report to determine individual user compliance. A scanning report from the previous month (before the microsystem assessment was conducted) indicated the microsystem was not 100% compliant with BCMA procedure. Medication scanned rates were 90.74%, and 95.79% for patient's scanned during medication administration on this unit. This finding indicated a need for improvements in on BCMA.

Purpose & Aim of Proposal: The purpose of this project was to improve safety in medication administration. By working on this process of medication administration, we also expected to improve timeliness of medication administration, nursing knowledge about BCMA, and compliance with prescribed policy. It is important to work on this process because adverse drug events harm at least 1.5 million people every year and cost approximately 3.5 billion dollars annually (Institute of Medicine et al., 2000, p. 33; Dubin, C., 2010, pg. 212). The specific aims were to improve nursing compliance with medication and patient scanning by at least 1% and increase overall nursing knowledge of BCMA policy and procedures by 20%.

CHAPTER 2

MethodsEthical Issues

The methods used to educate the medical floor staff nurses on BCMA Workarounds during medication administration were reviewed and approved by the MSU Institutional Review Board (IRB). The Clinical Nurse Leader (CNL) student, Quality Improvement Department manager, unit manager, Chief Nursing Officer, along with the CNL project committee from MSU supervised the implementation of this project. Information about the study, the risks, benefits, protection of confidential information was provided to participants on the pre-test, post-test, and survey. Completion of each of these measures indicated consent.

Setting & Sample

The setting for this project was an urban hospital located in Northwest America. Medical floor staff nurses were invited to participate in the study. Most of the attendees were female (90%), with the majority of nurses between the ages of 20-40 (see figure 2). Most of the nurses had a BSN degree (see figure 3) with the highest percentage of 61% with zero to five years of nursing experience (See figure 4), with the largest experience care area of general medical floor patients at 93% (see figure 5).

Figure 2: Age of Workforce

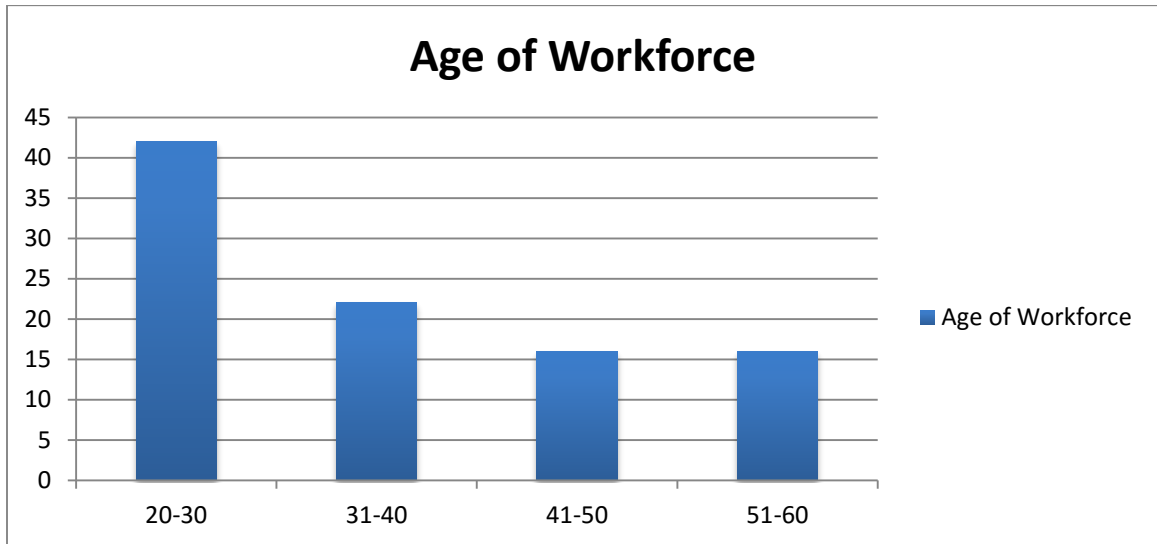


Figure 3: Nursing Education Breakdown

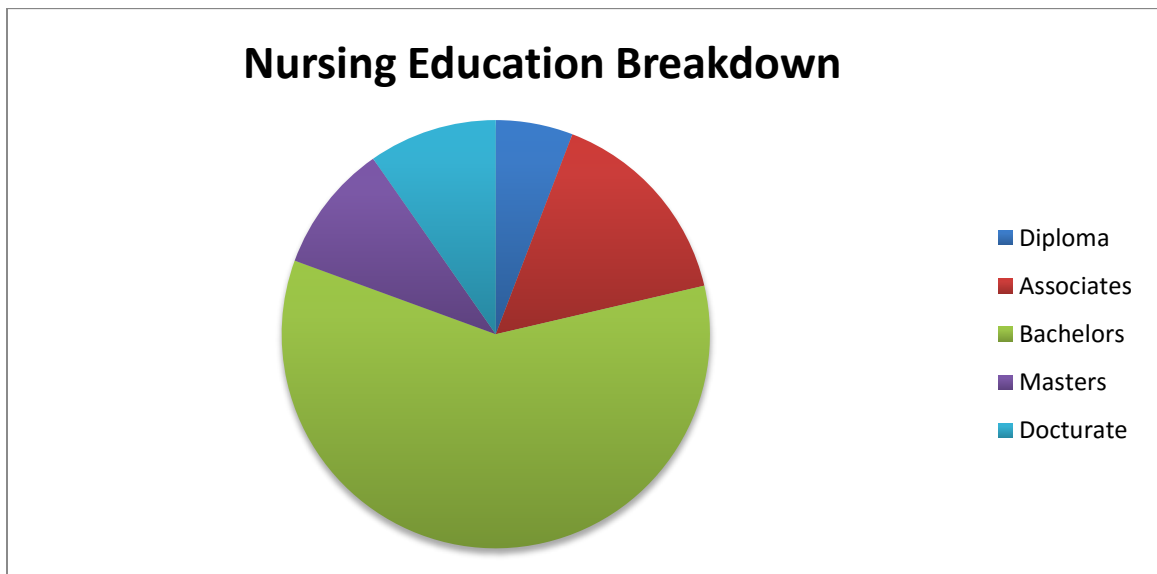


Figure 4: Years of Nursing Experience

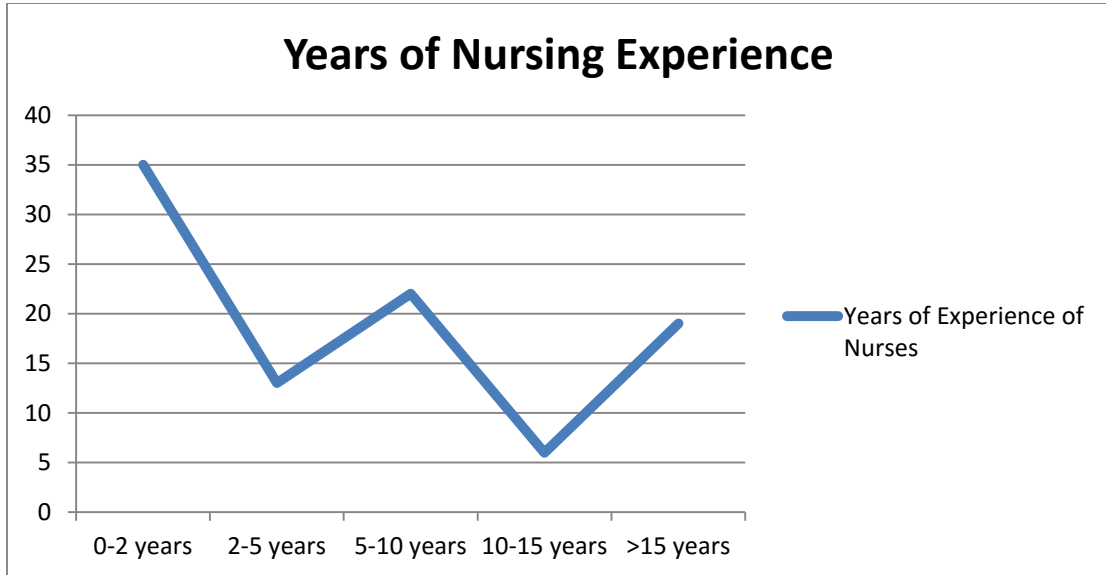
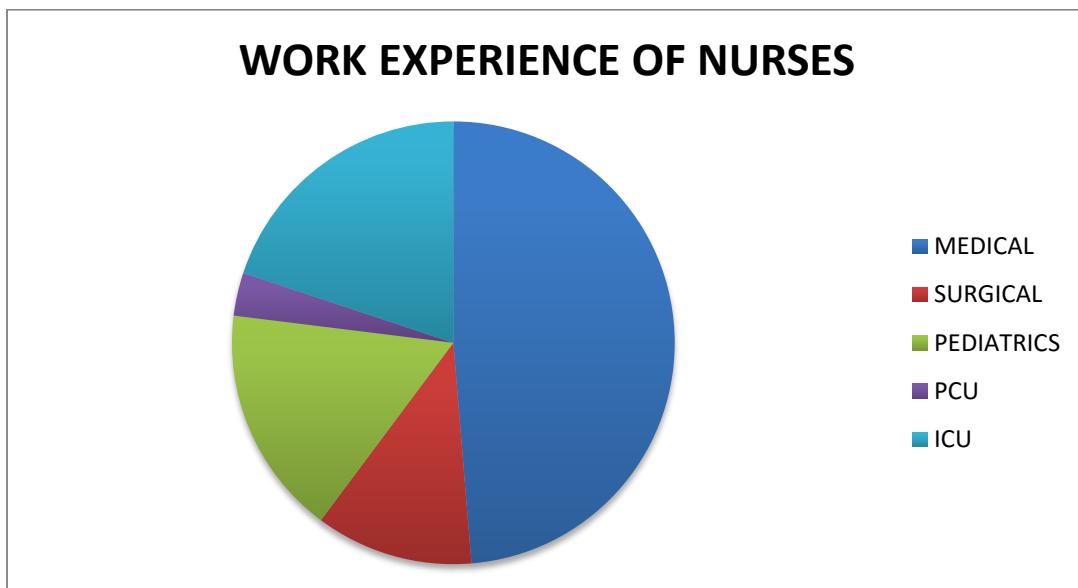


Figure 5: Types of Work Experience



Procedure

The first phase of the project focused on gathering baseline data about BCMA from the pharmacy department and nurses. An aggregate scanning report was collected from the Pharmacy Director before the workshop. The BCMA process was also observed 50 times to identify any variances in the BCMA process, and variances were documented on a worksheet that depicted the ideal process (Appendix A). The staff nurses recruited to participate in baseline data collection (N=23) were also asked to complete a short survey prior to the observation (Appendix B) that asked them to rate current satisfaction with BCMA process using an 11-point Likert scale anchored by 0 (very dissatisfied) and 10 (very satisfied). The survey also included 2 questions asking about individual likes/dislikes about the BCMA process and suggestions for improving the BCMA process. The second phase of the study was an educational workshop targeting medical floor staff nurses and focused on a review of Bar Code Medication Administration Workarounds observed in the first phase. The CNL Student met with the CNO, the manager of the medical unit and the nurse educator to review the outline of the educational offering and procedure for conducting a Root Cause Analysis (RCA) with the attendees. Two separate meetings with the staff were offered on different days in order to accommodate as many nurses as possible. Each meeting lasted less than two hours.

The CNL Student began the workshop with a greeting and introduction to the study and workshop. Next the CNL student explained the study (Appendix C) and requested the attendees to complete a pre-test (Appendix D). The pre-test was designed to assess baseline knowledge of policies and procedures regarding BCMA. After the

pretest was completed, the CNL presented a power point presentation on BCMA and workarounds. The outline of the Power Point Present consisted of:

- Background
- Local Problem
- Purpose
- Aim
- Methods for conducting the RCA

Next, the CNL student answered any questions about the material presented. A bathroom break was scheduled to occur before the CNL student engaged the attendees in a Root Cause Analysis (RCA) of BCMA workarounds.

The CNL student began the RCA by describing the function of a cause and effect diagram (i.e. Fishbone) in the big picture of the improvement process to engage them in creating and modifying a fishbone diagram. The CNL student also reviewed the specific aim of the study to clarify the effect or outcome of interest (Nelson et al., 2007, p. 318), BCMA workarounds. The CNL student then provided the major categories of causes that contributed to the variance (time, equipment, policy, medications, patients and staff). Together as a group, the CNL student and attendees participated in a brainstorming session to further identify causes in the larger categories – using affinity grouping.

This process was refined, regrouped and improved as the brainstorming session ensued. After the fishbone diagram was completed, the group was asked to identify one cause to further review using the 5 Whys assessment approach to determine a root cause

and counter measure to improve BCMA workarounds. At the end of the RCA the CNL student asked the attendees to complete a post-test and respond to a survey.

The post-test was administered to assess changes in baseline knowledge about BCMA workarounds and RCA (Appendix E). A written survey was also administered to obtain demographic information (age of the nurses, years of experience, types of experience and type of education) and feedback on the nurses' perception of the workshop and their experience engaging in the RCA (Appendix F). No identifying data were collected. The last step of the workshop included closing statements thanking them for their participation. After the workshop, the BCMA process was observed again 50 times and post workshop scanning rates were reviewed from pharmacy.

Data Analysis

Categorical data were analyzed and reported as frequencies and percentages. Means were calculated for quantitative data. Pharmacy scanning reports reporting the percentage of medications and patients scanned by all nurses (treated as an aggregate, de-identified group) before and after the workshop were examined to determine if there was an improvement in percentages. The independent T-test was used to determine if the average number of variances per observation differed before and after the workshop.

The percent of persons answering each item correctly on the pre and post-test was calculated along with a summary score for each test. An average grade was then calculated for group pre-test and the post-test scores. The difference between the group pre-test and post-test scores was analyzed using the independent t-test.

The qualitative data collected during the workshops about potential root causes were clustered into categories and displayed as a fishbone analysis. Qualitative data from the survey regarding the workshop and the experience of participating in a RCA were analyzed and categorized into themes. Mean BMCA satisfaction scores were also calculated and displayed in a table.

CHAPTER 3

Results

There were several important findings in this project that were revealed in the RCA, observation of the BCMA process, pre and post testing, and feedback from the participants. The project aims were achieved-- the overall knowledge about BCMA policy and procedures improved by 31%. Scanning compliance also improved-- medication scanning increased by 5.9 percentage points and patient scanning increased by 1.2 percentage points.

Root Cause Analysis

The Root Cause Analysis that was developed in the workshop revealed several problems that contribute to BCMA workarounds that are displayed in Figure 6. During the RCA the teams were able to identify four major categories like wrist bands, medications, equipment, and policy as contributors to the problem of BCMA Workarounds.

First Major Category was medications and the contributing issues with medications were crinkled bar codes on the medication, medication not available while it was on the eMAR, and medications that were coded by the pharmacy but did not scan properly.

The Second Major Category was the actual medication administration policy.

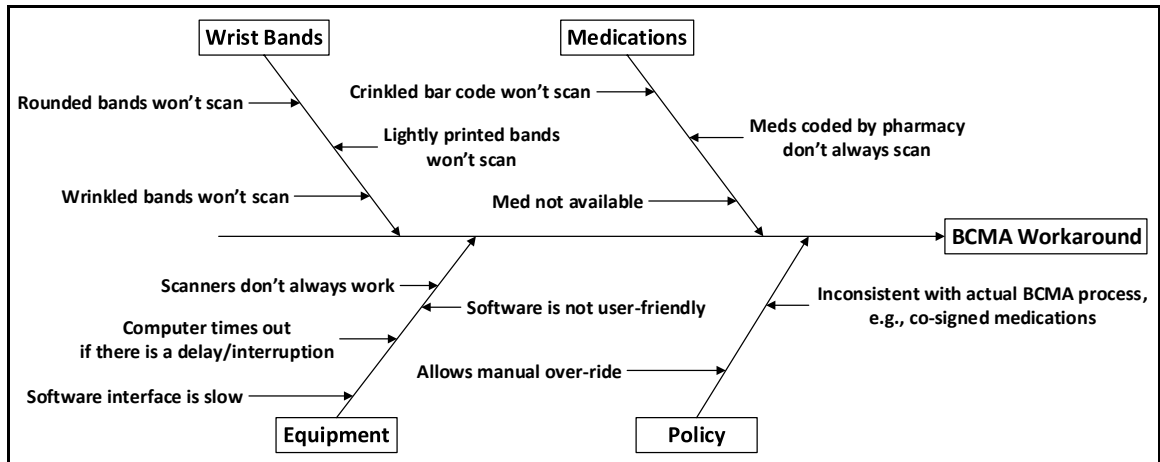
The contributing issues were one the policy was inconsistent with actual BCMA process workflow and the policy detailing step by step instructions on how to complete a manual overrides, which then armed nurses with the knowledge on how to create workarounds to meet their needs.

The Third Major Category that was discussed was equipment and how there were software interfacing issues, malfunctions with the scanning equipment. Another issues that was important to the staff was how the software was not very user friendly and time consuming. Lastly computer timing issues when attempting to administer a medication and documentation practices were frustrating for nurses when it impacted their time management with their workflow.

Lastly, the Fourth Major Category was the actual wrist band themselves. The ineffectiveness of the bar code being on a rounded wrist bands created scanning patient difficult and time consuming to the point where it was bypassed with the use of a manual override, wrinkled bar codes on the wrist bands did not scan creating frustration, often times leading to extra wristbands on the bedside table or windowsill, and if the bar code was lightly printed it would not scan as well leading to some staff utilizing manual overrides or scanning extra wrist bands in the room. Collectively it was decided to tackle one of the major categories and after much discussion, it was decided it would be easier to incorporate into practice for the wrist band to be replaced for the short term

intervention as well as discussing at a staff meeting the possibility of changing the design of the wrist bands to something that did not have as much variable issues with scanning.

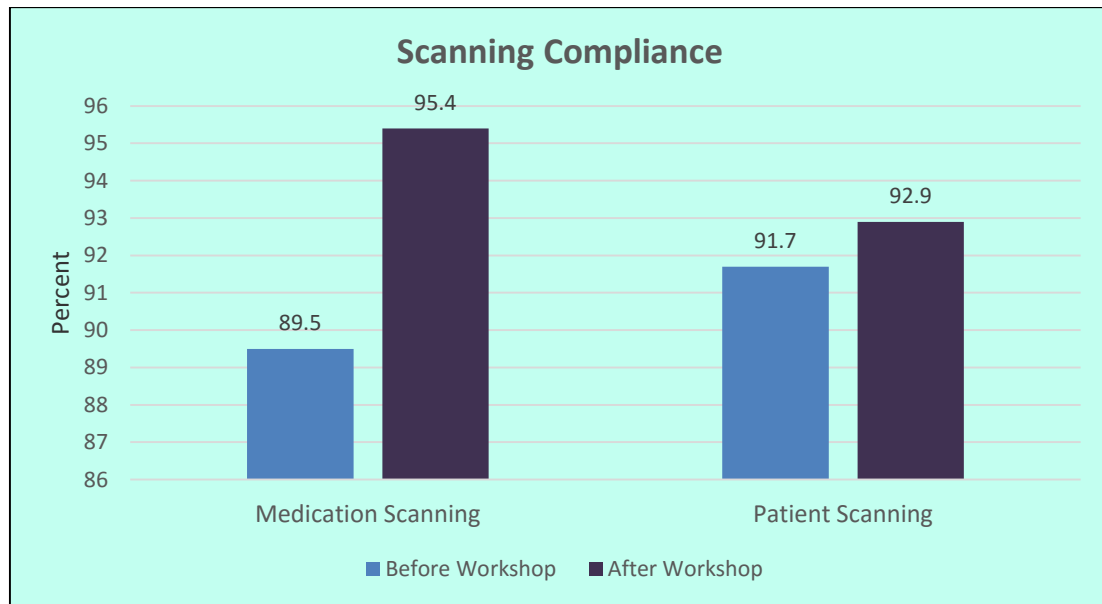
Figure 6: Fishbone Analysis



Medication and Patient Scanning Compliance

The percentage of medications scanned improved by nearly 6 points after the workshop and the percentage of patients scanned also increase by 1% (Graph 2). Before the workshop, the scanning report owed that, on average, 89.5% of the medications were scanned properly by the nurses, along with 91.7% of the patients. After the workshop 95.4% of medications were scanned properly, and 92.9% of patients were scanned prior to receiving medications. This represents at least a 1% improvement in BCMA scanning procedure compliance on the medical floor.

Graph 2: Medication and Patient Scanning Compliance



Observational Survey

Table 1 displays the mean score of the observational survey asking staff nurses to rate their satisfaction with the current BCMA process (N=23). The average score was 7.26 on a scale that ranged from 0 (very dissatisfied) to 10 (very satisfied), indicative of satisfaction with the current BCMA process. Sixty percent (60%) were moderately satisfied (rated satisfaction as 6, 7, or 8), and 25% were very satisfied (rated satisfaction as 9 or 10).

Table 1. Nurse Satisfaction with Current BCMA process (N=23)

	Mean	SD
Satisfaction Survey (0=Very Dissatisfied to 10= Very Satisfied) Range (4-10)	7.26	1.60

Variation in BCMA Process

The average number of variances observed before and after the workshop also decreased significantly from 2.5/observation to 1.5/observation (Table 2).

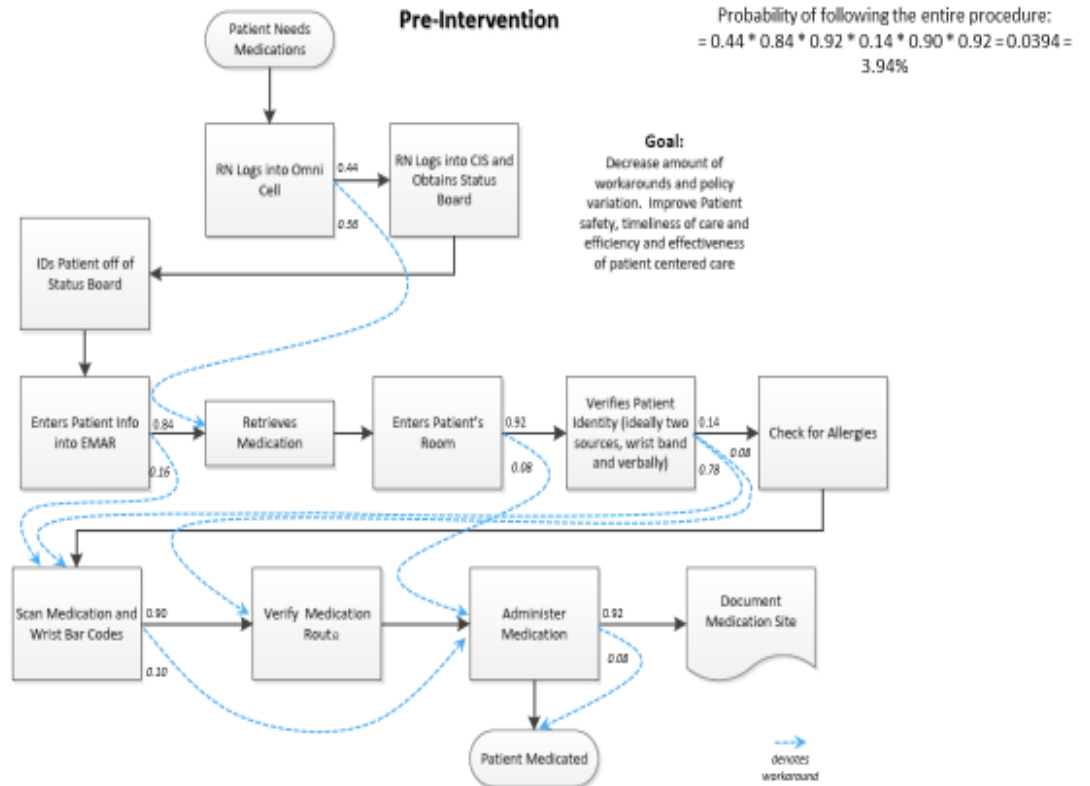
Table 2. Average Number of Variances

	Before Workshop	After Workshop
Average Number of Variances (SD)	2.50 (2.44)	1.52 (2.06)*
Range (0-10)		

* $p = .032$

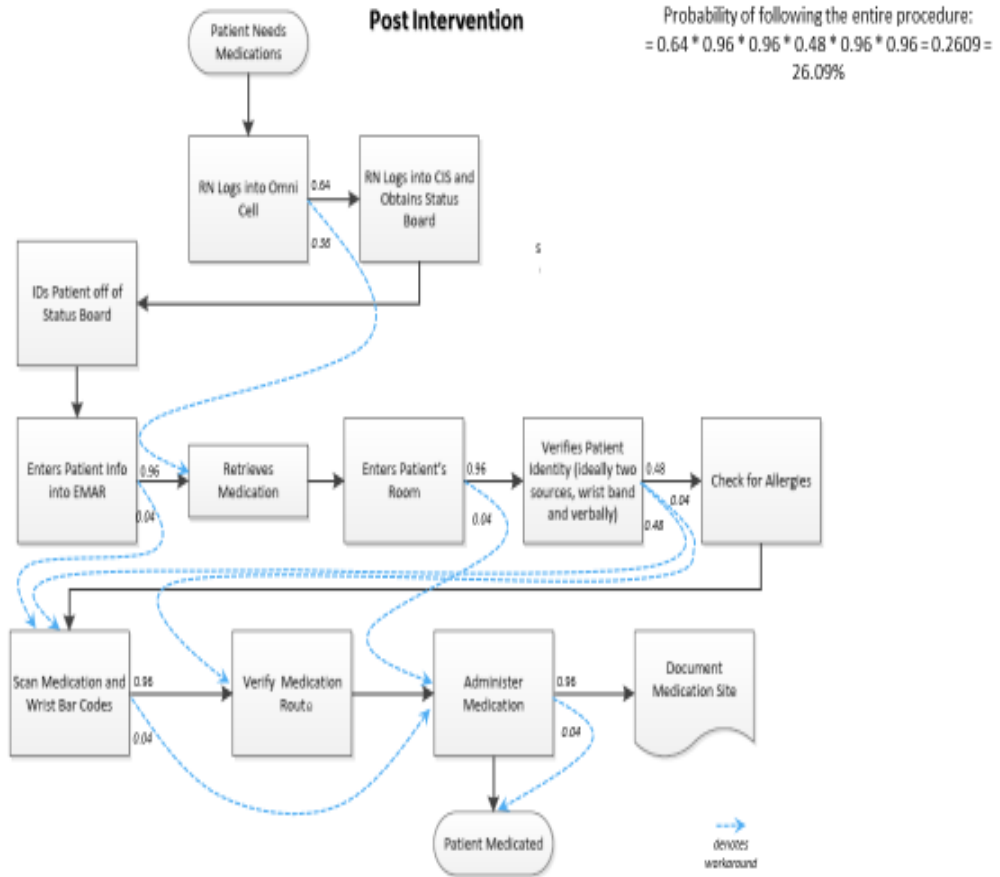
Figure 7 displays the BCMA Process Flow Map and the percentage for each workaround identified during the direct observations. Fifty six percent of the time nurses bypassed logging into the computer system at the same time as logging into the medication dispensing unit (Omni Cell). The most notable workaround indicated 86% of the time, nurses' did not verify allergies at the bedside.

Figure 7. Pre-Intervention Process Flow Map



However, in the Post-Intervention BCMA Process Flow Map (Figure 8) demonstrates marked improvement with the entire process. Nurses were more compliant as evident by the 20% decrease in the workaround of bypassing the step to enter the computer system along-side of entering the medication dispensing unit (Omni cell). As well as allergy verification at the bedside increased by 34%.

Figure 8. Post-Intervention BCMA Process Flow Map



Pre and Post Test

The results of the pre and post-test are displayed in Table 3. It is notable that the pretesting revealed 96% were aware there was a policy/procedure for medication administration at this facility, but that number was not reflected in the items that tested knowledge of specific components of the policy (Items 2-10)). For example only 58% were aware they needed to log into both computer systems simultaneously to retrieve medications for a patient.

Table 3: Pre and Post Test Results

	Item	Pre	Post
1	Aware of Policy	96	100
2	Required to log in to both Omni Cell & Meditech	58	90
3	Compare profiled medications prior to retrieval	76	90
4	How to confirm patient's ID	55	67
5	Need to confirm allergies each time	79	100
6	Scanning patient wristband while sleeping	79	77
7	Manually enter wristband or name in non-emergent encounter	82	90
8	Use extra wristbands	100	100
9	Acceptable time frame	79	87
10	Utilize co-workers mnemonic as co-sign for pediatric patient	97	100
11	Familiar with BCMA workarounds	56	100
12	Identify BCMA workarounds	55	100
13	Familiar with purpose of Root Cause Analysis	45	96
14	Familiar with fishbone diagram	21	100
15	Familiar with 5 Why's	61	100
	Total	70	92***
	***<i>p</i> < .001		

About half of the nurses were able to correctly confirm a patient's identity prior to administering medications. In addition 55% of nurses were familiar with and able to identify a BCMA workaround. However only 45% were familiar with what a root cause analysis was or how it was used in finding a solution. Finally, about a fifth of the nurses were familiar with a fishbone diagram on the pre-test evaluation.

The post-test results revealed significant improvement, however it is disappointing to see that after discussing the policy/procedures of BCMA, only 67% of nurses knew how to correctly verify the patient's identity and nearly one-fourth were still not able to correctly identify the acceptable timeframe for giving scheduled mediations (60 minutes).

Qualitative Results from Workshop Survey

The analysis of responses to the post-workshop survey questions that explored perspectives on BCMA workarounds revealed several themes. The staff acknowledged that workarounds happen and that they are unsafe. However, they are also noted that these workarounds are unavoidable when the computers don't function properly. Others felt that the workarounds are result of poor time management or lack of awareness about the policy.

When asked which parts of the workshop were informative they reported the power point presentation raised awareness about the workarounds that were occurring in their unit and appreciated seeing a flow chart of the medication administration process as written in the policy and the workarounds that were witnessed. When asked which part of the root cause analysis was most informative, one attendee stated, "Thinking in problem-solving fashion is at the core of increased safety" (anonymous, personal communication, December 2014). Others stated, it was a good way to raise awareness of the problem by seeing the data. When asked which part of the fishbone analysis was more informative, participants noted it was easy to see all the possibilities in the diagram. They appreciated having the opportunity to brainstorm solutions, pinpoint issues and

understand the different factors that contribute to the problem. When asked about the 5 Whys, one person stated, “when looking at the 5 Whys, specific changes could be targeted and measured, it forces us to evaluate our workflow and why we work that way ” (anonymous, personal communication, December 2014).

The nurses who were observed before the workshop also provided information about the BCMA process. Only 30% rated their satisfaction moderate satisfaction with the current BCMA process. There was a 4% rating on very dissatisfied perception and a 8.6% rating for very satisfied perception of staff.

Staff noted they liked the extra security and assurance the 5 rights of medication administration provided along with being followed. They also liked the fact that it was easy to scan the medications and felt that BCMA enhanced time management and organizational skills and reduced the risk for errors. They did not like the technical difficulties they encountered with hardware (computer, scanners, and software package), difficulties reading wristbands with the scanners, and the slow response from computers. They reported difficulties with the software system in that it takes a lot of time to scan medications and the inconvenience of having to re-enter login information when the system closed out before the nurse was able to complete documentation. Cosigning for others was also cited as a problem, along with problems they have with medications prepared by the pharmacy that will not scan properly. Not surprising, the staff suggested improvements included better computer software package, improved barcoded wristbands, and updating computers and scanners.

CHAPTER 4

Discussion

This project was designed to raise awareness about BCMA workarounds and engage staff in the process of planning improvements in this process. The specific aims for this study were to improve overall nursing compliance rates for medication and patient scanning rates by at least one percentage point and increase overall knowledge of BCMA policy and procedures by 20%.

Knowledge of BCMA Policy and Procedure

It was clearly evident in reviewing the pre-test results that there was poor understanding of the policy for BCMA. Nurses were unaware of the need to enter into both computer systems to verify medications being dispensed from the Omnicell. This is an important step because it allows the nurse to validate that the medications ordered by the physician in the EMAR match the medications profiled in the Omnicell by the pharmacist. The nurse also needs to verify the correct medication dose, frequency and route. This safety check is a good example of how the “Swiss Cheese Model” can be systematically used to avoid failure/error. This safety check helps nurses find and correct transcription errors, and prevent an adverse drug event due to medication error.

It was very clear in the direct observations both pre and post workshop that there is substantial variation in BCMA in this microsystem. This was a surprising result since medication administration is one the most frequent tasks a nurse completes during the

day. The post workshop observations indicated improved compliance with the policy but variations were still observed.

The most surprising and disturbing finding was that only 22% of observations verified the patient's allergies. This is a significant patient safety issue. Confirming patient allergies before administering medication is essential to prevent an adverse drug event and harm to our patients (Shane, 2009). Post workshop results on the verification of allergies did increase to 52%. Although there was an increase in compliance there still remains a potential patient safety issue. More improvements are needed to ensure compliance in this area.

Failure to follow organizational policy and procedures designed to standardize practice and reduce variations in the BCMA process is a serious threat to patient safety (Early et al., 2011). There is a very narrow margin for error in healthcare for good reason--any mistakes can lead to a life threatening situation that is costly to the patient as well as the system (Keller, 2012).

Engaging Frontline Nurses

This work highlights several innovative approaches that can be used to engage frontline nurses in continuous quality improvement. Inviting medical floor staff nurses to attend a BCMA Workshop to learn about BCMA, discussing the variances that were observed, and participate in a root-cause analysis of BCMA workarounds was a novel and effective way to educate nurses about BCMA policy and procedures. Informal transformational leadership can motivate staff to identify variations and promote best practice (Porter-O'Grady, & Malloch, 2014). As a transformational leader it is essential

to demonstrate creativity, growth and ability to sustain relationships through effective and efficient communication (Barker, et al., 2006). It is also important to be able to meet each participant's individual learning style in order to make sure the information is received, understood and accepted.

In order to build an excellent team, it is important to select, develop, and engage professionals in a way that utilizes their talents, skills, to enhance knowledge in a supportive, creative learning environment (Nelson et al., 2007). Education that focuses on sharing best practices, identifying successful solutions and creating cycles of continuous learning which was done during the process of conducting a root cause analysis can promote change that leads to improved practice (Bowen, D., 2014; Nelson et al, 2007). As the team learns and works together they develop a mutual respect and trust, learning they are stronger together than alone, thus able to accomplish more as a unit to create a culture of safety for patients by improving processes to ensure quality care. This bond created will help create early adopters and possibly early majority from within this microsystem (Suter, 2013).

Creating valuable and positive practice changes that have the potential to reduce BCMA workarounds is important work. Change is essential to growth, but without effective change agents and frameworks for change, most efforts are unsuccessful because they are not accepted by staff or sustained (Mitchell, 2013). Change takes time, and requires effort, patience and constant encouragement by the leadership team (Dearmon, Roussell, Buckner, Mulekar, Pomrenke, Salas, et al., 2013).

Planned change is a purposeful, calculated, collaborative effort to create improvements and best accomplished with the assistance of a change agent or key stakeholder (Mitchell, 2013). In the context of Lewin's change theory, one can see how this project began the process of unfreezing current thoughts on BCMA process, and initiated movement from current practice that does not comply with policy/procedures towards best practice that includes very few workarounds (Mitchell, 2013). Conducting a root cause analysis during the educational workshop provided staff nurses with the opportunity to examine the data and participate in the process of brainstorming causes and potential solutions for BCMA workarounds. When change originates at the point of care and the process engages the frontline workers (nurses) to transform the work processes, quality of care and staff satisfaction on a unit follows. This is what is meant by transforming care at the bedside (Dearmon et al., 2013).

At first it was intimidating and a bit overwhelming as the leader of this project to think about hosting an educational workshop for approximately thirty staff nurses about a process they use multiple times during a typical work day- approximately 40% of the nurses' time is spent administering medications (Shane, 2009). Focusing on the type of variations observed during BCMA instead of individual performance allowed the group to explore root causes of BCMA workarounds more easily and identify ways to minimize their occurrence. Working with this particular microsystem was an instructive and very satisfying experience. The staff was open minded when first approached to be part of this study, and demonstrated high levels of trust, collaboration and respect for each other and the CNL student. Their trust in the CNL student sparked the confidence needed to

conduct and carry out the project. That trust grew throughout this entire process. The workshop participants provided some sound suggestions for improvement including upgrading to be more unified computer software package system, redesigning the wristbands to reduce scanning difficulties, and developing a system for routine equipment maintenance to ensure it is dependable and working properly.

In retrospect, some aspects of the project could be changed to make it more successful. Reducing the number of participants in each workshop would enhance participation and the quality of brainstorming. Scheduling a few smaller focus groups would be another way to enhance the group process. A less formal presentation may also to promote participation.

Using a fishbone diagram to categorize the categories of root causes (barcoded wristbands, medications, equipment, policy, and time) was an excellent way to visualize the work being done by the group. Asking the participants to ask ‘why’ the causes occur also helped to promote brainstorming of countermeasures like replacing the wristband immediately if scanning issues were detected during BCMA. The student CNL observations of the BCMA process and workarounds provided insights into the scope of the problem. Direct observation is a very important method to incorporate into any microsystem assessment.

Nursing Implications

A CNL would be a perfect partner with the medical floor manager, supervisor, team leaders and nurse educator to assist with ongoing education to ensure patient safety during BCMA. Properly utilizing the advanced technology of BCMA, with minimal

workarounds will provide that an extra layer of security and safety during medication administration. Following policies and procedures ensures quality and safe practices for the patient populations served. Engaging the staff in a root cause analysis was a very effective way to raise awareness about BCMA workarounds and promote compliance. Because nurses play such an important role in preventing medication errors, they are the last line of defense to protect the patient.

The BCMA process needs to be monitored regularly and workarounds that do occur need to be reviewed regularly to ensure patient safety. Continued monitoring of compliance with BCMA procedures and policies is needed to decrease the risk of Adverse Drug Events (ADE)s. This will also increase patient satisfaction, patient safety and be a cost effective method to reduce the overall cost of ADEs.

Limitations

This was a process improvement project and these results are unique to this setting and have not been applied to any other care setting within this facility or outside the service area. The possibility of a Hawthorne effect could not be disproved on the direct observations post education. There is uncertainty if the same results or outcomes would be replicated in different environments due to various variables like turn over, processes, or participants.

Recommendations

There are several recommendations to consider from this project. These include scanning reports, trust and respect, policy and procedure, and team work. They say

quality improvement focuses on enhancing existing processes, or designing quality processes, and decreasing variation in order to achieve improvements in measured outcomes (Barker et al., 2006).

Scanning Reports: The CNL should disseminate monthly scanning reports for staff nurses to review, as a visual aide of the progression or regression of their efforts in scanning compliance. Conducting quarterly audits using direct observations would allow the CNL to ensure compliance with new process changes and validate sustained change in practice (Di Censo, Guyatt, & Ciliska, 2005).

Trust and Respect: By continuing to build on the developed trust, mutual respect and empathy of the staff during ongoing educational opportunities, allows the CNL to begin the process of developing a culture of safety and a new community of knowledge to be shared with the staff. The CNL will be able to elicit feedback during tests of change in ongoing process changes. For instance, based on the feedback from the nurses during the RCA, the CNL could enlist the help of nurses to redesign patient wrist bands to be more effective and efficient while using the tool for process improvement called the PDSA. This project could help to reduce workarounds and improve the BCMA process as well as increase efforts of the nursing staff to promote patient safety.

Another potential improvement project that could be undertaken by the CNL would be to collaborate with bioengineering to set up a regular schedule for routine maintenance of the computers and scanning equipment as suggested from the feedback of the nurses during the workshop.

Finally, the CNL could follow up with the suggestions from the root cause analysis in the workshop for an upgraded integrated computer system, where every department can communicate and share information all within one system. Systems like McKesson or EPIC for example. The CNL would be the liaison and voice of the frontline nurses to senior management to highlight thoughts and concern over patient safety. The CNL can empower nurses to participate in solutions, innovations, and acceptance of changes to practice (Barker et al., 2006).

Policy & Procedure: The CNL could prepare a proposal to share with senior management with a focus on the risk to patient safety related to workarounds, specifically in regards to allergy verification. This process would entail a complete review of the current policy and workflow to determine if the policy reflects current practice. The CNL could create a new standardization for allergy verification within the process of BCMA along with a new process flow map to improve predictions on the percentage of workarounds.

Teamwork: It's been said that teamwork is the heart of quality improvement and with the various diverse brains working together collaboratively to find a solution to improve the process of BCMA, and to ensure safe medication delivery to our patients, we are able to achieve the desired outcomes we are seeking (Barker et al., 2006). The CNL can foster teamwork by using effective communication like email, posters, social media, face to face interaction and newsletters; creating a culture for learning like valuing feedback, maintaining trust and respect, inspiring and empowering nurses to use evidence

based practice and guidelines in their efforts as change agents. The CNL becomes part of the unit “family” by working with and for the manager, educator, staff, physicians and patients.

CHAPTER 5

ConclusionSummary

Adverse drug events are inevitable in healthcare, and every effort should be made to reduce the incidence of preventable adverse events (errors) in medication administration. BCMA is the gold standard for medication administration, as it requires nurses to simultaneously scan patients' wristbands and medications as a method for verifying the 5 rights of medication administration. BCMA and policy and procedures governing its use were designed to reduce the risk of errors that can occur during medication administration (preventable ADEs) (Poon et al., 2010, para. 30). BCMA workarounds increase the risk for adverse drug events leading to patient harm.

In this project, the process of BCMA was perceived to be working well by the nursing staff, however many BCMA workarounds were observed. The purpose of this project was to improve the BCMA process and compliance with agency policy. The aims were accomplished by providing an educational workshop to the medical floor nurses that actively engaged them in a root cause analysis of observed BCMA workarounds. It will be important to continue to engage the staff in any BCMA improvement work that results from this project.

Nurses play an important role in preventing medication errors. They are the last line of defense to protect the patient from preventable adverse events. It is estimated that a hospitalized patient is exposed to at least one medication error per day, so it is no

surprise that reducing the risk of preventable medication errors is a high priority (Koppel et al., 2008, p. 408). Innovative approaches that engage frontline workers in the improvement process are needed to ensure the Institute of Medicine's six aims for quality improvement; to deliver safe, effective, timely, efficient, equitable and patient-centered care, are achieved. This project demonstrated how a clinical nurse leader (CNL) can engage frontline staff and provide the clinical leadership needed to enhance healthcare quality.

REFERENCES CITED

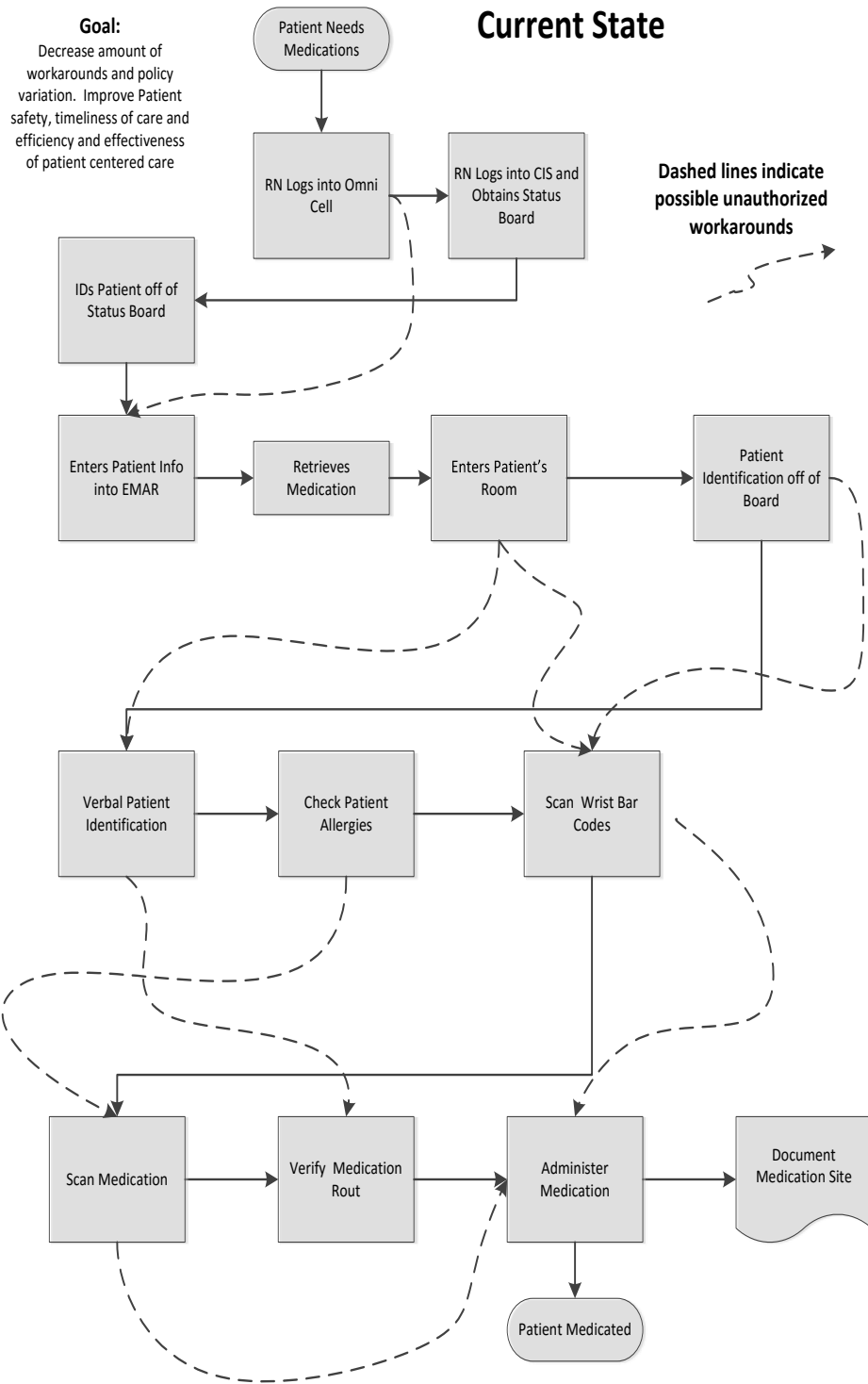
- American Society of Health-System Pharmacists. (2009). ASHP statement on bar-code-enabled medication administration technology. *American Journal Health System Pharmacists*, 66, 588-590.
- DiCenso, A., Guyatt, G., & Ciliska, D. (2005). *Evidence-based nursing: A guide to clinical practice*. St. Louis, MO: Elsevier Mosby.
- Dubin, C. (2010). Bar-code scanning at four health care facilities in the U.S. *Pharmacy and Therapeutics*, 35(4), 212-214, 233.
- Early, C., Riha, C., Martin, J., Lowdon, K. W., & Harvey, E. M. (2011). Scanning for safety: an integrated approach to improved bar-code medication administration. *CIN: Computers, Informatics, Nursing*, 29, 157-164. Retrieved from <http://dx.doi.org/10.1097/ncn.0b013e3181fc416d>
- Gooder, V. (2011). Nurses' perceptions of a (BCMA) bar-coded medication administration system. Retrieved from <http://ojni.org/issues/?p=703>
- Hook, J. M., Pearlstein, J., Samarth, A., & Cusack, C. (December 2008). Using barcode medication administration to improve quality and safety: Findings from the AHRQ Health IT portfolio. Retrieved from http://healthit.ahrq.gov/images/dec08bcmareport/bcma_issue_paper.htm
- Institute of Medicine Committee on Quality of Health Care in America. (2001). *Crossing the quality chasm: A new healthcare system for the 21st century*. Retrieved from <http://www.nap.edu/books/0309072808/html>
- Institute of Medicine, Committee on Quality of Health Care in America., Kohn, L. T., Corrigan, J. M., & Donaldson, M. S. (Eds.). (2000). Errors in health care: A leading cause of death and injury. *To err is human: Building a safer health system* (pp. 26-48). Washington, DC: National Academy Press.
- Kalman, M., Nigolian, C., & Olrich, T. (2012). Hourly rounding: a replication study. *MedSurg Nursing*, 21(1), 23-26, 36. Retrieved from <http://ehis.ebscohost.com.proxybz.lib.montana.edu/ehost/pdfviewer/pdfviewer?siid=936ca4e7-a47d-4bc1-8956-b102f29cb4c8%40sessionmgr111&vid=2&hid=104>
- Koppel, R., Wetterneck, T., Telles, J. L., & Karsh, B.-T. (2008). Workarounds to barcode medication administration systems: Their occurrences, causes, and threats to patient safety. *Journal of the American Medical Informatics Association*, 15, 408-423. Retrieved from <http://dx.doi.org/10.1197/jamia.M2616>

- McNulty, J., Donnelly, E., & Iorio, K. (2009). Methodologies for sustaining barcode medication administration compliance: A multi-disciplinary approach. *Journal of Healthcare Information Management*, 23(4), 29-33.
- Nelson, E. C., Batalden, P. B., & Godfrey, M. M. (2007). *Quality by design: a clinical microsystems approach*. San Francisco, CA: Jossey-Bass.
- Patterson, E. S., Rogers, M. L., & Render, M. L. (2004). Fifteen best practice recommendations for bar-code medication administration in the veterans' health administration. *Joint Commission Journal on Quality and Safety*, 30(7), 355-365.
- Poon, E. G., Keohane, C. A., Yoon, C. S., Ditmore, M., Bane, A., Korach, O. K.,... Gandhi, T. K. (2010). Effect of bar-code technology on the safety of medication administration. *The New England Journal of Medicine*, 362, 1698-1707. Retrieved from <http://dx.doi.org/10.1056/NEJMsa0907115>
- Rack, L. L., Dudjak, L. A., & Wolf, G. A. (July/September 2012). Study of nurse workarounds in a hospital using a bar code medication administration system. *Journal of Nursing Care Quality*, 27(3), 232-239. Retrieved from <http://dx.doi.org/10.1097/NCQ.0b013e318240a854>
- Shane, R. (2009). Current status of administration of medicines. *American Journal of Health System Pharmacy*, 66(Suppl 3), S42-8.
- Work, M. (May/June 2005). Improving medication safety with a wireless, mobile barcode system in a community hospital. *Patient Safety & Quality Healthcare*. Retrieved from <http://www.psqh.com/mayjun05/casestudy.html>

APPENDICES

APPENDIX A

BCMA PROCESS FLOW MAP



APPENDIX B

OBSERVATIONAL SURVEY

BCMA Observational Survey

This survey is part of a study being done by Lynda Gullett, a graduate student at Montana State University – Bozeman. She is a registered nurse attempting to complete her master's project, with a focus on Bar Code Medication Administration (BCMA) Workarounds.

The observations and data obtained, along with your responses contained in this questionnaire are completely anonymous.

There is minimal risk associated with participating in this study. It is possible that you may experience some fatigue during the survey. It is possible you may feel apprehension or anxiety while observations of the BCMA process is being conducted. You are free to stop participating at any time. There is no risk to employment status if you refuse to participate. All responses will be confidential and only aggregate data will be reported. Observations will be of the BCMA process only. Observations will be obtained by, Lynda Gullett, a graduate student at MSU.

There is no benefit for participating, but participants may learn more about BCMA workarounds and risk of medication adverse events by participating.

Consent to participate is assumed if you return the completed survey. If you wish to participate in this study, please answer the questions below and return to Lynda Gullett today as directed.

Please provide the short answers to the following questions:

1. What is your current satisfaction with Bar Code Medication Administration (BCMA) process?

0=Very Dissatisfied

10=Very Satisfied

0 1 2 3 4 5 6 7 8 9 10

2. What likes and dislikes do you have about BCMA process?

3. What suggestions do you have to improve BCMA process?

APPENDIX C

NURSE INFORMATION SHEET

Nurse Information Sheet

Title: BCMA Workarounds: A Learning Experience

Principal Investigator: Lynda M. Gullett, RN BSN 406-580-7212

Faculty Supervisor: Linda Torma, PhD, APRN, GCNS-BC

Study Contact: Lynda M. Gullett, RN BSN 406-580-7212

What is the purpose of the study?

The purpose of this project is to improve awareness of Bar Code Medication Administration Workarounds amongst the nursing staff on the medical floor and engage them in a root cause analysis to identify reasons why workarounds occur on the unit during BCMA. The information we learn from this study will be used to increase awareness and risks of workarounds, decrease the percentage of workarounds and increase overall knowledge of BCMA policies and procedures.

What is required to participate in this study?

To qualify for this study you must be 18 years of age; be a staff nurse on the medical floor at BDH during the time of the study; be a resident of Montana and be able to speak English.

What can I expect as a study participant?

Consent will be implied by filling out a pre and post test and/or survey. The pre/post tests and survey takes approximately 10 minutes each to complete. The completed questionnaires will then be placed in the envelope provided, sealed and returned to the principal investigator. You can choose to not answer any questions you do not want to answer during completion of the questionnaires. You can also stop participating at any time.

What effect will this study have on my clinical care?

Your decision to participate or not participate in this study will not affect your employment status.

What are the possible risks of participating in this study?

There is minimal risk associated with participating in this study. It is possible that you could become fatigued while completing the questionnaires and you have the option of stopping to rest or terminate participation. Some of the questions may make you uncomfortable. You do not have to answer any questions you do not want to answer.

What are the possible benefits of participating in this study?

There is no benefit to you for participating in this study.

Will it cost me anything to participate?

There is no cost to you to participate in this study.

How will my privacy be protected?

Each nurse questionnaire will be coded and will not contain any identifiable data.

What if I am harmed in this study?

If you believe you have been harmed or injured while participating in this research and require immediate treatment, contact your health care provider and Lynda Gullett at (406) 580-7212. There is no compensation available from Montana State University for injury.

What are my rights as a participant?

If you have any questions about your rights as a research participant, you may contact Lynda Gullett at 406-580-7212. If you have additional questions about the rights of human subjects you can contact the Chair of the Institutional Review Board, Mark Quinn, at 406-994-4707 (mquinn@montana.edu)

APPENDIX D

WORKSHOP PRE-TEST

Bar Code Medication Administration Pre-test

This pre-test is part of a study being done by Lynda Gullett, a graduate student at Montana State University – Bozeman. She is a registered nurse attempting to complete her master's project, with a focus on Bar Code Medication Administration Workarounds.

The information and your responses contained in this questionnaire are completely anonymous.

There is minimal risk associated with participating in this study. It is possible that you may experience some fatigue during the pre-test. You are free to stop participating at any time. There is no risk to employment status if you refuse to participate. All responses will be confidential and only aggregate data will be reported.

There is no benefit for participating, but participants may learn more about BCMA workarounds and risk of medication adverse events by participating.

Consent to participate is assumed if you return the completed pre-test. If you wish to participate in this study, please answer the questions below and return to Lynda Gullett today as directed.

Please complete this pre-test. Circle the response that you think is the best.

1. Are you aware there is a policy and procedure for medication administration?
 - a. Yes
 - b. No
2. Are you required to log into both the Omni Cell and Meditech simultaneously to retrieve medications for a patient?
 - a. Yes
 - b. No
3. Are you required to compare the profiled medications in the Omni Cell to the eMAR in Meditech prior to retrieving medications for a patient?
 - a. Yes
 - b. No
4. To confirm a patient's identification you would
 - a. Verify name and date of birth
 - b. Verify name, date of birth and visualize the patient's wristband
 - c. Ask a family member that is present (except pediatric patients)
 - d. Look at the wrist band while patient is sleeping.
5. Is it necessary to confirm allergies with every medication administration encounter?
 - a. Yes
 - b. No

6. Is it acceptable to scan a patient's wristband while they are sleeping to replace a maintenance IVF bag to complete the medication administration?
 - a. Yes
 - b. No
7. Is it acceptable to manually enter a patient's wristband or name look up when administering medication during a non-emergent encounter?
 - a. Yes
 - b. No
8. Is it acceptable to have extra wristbands in the patient room to scan for easier scanning?
 - a. Yes
 - b. No
9. What is the acceptable time frame to medicate a patient for scheduled medications?
 - a. Within 30 minutes
 - b. Within 60 minutes
 - c. Within 90 minutes
 - d. Whenever the patient requests it
10. For pediatric patients, is it acceptable to utilize a co-workers mnemonic when administering medications as a co-sign without them present?
 - a. Yes
 - b. No
11. Are you familiar with BCMA workarounds?
 - a. Yes
 - b. No
12. Which of the following are BCMA workarounds?
 - a. Omission of the process steps
 - b. Steps performed out of sequence
 - c. Unauthorized BCMA process steps
 - d. All of the above
13. Are you familiar with how and why a root cause analysis would be completed?
 - a. Yes
 - b. No
14. Are you familiar with a fishbone diagram?
 - a. Yes
 - b. No
15. Are you familiar with the "5 Whys" assessment to problem solving?
 - a. Yes
 - b. No

APPENDIX E

WORKSHOP POST-TEST

Bar Code Medication Administration Post-Test

This post-test is part of a study being done by Lynda Gullett, a graduate student at Montana State University – Bozeman. She is a registered nurse attempting to complete her master's project, with a focus on Bar Code Medication Administration Workarounds.

The information and your responses contained in this questionnaire are completely anonymous.

There is minimal risk associated with participating in this study. It is possible that you may experience some fatigue during the post-test. You are free to stop participating at any time. There is no risk to employment status if you refuse to participate. All responses will be confidential and only aggregate data will be reported.

There is no benefit for participating, but participants may learn more about BCMA workarounds and risk of medication adverse events by participating.

Consent to participate is assumed if you return the completed post-test. If you wish to participate in this study, please answer the questions below and return to Lynda Gullett today as directed.

Please complete this post-test. Circle the response that you think is the best.

1. Are you aware there is a policy and procedure for medication administration?
 - a. Yes
 - b. No
2. Are you required to log into both the Omni Cell and Meditech simultaneously to retrieve medications for a patient?
 - a. Yes
 - b. No
3. Are you required to compare the profiled medications in the Omni Cell to the eMAR in Meditech prior to retrieving medications for a patient?
 - a. Yes
 - b. No
4. To confirm a patient's identification you would
 - a. Verify name and date of birth
 - b. Verify name, date of birth and visualize the patient's wristband
 - c. Ask a family member that is present (except pediatric patients)
 - d. Look at the wrist band while patient is sleeping.
5. Is it necessary to confirm allergies with every medication administration encounter?
 - a. Yes
 - b. No

6. Is it acceptable to scan a patient's wristband while they are sleeping to replace a maintenance IVF bag to complete the medication administration?
 - a. Yes
 - b. No
7. Is it acceptable to manually enter a patient's wristband or name look up when administering medication during a non-emergent encounter?
 - a. Yes
 - b. No
8. Is it acceptable to have extra wristbands in the patient room to scan for easier scanning?
 - a. Yes
 - b. No
9. What is the acceptable time frame to medicate a patient for scheduled medications?
 - a. Within 30 minutes
 - b. Within 60 minutes
 - c. Within 90 minutes
 - d. Whenever the patient requests it
10. For pediatric patients, is it acceptable to utilize a co-workers mnemonic when administering medications as a co-sign without them present?
 - a. Yes
 - b. No
11. Are you familiar with BCMA workarounds?
 - a. Yes
 - b. No
12. Which of the following are BCMA workarounds?
 - a. Omission of the process steps
 - b. Steps performed out of sequence
 - c. Unauthorized BCMA process steps
 - d. All of the above
13. Are you familiar with how and why a root cause analysis would be completed?
 - a. Yes
 - b. No
14. Are you familiar with a fishbone diagram?
 - a. Yes
 - b. No
15. Are you familiar with the "5 Whys" assessment to problem solving?
 - a. Yes
 - b. No

APPENDIX F

WORKSHOP SURVEY

BCMA Workaround Workshop Survey

This survey is part of a study being done by Lynda Gullett, a graduate student at Montana State University – Bozeman. She is a registered nurse attempting to complete her master's project, with a focus on Bar Code Medication Administration Workarounds.

The information and your responses contained in this questionnaire are completely anonymous.

There is minimal risk associated with participating in this study. It is possible that you may experience some fatigue during the survey. You are free to stop participating at any time. There is no risk to employment status if you refuse to participate. All responses will be confidential and only aggregate data will be reported.

There is no benefit for participating, but participants may learn more about BCMA workarounds and risk of medication adverse events by participating.

Consent to participate is assumed if you return the completed survey. If you wish to participate in this study, please answer the questions below and return to Lynda Gullett today as directed.

Please provide the following demographic information by circling the correct response.

1. Gender
 - a. Female
 - b. Male
2. Age
 - a. 20-30
 - b. 30-40
 - c. 40-50
 - d. 50-60
3. Education
 - a. Diploma
 - b. Associates Degree
 - c. Bachelor's Degree
 - d. Master's Degree
 - i. CNL
 - ii. FNP
 - iii. FNPMH
 - e. Doctorate Degree
 - i. DNP
 - ii. PhD

4. Experience
 - a. 0-2 years
 - b. 2-5 years
 - c. 5-10 years
 - d. 10-15 years
 - e. >15 years

5. Types of Experience
 - a. General Medical Floor
 - b. Surgical Floor
 - c. Pediatrics
 - d. ICU
 - e. Progressive Care Unit
 - f. Palliative Care/Hospice

It is important for the CNL student to have as much feedback as possible on this project. Please provide as much detailed information about your satisfaction or dissatisfaction of the presentation.

1. Were you aware of any possible workarounds that occur during BCMA?
 - a. Yes
 - b. No

2. What are your thoughts about BCMA workarounds?

3. Did you find the presentation informative?
 - a. Yes
 - b. No

4. Which parts of the workshop were informative?

5. Have you ever been involved in a RCA?
 - a. Yes
 - b. No

6. Which part of the RCA was most informative?

7. Have you ever been involved in creating a fishbone diagram?
 - a. Yes
 - b. No

8. Which part of the fishbone diagram did you find most informative?

9. Have you ever been involved with the 5 Whys assessment tool?
 - a. Yes
 - b. No

10. Which part of the 5 whys assessment was most informative?

11. In your opinion do you feel the RCA was effective in working on a solution to decreasing the amount of workarounds that occur during BCMA?
 - a. Yes
 - b. No

12. Why or why not was the RCA effective in working on a solution to decreasing the amount of workarounds during BCMA?

13. In your opinion do you feel like the 5 Whys assessment was effective in identifying a workable solution?
 - a. Yes
 - b. No

14. Why or why not was the 5 Whys assessment effective in identifying a workable solution.

15. Would you recommend this presentation to other co-workers?
 - a. Yes
 - b. No