Fall 12-15-2017

Increasing Patient Safety During Medication Administration

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Abstract

Medication administration error is one of the crucial medical errors that compromises patient safety in hospitals each day. Direct observations were conducted to assess medication administration (MA) accuracy and practices in order to determine the root cause(s) of errors at a community-based, non-profit hospital. Failure to scan patients' wristbands, to verbally verify patients' identity with two identifiers, and to verbally verify patients' allergies, were some practices that were found to lead to medication administration errors. Implementation tools such as an informative video and reminder signage at bedside computers were piloted at the oncology unit of the hospital to improve nursing practice consistency during medication administration.

Keywords: medication administration error, medical errors, patient safety

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Increasing Patient Safety During Medication Administration

Medical errors such as medication errors are persistent global problems that can threaten patient safety in the hospital. Improving patient safety by reducing medication errors has become a prevalent topic among healthcare professionals as well as political entities in the United States (Benjamin, 2003). Research by The National Academies of Sciences, Engineering, & Medicine (2006) indicates that annually there are 400,000 preventable medical errors occurring in hospitals, 800,000 occurring in long-term care settings, and about 530,000 occurring in outpatient clinics. According to Lassetter and Warnick's (2003) study, these medical errors are estimated to cost large hospitals $5 million per year, in addition to $17-$29 billion to the U.S. economy. Beyond financial repercussions, research has shown that approximately one out of 25 hospital patients are injured and 44,000 to 98,000 hospitalized patients die from medical errors each year, which is estimated as the eighth leading cause of mortality in the United States (Lassetter & Warnick, 2003). However, Stefanacci and Riddle (2016) have found that medical errors have escalated to become the third leading cause of death in the United States in more recent years, resulting in about 10,000 complications every day. These newer findings estimate the financial burden to the U.S. healthcare system as greater than $1 trillion per year (Stefanacci & Riddle, 2016).

At least 1.5 million people are harmed by one of the most common medical errors each year in the United States – medication errors (Muroi, Shen & Angosta, 2017; The National Academies of Sciences, Engineering, & Medicine, 2006). Medication errors are defined by the National Patient Safety Agency as "Any incidents where there has been an error in the process of prescribing, dispensing, preparing, administering, monitoring or providing medicines advice, regardless of whether any harm occurred or was possible" (Kavanagh, 2017, p. 159). Medication

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error, listed as one of the most common medical errors by the Institute of Medicine of the National Academies, has received much national attention since the publication of a revealing report titled "To Err is Human: Building a Safer Health Care System" in 1999 (The National Academies of Sciences, Engineering, & Medicine, 2006). Notably, Donaldson, Aydin, Fridman, & Foley (2014) stated that preventable medication errors accounted for about 42% of medical errors that resulted in injury or death. Each year, preventive medication errors are costing $16.4 billion in inpatient settings and $4.2 billion in outpatient settings (NPP, 2010). Although medication errors have been greatly reduced since the introduction of the Veterans Affairs Bar Code Administration Project in 1999 and electronic prescribing in hospital settings, the problem persists due to the complexity involved in the process. Human error (such as lack of verification, miscommunication between providers, and inadequate staff) is a significant factor that contributes toward medication errors (Anderson & Webster, 2001; Benjamin, 2003; Elliot & Liu, 2010; Kavanagh, 2017; Muroi et al., 2017; Stefanacci et al., 2016). The Reason's Theory, also known as the Swiss Cheese Theory, explains the phenomenon of active (human) and latent (system) failures that can contribute to medication errors. It is when all safety practices and measures are not executed by individuals and/or when any failure within the layered defense system of any complex process is not addressed (Anderson & Webster, 2001; Muroi et al., 2017). Hence, while it is important to rectify incorrect patterns of human behavior to prevent errors, it is just as important to understand the contributing factors that cause medication errors by utilizing systems-approach techniques, such as nonpunitive, anonymous incident reporting (Anderson & Webster, 2001; Kavanagh, 2017; Stefanacci et al., 2016). Such techniques remove blame from individuals, uncover systemic causes that contribute toward medication administration errors, as well as drive initiatives that develop preventive strategies to improve

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patient care - as a result, patient safety increases. Some of the most essential strategies that hospitals can adopt to achieve error reduction are as follows: perform continuous monitoring of nurses following the 'five rights' rule during administration; ensure correct patient identification and allergy status; implement auto-identification technology; perform two-nurses double-check independently; protect drug administration time; ensure that the same nurse prepares and administers the medication; improve communication among health care workers; keep up with medication training; provide medication safety guidelines; promote patient education and communication between nurses and patients; use past errors as learning experiences; report all near misses and medication errors; and improve staff skills and competencies (Kavanagh, 2017). Reduction or elimination of medication errors can significantly increase patient safety, increase quality of patient care, decrease morbidity and mortality, decrease litigation, reduce financial burden on hospitals, reduce overall cost of the healthcare system, reduce length of hospital stay, and reduce potential adverse emotional impact on hospital staff morale (Anderson & Webster, 2001; Muroi et al., 2017; Kavanagh, 2017; Stefanacci et al., 2016).

Statement of Problem

A community-based, not-for-profit hospital would like to improve patient safety by reducing its medication error rate. According to the most recent statistics provided by the hospital's medication safety pharmacist, 2,162,138 doses of medications have been administered in the past year. Ninety-seven percent barcode scanning compliance has prevented major medication errors; however, the remaining 3% noncompliance (which amounts to 64,864 doses of medication) has been causing medication errors that range from Category A to Category E* per the National Coordinating Council for Medication Error Reporting and Prevention index (see Appendix A). To further reduce the existing medication error rate and to prevent similar errors

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from occurring in the future, the Patient Safety/Risk Management Department performed a cross-campus root-cause analysis to investigate the underlying cause(s) of the errors in lieu of blaming the errors on individuals. Furthermore, research revealed that interruption might compromise safe medication administration practice, which increases potentials for medication administration error (Donaldson, Aydin, Fridman, Foley, 2014; Kavanagh, 2017; Muroi et al., 2017). In response to such revelation, a registered nurse from the Endocrine Unit launched a campaign named "Mindfulness", whereby nurses were provided with lanyards to wear and warning signs to place at patients' doors to protect their time while alerting other staff to refrain interruption during medication administration. This investigation also concluded that most medication errors occurred as a result of failure to scan patients' wristbands prior to medication administration. Hence, the hospital administration is interested in examining the following aspects that might be perpetuating the existing medication errors: which units persistently fail to scan the wristbands before medications are administered to patients; which workflow interruptions adversely impact safe medication administration practice; whether the "Mindfulness" campaign mitigates interruptions during medication administration; and whether the "five rights" are consistently practiced by the nurses. Figure 1 presents a visual delineation of the root-cause analysis that identifies the focus of the project.

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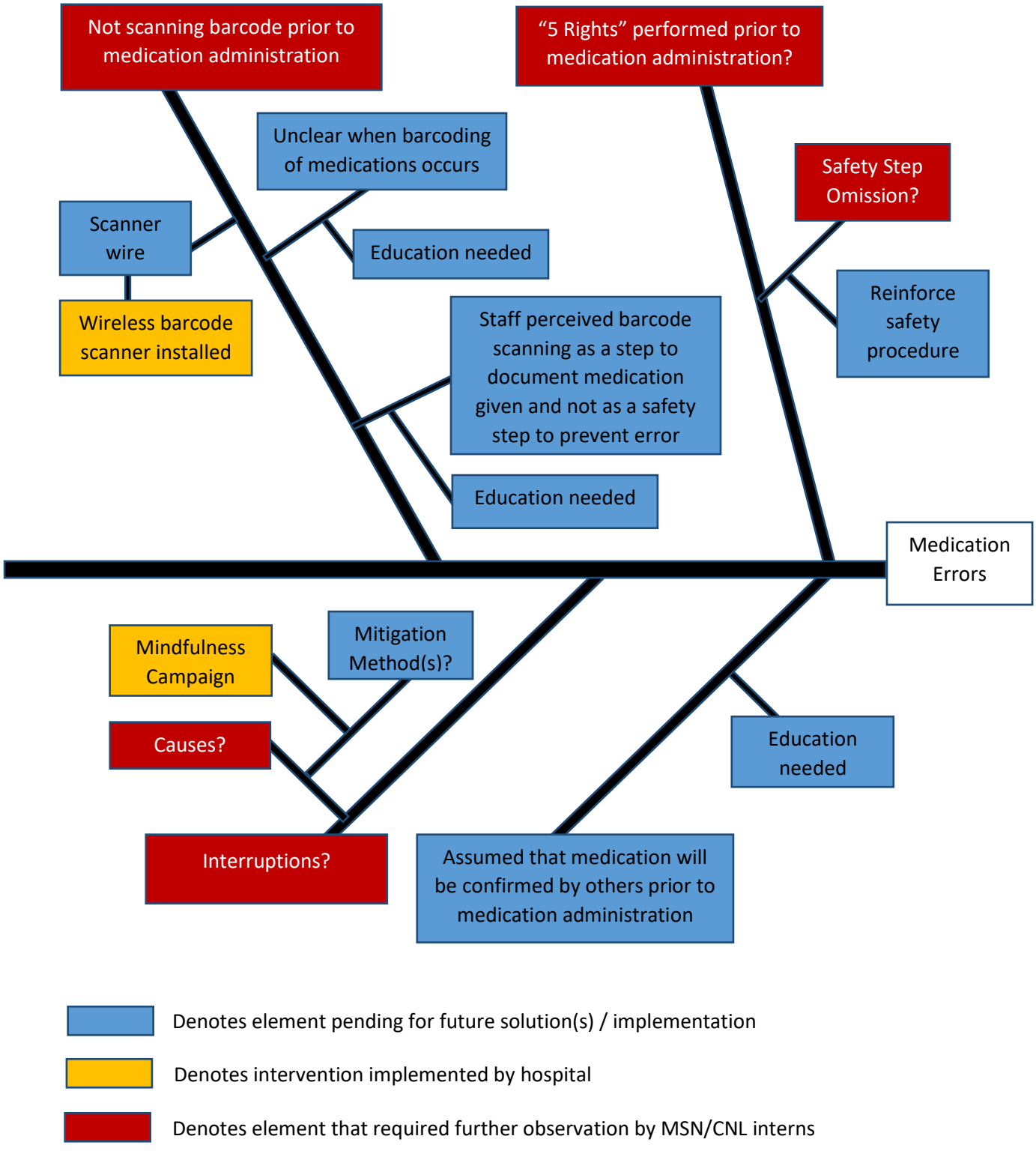

Figure 1. Fishbone diagram of causes of medication error.

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Method

The author of this paper is one of seven Master of Science in Nursing (MSN) / Clinical Nurse Leader (CNL) interns that conducted a CNL quality improvement project for the hospital. The main goal of the project was to address the hospital's current medication administration error issue. To achieve this goal, the following assessments were performed: (a) assess whether nurses were scanning patients' wristbands prior to medication administrations; (b) assess which specific units remained noncompliant to barcode scanning; (c) assess whether nurses were administering medications per the "five rights" procedure (i.e. the right patient, the right medication, the right dose, the right route, and the right time); (d) assess the frequency and type of interruptions nurses encountered during the entire medication administration process (i.e. retrieval, preparation, and/or administration).

To assess the elements for the project, the interns initiated a collaborative effort to perform direct overt observations at each microsystem of the hospital. This method was chosen because Donaldson et al. (2014) states that direct observation can be "the most reliable method to determine medication administration accuracy" (p. 59). To distribute the responsibilities, each intern designated the units and shifts he/she was committed to observe. Data was collected at 18 microsystems (see Appendix C) from September 16, 2017, to October 2, 2017 through a tallying system based on a pre-constructed itemized schedule (see Appendix B). The goal was to observe every microsystem for three days during each morning, evening, and nocturnal shift. Interns were either assigned by the charge nurse to shadow a specific nurse or nurses were randomly selected by the interns as subjects for observation. Informal interviews were conducted with the nurses at the end of each observation to obtain qualitative data concerning interruptions during medication administration. Since the intent was to obtain accurate data, the interns limited the

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introduction of their project as general workflow observation to their subjects to eliminate the occurrence of the Hawthorne effect. This effect, as defined by researchers such as Cochran and Haynatski (2013), is a response in which individuals may have the tendency to modify their behavior when they are being observed. To preserve anonymity, none of the hospital staff were identified by name in the data.

Results

Quantitative and qualitative data were collected from the collaborative, direct overt observations performed. Each intern entered data into the same Google spreadsheet for each corresponding unit. Once all unit data had been received, a consolidated data sheet was compiled and assessed (see Appendix C). Formulas were used to identify the percentage of the following procedures being performed by the registered nurses (RN) prior to medication administration: "five rights," explaining medications to patients, scanning patients' wristbands, and verifying allergies. The number of interruptions and medication overrides were also quantified. A total of 82 shifts and 297 medication administrations (MAs) were observed between the 18 designated microsystems. Of the 297 MAs, 286 (96%) indicated that the RNs scanned patients' barcode prior to administration. Specifically, the emergency department (ED), maternity department (Mom-Baby), post-anesthesia care unit (PACU), catherization laboratory (Cath Lab), and progressive care unit (PCU) were the units that had incidents in which barcodes were not scanned. A total of 147 uninvited interruptions were tallied during the 297 medication administrations. Interruptions observed included phone calls, hospital staff entering the room and asking questions, family visits, conversations between nurses during retrieval and preparation of medication, patients' questions and requests unrelated to medication, calls to co-sign medication for another nurse, call light from another patient, and equipment malfunction.

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These all could compromise medication administration safe practice, which could in turn potentially increase errors (Donaldson et al., 2014).

Based on interviews, phone interruption is the unanimous distraction that the RNs wish could be diminished or eliminated. That being said, the Endocrine unit experiences a unique challenge - according to two RNs within the unit, the secretary and charge nurse have been filtering most of the phone calls to reduce unnecessary interruptions. Therefore, the calls that nurses have been receiving are usually critical lab values that they must know in order to provide proper patient care.

With respect to the effectiveness of the "Mindfulness" campaign, none of the RNs at the Endocrine and Pediatric units were observed to use the lanyard or warning sign during medication administration. Interviews revealed several reasons for this. For one, the warning sign is an additional item that RNs need to remember to take with them after retrieving the medication; therefore, most nurses do not want to bother with the sign. Second, since the "Mindfulness" campaign is not enforced as a hospital-wide policy, the RNs at the Pediatric unit do not feel obligated to incorporate the new practice into their daily workflow. Lastly, (at least according to one RN), the lanyard is easy to forget to take on and off, which negates its utility.

While many occurrences were anticipated by the observers, unexpected findings were discovered from the direct observations as well. For example, during 70% of the MAs, RNs did not verify patients' identities with two forms of identifications (such as name and date of birth). In addition, verbal allergy check was not performed during 75% of the MAs as part of the safety practice.

Lastly, two near-miss incidents were observed. At the orthopedic unit, the wrong insulin pen was almost used on a patient because the nurse failed to verify the identity of the patient;

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however, the error did not reach the patient because the co-signer caught the error when he/she cross checked the patient's full name between the insulin pen and EPIC, an electronic medical record application. In a separate event at the acute rehabilitation unit, the nurse almost administered eye solution to the wrong eye due to inaccurate instruction on EPIC. Fortunately, the error did not reach the patient because the nurse verbally verified the patient's identity with two forms of identifications and communicated to the patient concerning the medications prior to administration.

Implementation

The preliminary data report indicated that ED, Cath Lab, and PCU are the main units that have the lowest barcode scanning rates as compared to the remaining 15 units. Distraction or interruption during medication management process is certainly a concern that needs to be mitigated; however, given the limited time and available resources, both the hospital administration and MSN/CNL interns' instructor determined that the issue is too vast for the interns to address at the moment. As a result, they decided to focus the implementation piece on the reinforcement of consistent "five rights" nursing practice. According to the collected data, most nurses administered medications after scanning their patients' wristbands, but omitted the verbal dual patient identifiers and verbal allergy check. Per the Joint Commission (2017) patient safety standard, identifying patient with at least two identifiers such as patient's name and date of birth before administering medications will improve patient safety. Elliot and Liu (2010) also emphasize that although the "rights" do not guarantee that errors will not occur, verbally asking patients for their identifications and known allergies/reactions will help ensure the safety and quality of patient care during medication administration. Moreover, it is clearly stated in the hospital's medication administration policy that performing two-forms of identification

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verification as well as an allergy check is required during each administration phase of the medication management process. Hence, the interns will reinforce the importance of the "asking then scanning" procedure before medications are given to patients.

The oncology unit was the microsystem selected for the pilot implementation because it had one of the highest noncompliant rates – 75% of the observed medication administrations were not performed with two forms of patient identification, and 86% of them were not performed with allergy status checks (see Appendix C). To assist the interns in creating implementation tools that were fitting for the oncology unit, an assessment of the unit was performed; the findings are as follows.

Purpose

The oncology unit upholds the overarching mission of the hospital – dedicated to improving the health of the community by providing quality and compassionate care. Thirty-four private rooms are available on the oncology unit. Chemotherapy administration and continuous monitoring of signs and symptoms of cancer-related side effects are the core procedures provided on this unit. General medical-surgical care is also offered for overflow purposes.

Patient Population

The unit predominantly consists of patients above 60 years of age undergoing radiation or chemotherapy treatments, as well as those experiencing cancer-related side effects such as intense pain and nausea. Every three to four admitted patients are under the care of one Registered Nurse (RN), while every eight to twelve admitted patients are under the care of one Certified Nurse Assistant (CNA).

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Professionals

Primarily the hospitalists, charge nurse, RNs, physical therapists, case managers, palliative care nurse practitioners, and CNAs contribute to the functioning of this microsystem. One to two nurse practitioners specializing in palliative/hospice care are also dedicated to this unit. Charge nurses and shift supervisors are the formal leaders of the unit. Nurses with over twenty years of experience act as the informal leaders, who guide and inspire the new nurses on the floor. They are invaluable assets to the team because of their vast knowledge within this nursing realm. However, these experienced nurses comprise the most challenging nursing population to influence for changes.

Processes

The nurses are the center of the microsystem, committed to providing the best care from admission to discharge. Such commitment is achieved by embracing a professional practice model called the **"**Shared Governance Model." As explained by Anthony (2004), this model fosters the principles of "autonomy and independence in practice, accountability, empowerment, participation, and collaboration in decisions that affect individual patient care, the more general practice environment, and group governance" (p. 55-72). The model asserts that in addition to patients and families, nurses are the vital stakeholders within the system. They are expected to actively participate in the control of their work environment and in making decisions when executing their professional tasks. Moreover, two staff nurses are elected as the ambassadors of the unit to act as the liaisons between all staff nurses and the superiors. They are responsible for facilitating effective communication when issues arise, such as internal conflicts and system problems. Interdisciplinary communication is also at the forefront of the microsystem. Mobile

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phone and instant text messaging are the core communication technologies that assist CNAs, RNs, and physicians to sustain streamlined information exchange.

Patterns

Each day at 7:00 a.m. and 7:00 p.m., the charge nurse leads a team huddle to discuss quality and safety issues that are relevant to the unit. At 9:00 a.m., the unit supervisor attends a hospital-wide huddle to stay informed of hospital issues that affect each unit.

Initially, the interns planned to create a "question and answer" exercise as one of the hospital's "Knowledge Center" curriculum; however, after a discussion with the nurse educator and information technology (IT) program manager, the interns understood that such implementation was not feasible because there was already a backlog of curriculum that the RNs had yet to complete by the end of October. Hence, the interns approached the educational portion of the project with different tools. The implementation tools included 11" x 17" posters (see Appendix D) that were conspicuously mounted at the nursing station, bathroom, conference room, break room, and medication rooms. The posters contained statistics based on collected data as well as a QR code that allowed nurses to easily access a light-hearted and brief video with their personal mobile phones (Costello et al., 2017). The interns also crafted story boards to develop the plot of the video, which was produced and filmed with smart phones at the hospital's simulation center. The video was edited and finalized with the iMovie application. The content of the video included a medication administration scenario, "Ask, then Scan" procedure, and a sing-along tune. Laminated "Ask, then Scan" signs are also adhered to each bedside computer as a reminder for the nurses. To ensure that all registered nurses at the oncology unit were informed of the project, interns made announcements at each morning (7:00 a.m.) and evening

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(7:00 p.m.) shift huddle from November 7 to November 12, 2017, so that all weekday and weekend shifts were covered.

Cost Analysis

The economic impact that each medication error imposes on hospitals is complex. Due to various calculation methodologies and tangible and intangible variables involved, assessing an accurate cost consequence caused by one medication error can be challenging. Extended inpatient stay, additional medical treatment, and litigation are some of the tangible costs to consider. On the other hand, patient's reduced quality of life, missed work days, emotional impact (both on the patient and on hospital staff), disability, and even death are some intangible variables to be considered (Lahue et al., 2012). Research studies that spanned from 1997 to 2012 illustrated that the per preventable medical error cost varied from $6,931, $3,480, and $4,263. Likewise, when looking at the per hospital cost on preventable adverse drug effects, they were $4.1 million, $0.9 million, and $5.6 million annually, respectively (Pan, et al., 2015).

Currently, the general understanding of inpatient preventable medication errors cost the healthcare system approximately $16.4 billion per year (NPP, 2010). According to one recent economic evaluation that was completed in 2014, each medication error on average can potentially cost $91.60 (Pan, et al., 2015). Assuming that this figure is relatively accurate, the 64,864 medication errors that occur at the hospital for this project ($91.60 x 64,864 errors) will cost the hospital almost $6 million extra per year to amend the tangible consequences. During this medication error reduction project, 500 hours were spent on the initial audit, 27 hours were spent on meetings and coordination, 49 hours were spent on literature review and reports, 38 hours were spent on implementation development, $20 was spent on printing material, and 49 hours were spent on the post-implementation audit. The national median salary of a CNL (1.4

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FTE) is about $84,000 plus 30% benefits per year, which amounts to $56.86 per hour. Taking this hourly salary, multiplying it by 663 hours of labor, and then adding $20 for material costs ($56.86 x 663 hours + $20 material costs), results in an estimate of $37,718 spent in the effort to reduce medication error. Achieving a medication error reduction of as little as one percent (649 doses) could save the hospital almost $60,000 (649 doses x $91.60) per year. Clearly, the potential monetary savings for the hospital outweighs the theoretical cost of this medication error reduction project.

Discussion

Evaluation

Immediately following the shift huddle announcements, the interns returned to the oncology unit for one week (November 13, 2017 – November 19, 2017) to evaluate the impact of the implementation. (Note that evaluation was not performed during the evening shift on November 18, 2017 due to intern's illness, see Appendix E). Observations were performed from the hours of 9:00 a.m. to 9:00 p.m. because most medications were given during that window of time. Given that a shorter time frame was allocated to complete the evaluation, the interns conducted the observations in pairs as much as possible to increase the amount of data. Quantitative and qualitative data were once again collected from the direct overt observations performed. Of the 94 MAs, 62 (66%) MAs indicated that nurses asked for two forms of patient identifications prior to barcode scanning while 50 (53%) asked for patients' allergy status. As compared to the initial audit, the implementation has achieved 41% and 39% increase in compliance regarding two-forms of patient identification and allergy status check, respectively (refer to Table 2 and Appendix F).

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Table 2

Verbal 2-Patient Identifiers and Allergy Check Compliance Rate Comparison

Oncology Unit	Pre-Implementation Compliance Rate (n = 28)	Post-Implementation Compliance Rate (n = 94)	Improvement Rate
2 Patient Identifiers	25%	66%	41%
Allergy Check	14%	53%	39%

In general, the nurses acknowledged the importance of identifying the patients prior to medication administration, but expressed various degrees of skepticism with respect to the requirement of verbal allergy verification. Moreover, a unanimous opinion was expressed that after the initial verification at the beginning of the shift, the procedure is considered redundant and unnecessary to be performed at each administration (especially when they have had the same patients, for instance, for three consecutive days). The nurses felt that asking at every MA could also become an annoyance to patients who have multiple allergies. One nurse commented that it could be challenging to change the nurses' habits, especially those who had practiced for many years and/or had not made an error. Two nurses believed that verbally asking for patients' allergies was not part of their training at the hospital. One nurse did not believe that medication errors happen because of omitting to ask the patient for two forms of identifications. She added that for an error to happen, the patient would have to be wearing the wrong wristband or that the medical record in EPIC was incorrect when scanned, which is not likely. She further explained that because the wristband consists of the patient's name and medical record number, most nurses at the unit believe they are fulfilling the two-forms patient identification procedure and hospital policy by scanning the wristbands.

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Nursing Relevance

The initiative to reduce medication administration error is relevant because registered nurses spend about 40% of their time administering medication during their shifts, making the margin of error immense (Kavanagh, 2017). This phenomenon is confirmed by Donaldson et al. (2014) and Elliott and Liu (2010), who state that 26% - 38% of preventable medication errors occur during administration. As noted by Muroi et al. (2017), administration is the last phase of the complex medication management process; therefore, nurses are the last layer of defense to prevent error. Further, when errors do occur, nurses are the most likely to be blamed or disciplined -- hence, it is imperative that each step of the safety practice is duly completed to minimize errors and to ensure accuracy (Donaldson et al. 2014). In addition, it is important to reiterate that although the technology of barcode scanning has significantly reduced medication errors, it does not mean that the technology should replace the evidence-based nursing practice of the "five rights" procedure prior to drug administration. The "five rights" procedure has certainly proved its effectiveness in preventing MA errors that would not have otherwise been intercepted by technology, as evidenced in the two near-miss incidents observed during the initial audit of the project.

CNL Relevance

Improving patient outcomes through transformational change is the core function of CNLs. As leaders in advocacy, hospitals will certainly benefit from having a CNL to conduct this medication error reduction project to increase patient safety. A CNL is necessary because the scale of the investigation, audits, and analysis involved would be too vast for any bedside nurse to undertake beyond his/her daily responsibilities. The monetary savings that hospitals can reap annually from reduced medication errors will far outweigh the cost to hire a CNL dedicated

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to the project. Ongoing coordination with hospital committees and other disciplines are essential to facilitate lateral integration and implementation. Additionally, other skills (such as root-cause analysis and business proposal writing to obtain budget and manpower for the project) are also unique skills that CNLs are trained in.

Timeline

Communication between the clinical instructor and hospital's education department regarding the project began on August 21, 2017. On September 5, 2017, the clinical instructor, MSN/CNL interns, nurse educator, medication safety pharmacist, student pharmacist, and risk manager met to discuss, coordinate, and establish the project. The nurse educator disseminated an email to each unit at the hospital to notify charge nurses and supervisors of the interns visiting. Literature review started two weeks before the project began, and writing occurred over three months. Collaborative direct observations/audit of the nursing workflow took place for 17 days from September 16, 2017 to October 2, 2017. Results and data were analyzed and presented to the nurse educator and medication safety pharmacist the day after the last direct observation. Subsequently, the interns developed implementation ideas and, in the meantime, presented the project and data to the cross-campus medication safety committee on October 12, 2017. On October 18, 2017, the interns received feedback regarding their implementation ideas from the nurse educator and IT program manager for revision. The oncology unit was then selected as the microsystem for pilot implementation. Posters, laminated reminder signs, and an educational video were created in response to the feedback. Ongoing revisions, approval, and coordination of the implementation tools occurred over two and a half weeks. On November 6, 2017, the interns presented the project to the nurse manager and supervisor of the unit that was selected for pilot implementation. After they obtained approval from the unit's authorities, the

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interns announced the project at morning and evening huddles to staff nurses for six days (November 7, 2017 to November 12, 2017). To evaluate the effectiveness of the implementation, interns returned to the unit (November 13, 2017 to November 19, 2017) to observe the staff nurse. To conclude the project, the interns, the clinical instructor, the nurse educator, and the clinical nurse educator convened on November 27, 2017 for the last time to review post-implementation data. All data were then transmitted to the hospital for future reference and discussion (see Appendix G).

Future Directions

The MSN/CNL interns were highly supported by the hospital's nurse educator, medication safety pharmacist, nurse manager, unit supervisor, clinical nurse educator, IT program manager, and clinical instructor to complete the project. Numerous meetings and email exchanges entailed to coordinate and discuss the direction of the project, as well as to refine the implementation tools. If this project were to be undertaken by future CNL interns, they need to be cognizant of the importance of implementing tools that are concise and easy to engage in order to accommodate nurses' limited time availability. Some changes that can enhance the execution of the project in the future are as follows: first, focus on one microsystem and observe all shifts for one complete week - this will help capture all variations that occur during different days of the week. Second, develop a standardized list of question(s) to conduct consistent, informal interviews of the nursing staff by all interns. Doing so obtains a thorough pattern of nurses' perspectives on medication administration process and policy at the hospital, what is currently working well, challenges that are impacting the process, as well as recommendations to improve the process. Likewise, interviewing patients at the unit regarding their perspectives concerning MA safety check may reveal invaluable data. Third, develop a consistent method to

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tally the data to avoid data discrepancies. Fourth, (as suggested by Stefanacci et al., 2016), obtain buy-in from all levels of the nursing staff about the goal(s) of the project so that there is an expectation that all will participate in the activities associated. Additionally, it is important to obtain corporate buy-in from the staff nurses prior to implementation in order to achieve true lateral integration -- in the current study, moderate resistance and disbelief were noted. More specifically, many nurses were skeptical that omission of verbal verification of patients' identification could cause adverse impact to the MA process; further, most believed that barcode scanning replaces that safety step.

Recommendations

To counteract the challenges experienced during the execution of the project, it is first recommended to review hospital policy regarding 'five rights' and allergy check procedures with nurses prior to implementation. Second, debunk the myth that medication errors do not happen when verifying two forms of patient identifications and allergies are omitted -- this can be done by sharing documented cases of medication error incidents from reports and anecdotes compiled by the hospital. For instance, in one case documented by the hospital in 2009, the RN checked the patient's allergy information in the patient's record upon medication retrieval. Upon MA, the RN asked the patient about allergies toward any medications but specifics were not verified. The RN administered an antibiotic and the patient showed signs of allergic reaction soon after.* This incident exemplifies the importance of asking patients to verbalize medications they are allergic to at the point of MA, because it is possible that some information could be omitted in the patient's medical record. Moreover, according to a hospital medication administration errors report (June to September 2017), 12 (27%) of the 44 cases were caused by omission of nursing duty or human error. In addition, the wrong medication was given to the patient in two (4.5%) of

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the 44 cases. One incident happened because the patient shared the same last name with another patient, and the incorrect medication was retrieved. Although the patient's wristband was scanned prior to administration, the system did not pick up the error because both patients had the same order.* This particular MA error exemplifies Elliot et al.'s (2010) rationale that nurses should always verify patients' full name prior to MA. Notably, a quality management newsletter published by the hospital in 2009 emphasized the important principle that RNs are responsible for educating their patients about the necessity of repeatedly asking for two forms of identification and allergy information at each MA.* Clearly, these safety steps cannot be replaced by barcode scanning. Lastly, the hospital should create a curriculum in its "Knowledge Center" to remind RNs about the elements written in the hospital's MA policy; completion of the curriculum would keep RNs accountable to the policy.

Furthermore, Muroi et al. (2016) proposed that certain classes of drugs (such as cardiovascular, antibiotics, anticoagulants, and electrolytes) are highly associated with medication errors. Hence, it may be worthwhile to investigate whether certain categories of drugs experience higher occurrences of errors at the hospital. In addition, future interns should explore evidence-based solutions to address phone interruptions, as it is the unanimous impediment that keeps RNs from performing focused MAs more than any other type of interruption. It may also be beneficial to further develop and improve the existing "Mindfulness" campaign to create protected MA time for RNs. For instance, placing the warning sign at every patient's door reduces the burden of carrying another item from the medication room. The lanyard could be replaced with a more conspicuous garment for RNs to wear.

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Limitations and Weaknesses

This quality improvement project has several limitations and weaknesses. First and foremost, interns were not able to observe each unit at equal time frames during the initial data collection phase due to time limitations. Some units were more heavily observed than others, which may have skewed the overall data. Likewise, qualitative data was not evenly collected from each unit to obtain comprehensive perspectives from RNs concerning MA interruption. Second, inconsistent observation and tallying methods were employed by each intern during the initial data collection phase. As a result, minor discrepancies were discovered when calculating the total number of observed medication administrations. Other factors that might have skewed the data were that most non-verbal and/or cognitively impaired patients were not accounted for when tallying for two-forms of patient identification and allergy check. Third, a few interns failed to observe inconspicuously when collecting post-implementation data, which may have caused the Hawthorne effect to take place among RNs while administering medications. Fourth, the sample sizes used to compare compliance rate before and after the implementation were not identical, hence, the improved compliance rate might be biased. Fifth, the interns had access solely to the most recent quarter report that elucidated the MA error details. Obtaining reports that span for at least a year might provide deeper insights into the pattern of errors at the hospital. Finally, since nurses at this hospital operate by the "Shared Governance" model , it is important to understand the fundamental principles of the model to effectively engage nurses in any new implementation, training, or ideas. Specifically, shared governance is not about each employee having a vote in every organizational decision -- instead, it is about having a representative. The model relies on a mixture of leaders who have been hired into formal roles and others who have been selected by their peers to represent them on various committees (Sanford, 2012). It was

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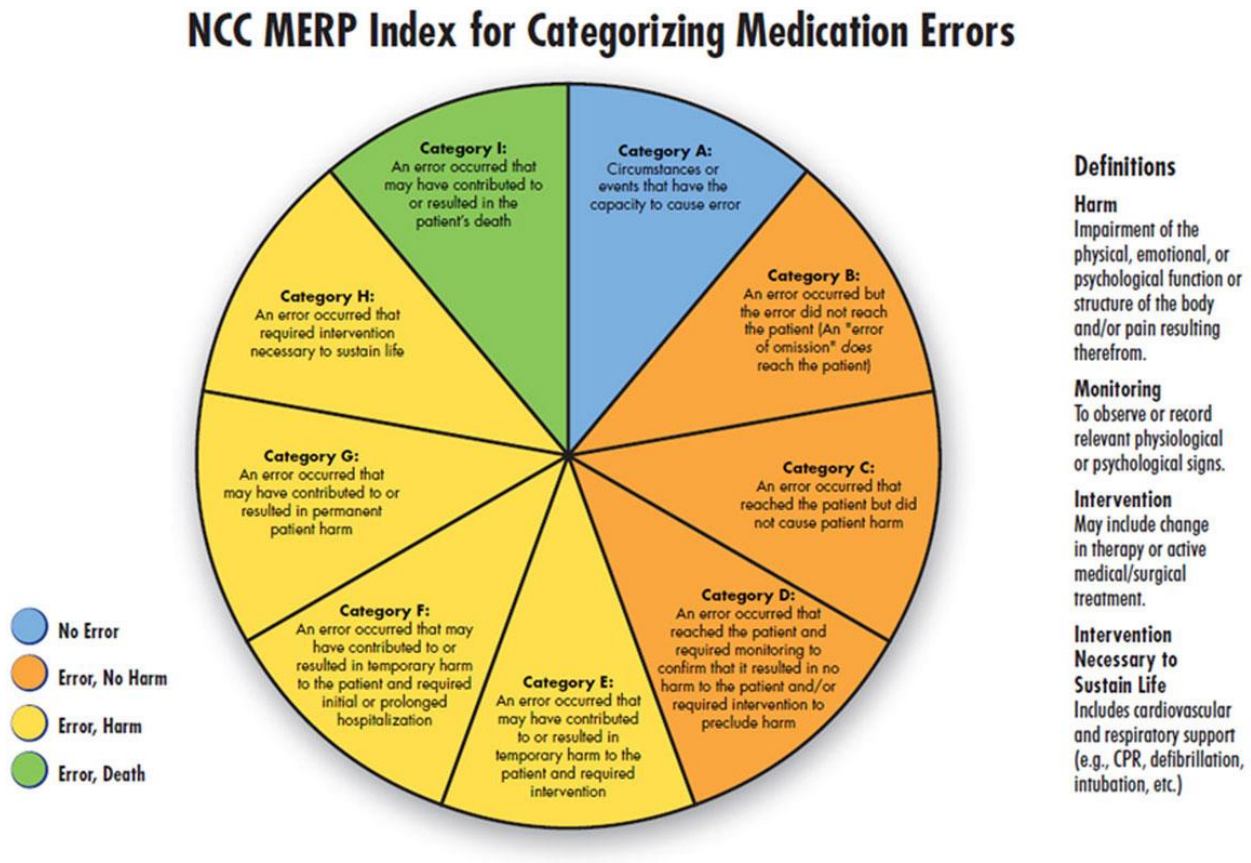
unfortunate that the interns failed to communicate with the unit's ambassadors (who were selected to represent the staff nurses). Resistance and questions from the RNs might have been reduced and higher compliance rates might have been achieved if the ambassadors were contacted to prepare the RNs' for the changes during implementation.

Conclusion

Medication administration error is a prevalent issue that requires proactive intervention to resolve. The hospital in this project performed a successful systems-approach to investigate and discover the root causes of medication errors. Medication administration is, undoubtedly, a complex process in which no technology can detect and repair all human errors. The fundamental nursing practices of "five rights" and allergy check remain two of the most crucial layers of defense that nurses cannot omit if they wish to maintain, promote, and increase patient safety in hospitals.

*Source is not disclosed to protect hospital's identity.

Appendix A



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Appendix B

Template for Nurse Workflow Observation During Medication Administration

Intro Script: My name is _____ from USF working on a project with the nurse educator. Is it fine with you that I observe the workflow of the unit?				
Date:		Unit:	Shift:	
ITEM		**YES**	**NO**	**NOTES**
5 Rights	Name & DOB Identifier			
	Drug (Right Form; Available)			
	Dose			
	Route			
	Time			
Explain med. to patient				
Barcode scan				
Verified allergies				
Interruption during med. admin. (Equip. alarm; phone calls; call lights; questions from others)				
Med. admin. override				

*Source is not disclosed to protect hospital's identity.

Appendix C

Table C1

Consolidated Data

	Consolidated Data	# of shifts/ unit	Name/DOB		Drug		Dose		Route		Time		Explain med. to patient		Barcode Scan		Verified allergies		Interruption during med. admin.		Med. admin. override	
			Yes	No	Yes	No	Yes	No	Yes	No	Yes	No	Yes	No	Yes	No	Yes	No	Yes	No	Yes	No
1	ED	9	36	2	38	0	33	0	33	0	33	0	31	2	30	2	33	0	14	19	4	29
2	Mom-Baby	1	0	5	5	0	5	0	5	0	4	1	2	3	4	1	0	5	1	4	0	5
3	Antepartum	2	5	0	5	0	5	0	5	0	5	0	5	0	5	0	5	0	2	3	0	5
4	NICU	2	11	0	11	0	11	0	11	0	11	0	0	11	11	0	11	0	1	10	0	11
5	PEDS	3	0	7	7	0	7	0	7	0	7	0	2	5	7	0	0	7	3	4	0	7
6	PICU	3	11	0	11	0	11	0	11	0	11	0	11	0	11	0	11	0	1	10	0	11
7	Endocrine	9	8	31	39	0	39	0	39	0	39	0	23	16	39	0	2	37	24	18	0	39
8	Oncology	7	7	21	27	1	28	0	28	0	27	1	8	20	28	0	4	24	10	20	2	28
9	Post-Surg	3	0	7	7	0	7	0	7	0	7	0	1	6	7	0	0	7	3	4	0	7
10	Orthopedics	7	1	39	39	1	40	0	40	0	40	0	40	0	40	0	1	39	22	21	5	35
11	Acute Rehabilitation	8	5	45	50	0	50	0	50	0	50	0	42	8	50	0	1	49	22	28	0	50
12	PACU	2	0	4	4	0	4	0	4	0	4	0	2	2	3	1	0	4	1	3	0	4
13	Medical ICU	5	0	14	14	0	14	0	14	0	14	0	3	11	14	0	0	14	13	6	2	12
14	Neuro ICU	5	0	12	12	0	12	0	12	0	12	0	2	10	12	0	0	12	18	4	0	12
15	Trauma ICU	4	0	9	9	0	9	0	9	0	9	0	2	7	9	0	0	9	8	4	0	9
16	Cath Lab (procedure)	4	4	0	4	0	4	0	4	0	4	0	0	4	0	4	2	2	1	2	0	4
17	3 South	7	7	9	16	0	16	0	16	0	16	0	5	11	16	0	4	12	1	15	3	3
18	PCU	1	0	2	2	0	2	0	2	0	2	0	0	2	0	2	0	2	2	0	2	0
	Total	82	95	207	300	2	297	0	297	0	295	2	179	118	286	10	74	223	147	175	18	271

*Source is not disclosed to protect hospital's identity.

Table C2

Data Collected During Initial Observation for Oncology Unit

Oncology		9/16 (Sat)		9/18 (Mon)		9/22 (Fri)		9/23 (Sat)		10/1 (Sun)		10/2 (Mon)		Total	Total	Notes
		Yes	No	Yes	No	Yes	No	Yes	No	Yes	No	Yes	No	Yes	No	
AM	Name/DOB	2	7				3							2	10	Name and DOB was never verbally asked, only wrist band scanning.
	Drug (Right Form; Available)	8	1			3								11	1	
	Dose	9				3								12	0	
	Route	9				3								12	0	Blood glucose check was done off-schedule, so insulin was given too late.
	Time	8	1			3								11	1	
	Explain med. to pt	2	7			1	2							3	9	Meds were given with no patient explanation, just explanation to significant other (ten minutes before actually giving meds).
	Barcode Scan	9				3								12	0	
	Verified allergies	4	5				3							4	8	I never heard a nurse ask about allergies.
	Interruption during med. admin.	2	7			5								7	7	Call lights, lift team, family members, physical therapists. CNA doing morning care. 2nd RN needed for co-sign. Calls from MD, family.Making phone call during med pass is another interruption seen.
	Med. admin. override		9			2	3							2	12	
PM	Name/DOB								2	3				3	2	
	Drug (Right Form; Available)							2		3				5	0	
	Dose							2		3				5	0	
	Route							2		3				5	0	
	Time							2		3				5	0	
	Explain med. to pt								2	1	2			1	4	Routine meds. When giving NS, does not explain to patient usually - unless asked
	Barcode Scan							2		3				5	0	
	Verified allergies								2		3			0	5	Routine medications, nurse had pt day before. In addition, allergies already listed on Epic, so nurses do not always ask.
	Interruption during med. admin.								2	1	2			1	4	One nurse was speaking with a patient about a procedure during med pass; phone call also interruption
	Med. admin. override								2		3			0	5	
NIGHT	Name/DOB				3				2	2	4			2	9	
	Drug (Right Form; Available)			3				2		6				11	0	
	Dose			3				2		6				11	0	
	Route			3				2		6				11	0	
	Time			3				2		6				11	0	
	Explain med. to pt			1	2			1	1	2	4			4	7	
	Barcode Scan			3				2		6				11	0	
	Verified allergies				3				2		6			0	11	
	Interruption during med. admin.				3			1	1	1	5			2	9	phone call
	Med. admin. override				3				2		6			0	11	

		Yes	No	Yes (%)	No (%)
Total	Name/DOB	7	21	25%	75%
	Drug	27	1	96%	4%
	Dose	28	0	100%	0%
	Route	28	0	100%	0%
	Time	27	1	96%	4%
	Explain med. to patient	8	20	29%	71%
	Barcode Scan	28	0	100%	0%
	Verified allergies	4	24	14%	86%
	Interruption	10	20	33%	67%
	Med. admin. override	2	26	7%	93%

*Source is not disclosed to protect hospital's identity.

Appendix D

5 Rights?

Watch a brief video from your phone!

Did you know that the hospital administers over **2 million medications** per year? During medication pass observations, **70% & 75% of 297 medication passes** did not include 2 patient identifiers and an allergy check, respectively.

On 5A, 75% of 28 medication passes did not include 2 patient identifiers and **86%** did not include an allergy check. Make these final safety checks a consistent part of your medication pass.

The video includes:

- Medication Administration scenario
- ASK, Then SCAN procedure
- Sing-along tune

Hospital Logo Here

To download the video to your own phone:

1. Download the QR Reader for iPhone app (free) or any other free QR Reader app.
2. Point QR Scanner at the QR Code below.
3. URL will open and video will autoplay. If video does not autoplay, scroll down and click the play button.
4. If you have recently upgraded to iOS 11, there is no need for the app. You can just use the camera on your phone.

Appendix E

Post-Implementation Data

5A	Oncology	11/13		11/14		11/15		11/16		11/17		11/18		11/19		Total	Total
		Yes	No	Yes	No	Yes	No	Yes	No	Yes	No	Yes	No	Yes	No	Yes	No
AM	2 Patient Identifiers	5	4	9	0	2	0	1	4	6	3	7	2	4	0	34	13
	Allergies	7	2	9	0	0	2	1	4	5	4	6	3	1	3	29	18
PM	2 Patient Identifiers	2	6	14	0	5	0	3	7	2	4			2	2	28	19
	Allergies	0	8	14	0	4	1	1	9	2	4			0	4	21	26

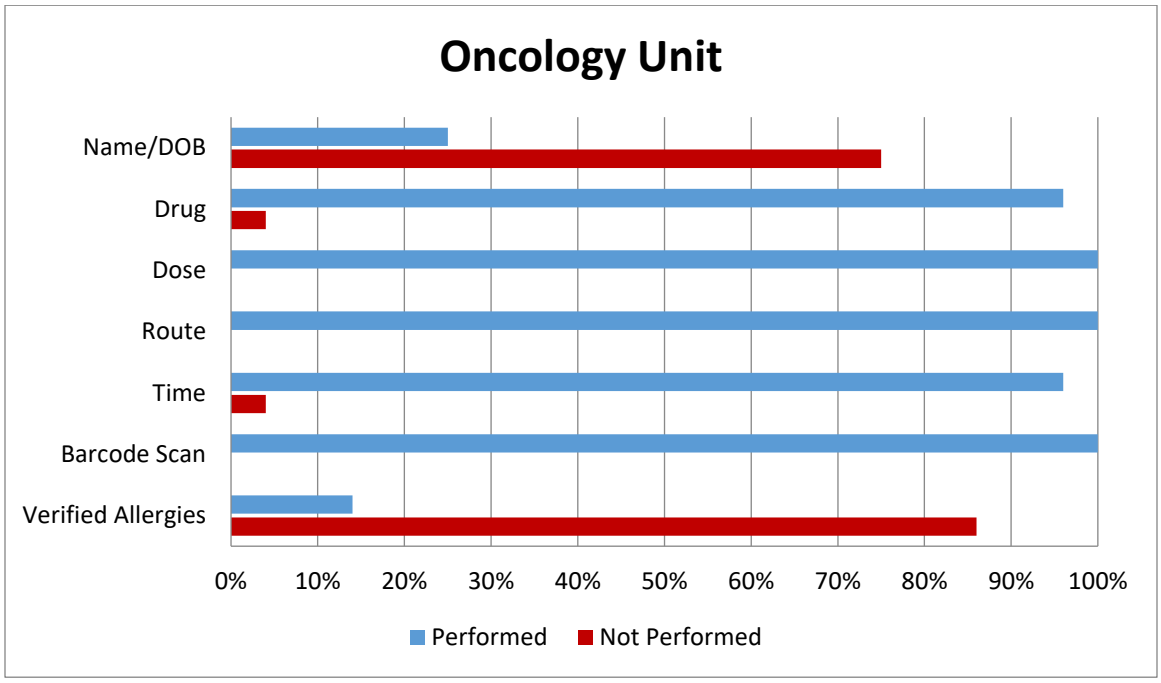
		Yes	No	Yes (%)	No (%)
Total	Name/DOB	62	32	66%	34%
	Allergies	50	44	53%	47%

*Source is not disclosed to protect hospital's identity.

Appendix F

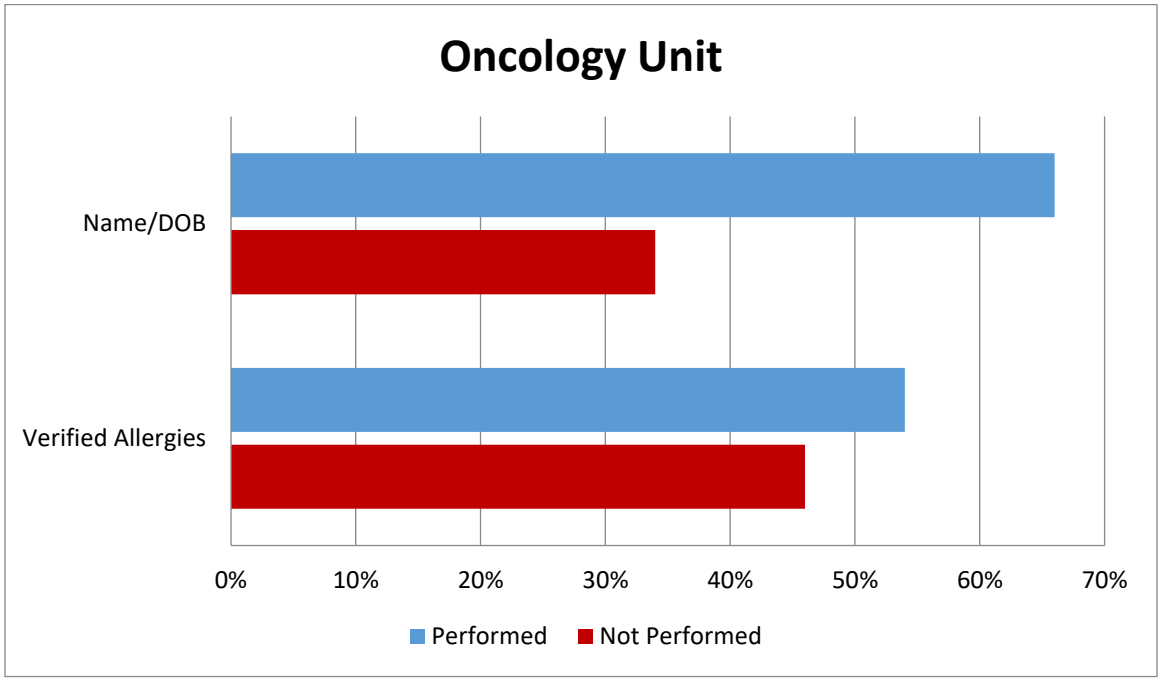
Results after Initial Direct Observation/Audit

(September 16, 2017 – October 2, 2017)



Post-Implementation Results

(November 13, 2017 – November 19, 2017)



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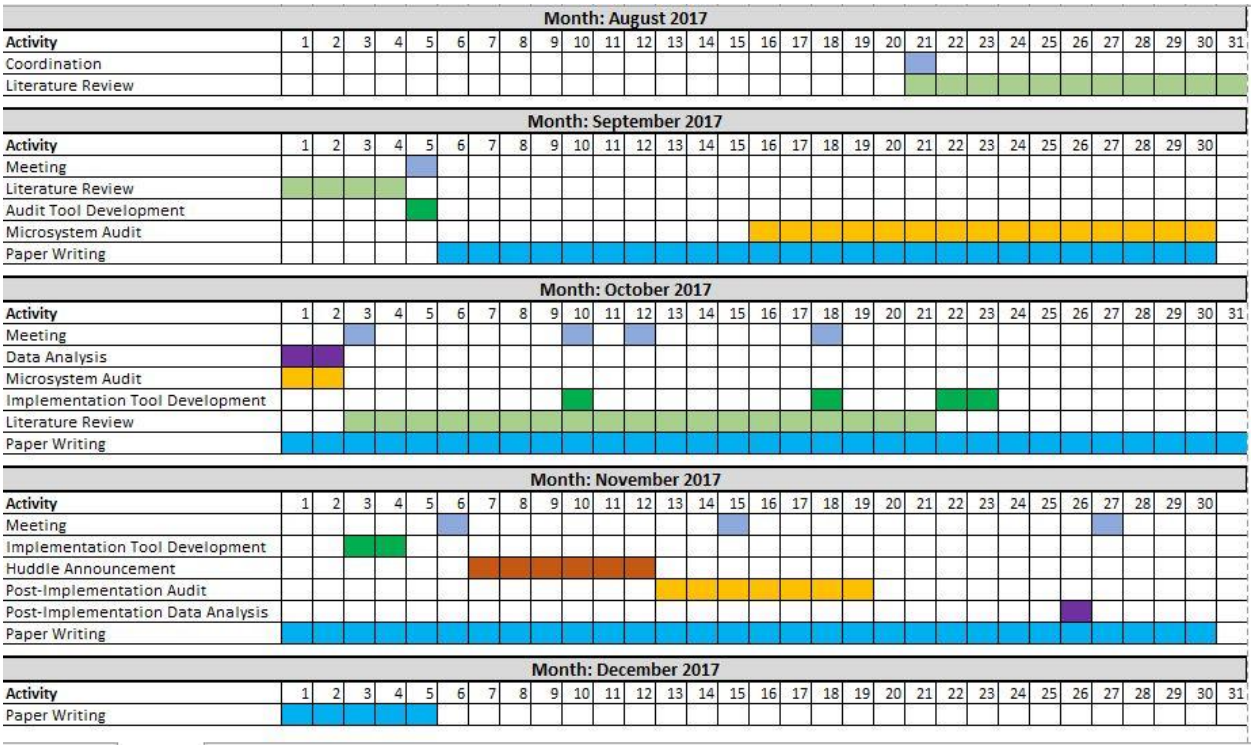
Appendix G

Timeline



Month: August 2017																													
Activity	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31
Coordination																															
Literature Review																															

Month: September 2017																														
Activity	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	
Meeting																															
Literature Review																															
Audit Tool Development																															
Microsystem Audit																															
Paper Writing																															

Month: October 2017																															
Activity	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31
Meeting																															
Data Analysis																															
Microsystem Audit																															
Implementation Tool Development																															
Literature Review																															
Paper Writing																															

Month: November 2017																														
Activity	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	
Meeting																															
Implementation Tool Development																															
Huddle Announcement																															
Post-Implementation Audit																															
Post-Implementation Data Analysis																															
Paper Writing																															

Month: December 2017																															
Activity	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31
Paper Writing																															

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