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MEDICATION RECONCILIATION: A QUALITY IMPROVEMENT PROJECT

A DOCTORAL PROJECT

Submitted in Partial Fulfillment of the Requirements

For the degree of

DOCTOR OF NURSING PRACTICE

By

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ABSTRACT

Medication reconciliation is a vital component of safe patient care and improving the safe use of medications in hospitals has been a Joint Commission National Patient Safety Goal since 2009 (The Joint Commission, 2020; Shah, Ishmael, & Wright, 2015). The Institute of Medicine's report *To Err Is Human: Building A Safer Health System* drew attention to the medical errors occurring in United States hospitals and subsequent studies suggest the rates of medical errors are increasing (Bosma et al., 2017; Classen et al., 2011; Kohn, Corrigan, & Donaldson, 2000; Lopez-Martin, Aquerreta, Faus, & Idoate, 2014). The goal of this quality improvement (QI) project was to improve the completeness of medication reconciliations for patients directly admitted to an intensive care unit (ICU) within 20 hours of admission.

A multimodal nurse driven intervention to improve medication reconciliation in an adult ICU in a large urban hospital was developed, implemented, and evaluated. The conceptual framework used for the QI project was the Plan-Do-Study-Act method. The QI project entailed asking the patient or family member to complete a form listing current medications and nurses were asked to complete a survey about their perception of the change in the medication reconciliation process. Baseline and post-implementation data were collected and compared to the implementation phase. Seventeen nurses participated in the QI project. Survey results about their perceptions of the medication reconciliation process change showed all nurses agreed that the form was helpful, and the average time saved was 6 to 10 minutes. Submissions of the medication reconciliation documentation

in the electronic health record improved from 92.7% prior to the QI project to 100% both during the project implementation period and for the following four weeks. However, it was noted that there was missing information about medication dose, frequency, and last time taken in several medication reconciliations. Ways to improve accuracy in documentation will need to be investigated as the next step in improving medication reconciliation.

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Thank you to the nurse educator and my scholarly project team who graciously offered their time, expertise, and unwavering dedication to me during the completion of this project.

BACKGROUND

The purpose of this Doctor of Nursing Practice (DNP) quality improvement (QI) project was to develop, implement, and evaluate a multimodal nurse driven intervention to improve medication reconciliation in a large urban adult intensive care unit (ICU). Medication reconciliation is recognized worldwide as a vital component of safe patient care and there are multiple national and international guidelines aimed at improving the process (Shah et al., 2015). Improving the safe use of medications in hospitals has been a Joint Commission (TJC) National Patient Safety Goal since 2009 (TJC, 2020). In support of this goal, the American Nurses Association (ANA) issued a position statement on safe medication use addressing medication reconciliation as a key component to ensure safe care (ANA, 2009). Reconciliation of patient's medications increases the potential for safe medication administration (Edlin, 2017).

Medication reconciliation involves the identification of the name, dose, route, frequency, and purpose of all medications currently taken by the patient (TJC, 2020). Completion of a medication reconciliation is endorsed by TJC for each patient upon admission to an acute care facility, when there is a change in the level of care, and upon discharge. The process of medication reconciliation is intended to ensure patients receive the correct medications and to avoid negative sequelae associated with medication administration.

The Institute of Medicine (IOM) report *To Err Is Human: Building A Safer Health System* drew attention to the frequency of lethal medical errors occurring in United States (U.S.) hospitals (Kohn et al., 2000). Subsequent studies suggest the rates of medical errors are high and possibly increasing (Bosma et al., 2017; Classen et al., 2011;

Lopez-Martin et al., 2014). Classen et al. (2011) estimated as many as one in three patients admitted to U.S. hospitals experiences a medical error, the most common being a medication error. TJC calculations show over 50% of patients admitted to a hospital have at least one medication discrepancy (Pascual et al., 2014). In a systematic review and meta-analysis authored by Laatikainen et al. (2017) the frequency of inpatient medication events was 19% of 46,626 pooled patients. Although, the prevalence of medication errors is alarming, the consistent use of a medication reconciliation process can decrease errors and potentially improve patient outcomes (Lopez-Martin, et al., 2014).

Significance

Patient Safety

There is ample literature showing issues with medication reconciliation in acute care facilities (Classen et al., 2011; Sanchez, Sethi, Santos, & Boockvar, 2014; Schnipper et al., 2018). In the U.S. there are approximately 106,000 deaths annually attributed to hospital medication errors (Laatikainen et al., 2017). Medication errors increase the risk of fatal injuries to patients and are associated with substantial economic expense (Aghajani, Ghazaeian, Mehrazin, Sistanizad, & Miri, 2016). The U.S. spends approximately \$1.6 billion in direct costs and \$137 billion in indirect costs annually on medication errors in hospitals (Laatikainen et al., 2017).

As the number of older Americans and those with multiple chronic conditions increase, so does the propensity for errors secondary to the complex nature of medication regimes. Currently 10% of the U.S. population and 30% of older adults take five or more medications (Quinn & Shah, 2017). Evidence suggests as the number of medication prescriptions increase, the proclivity for errors increases (Edlin, 2017).

Individuals admitted to an ICU tend to have more chronic illnesses and take more medications (Bosma et al., 2017). Therefore, these patients are at especially high risk for medication errors (Bosma et al., 2017). According to Bosma et al. (2017) the ICU environment is particularly prone to medications errors. In the ICU environment, staffing shortages, time constraints, language barriers, severity of illness, and lack of understanding of the importance of a complete medication reconciliation are barriers to the medication reconciliation process (van Sluisveld, Zegers, Natsch, & Wollersheim, 2012).

Current Event

A recent medication event at the medical center where the author conducted her project resulted in a call to improve its medication reconciliation process. The facility endorses a just culture concept which promotes systems improvement over individual punishment and uses the term *event* instead of *error*. The medication event occurred when the patient's medication reconciliation had not been started during admission to the facility or ICU; four days later upon transfer out of the ICU the medication event was discovered. During a review of the event, several factors were found to be associated with the lack of completion of the medication reconciliation. The patient was intubated, sedated, and the admission occurred on the night shift. The policy at the medical center states that the registered nurse (RN) caring for the patient is responsible to ensure medication reconciliation is complete by the 20th hour of admission. In this situation, the medication reconciliation was omitted, which jeopardized patient safety. Since medication reconciliation errors contribute to adverse patient events, a plan of action to address this problem was the focus of the author's QI project.

Purpose

The purpose of this DNP project was to develop, implement, and evaluate a multimodal nurse driven intervention to improve medication reconciliation in an adult ICU in a large urban hospital. The aims of this project were to:

1. Develop a bundle of activities to improve medication reconciliation.
2. Implement the interventions.
3. Evaluate the process based on the results.

Supporting Framework

The conceptual framework used for the project was the Plan-Do-Study-Act (PDSA) which is described below. The PDSA is a framework to turn ideas into action and connect action to learning (Langley et al., 2009). The PDSA Cycle gives a visual representation of how this framework promotes quality improvement efforts.

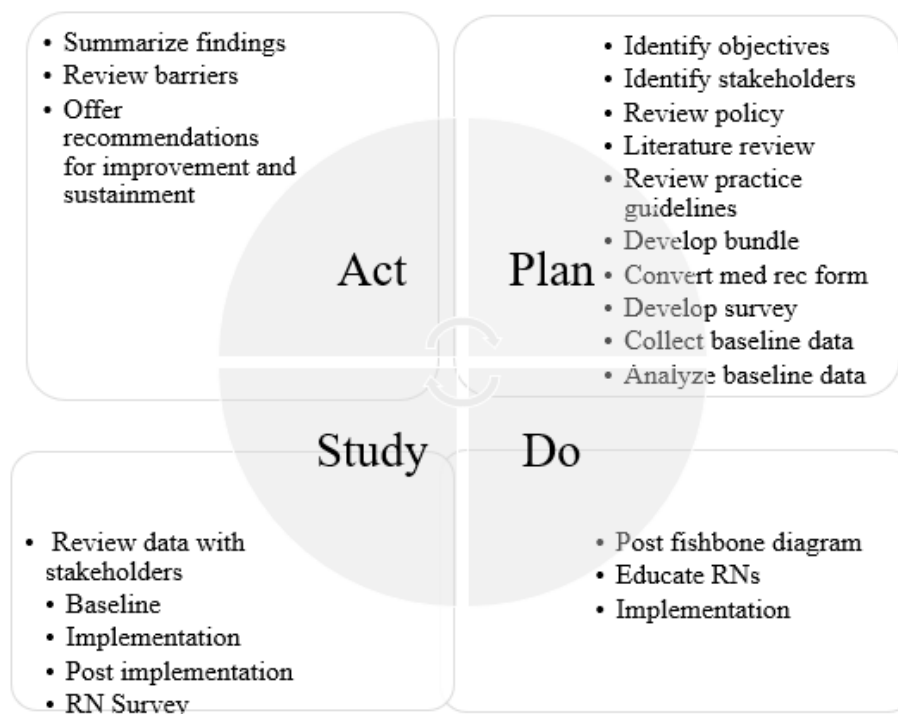


Figure 1. Plan, Do, Study, Act Cycle.

Plan-Do-Study-Act Cycle

This framework aids individuals and teams to test, adapt and implement changes to improve the quality of patient care. Per Deming (1988), the father of quality control, the PDSA Cycle is an efficient trial and learn methodology and is designed to test and adapt changes. Leis and Shojania (2016) describe the PDSA Cycle as an appropriate guide to assess and implement change in a health care setting, as it allows for iterative testing of changes to improve the quality of systems. Described below, are the four parts of the PDSA Cycle and how they were executed for this QI project.

Plan

The first phase began with developing the *Plan*, which is essential for a successful test cycle (Provost & Murray, 2011). The ICU nurse educator, ICU clinical nurse specialist, ICU director, and inpatient pharmacy manager were involved with the planning process and were the primary stakeholders for this project. During the planning phase the stakeholders were consulted, and the project was discussed to gather feedback, clarify the framework, and ensure buy-in.

Gather information. The objective was to improve the rate of complete medication reconciliations within 20 hours of admission to the adult ICU in compliance with the medical center's policy. To accomplish this, the medical centers medication policies were reviewed and baseline data from the facility's electronic health record (EHR) were obtained. TJC and ANA practice guidelines and a thorough literature search were completed.

RN input. A fishbone diagram on large poster board was posted in the two break rooms for input from the ICU RNs (Figure 2). Creating a diagram of the current

medication reconciliation process assesses the infrastructure to determine whether to design a new process or redesign the existing process (Gleason, Agramonte, & Perfetti, 2012). The fishbone diagrams were posted two weeks prior to QI project implementation. The fishbone diagram is a cause and effect tool that allows information about current knowledge of a problem to be collected and organized (Langley et al., 2009).

The fishbone diagram used in this project included the following contributing categories: environment, patient, manpower, methods, and materials. This process was important for RN buy-in of the project and to ensure relevant barriers and facilitators of the medication reconciliation process were discovered. Once the fishbone diagram posters were posted, information was presented in the RN shift huddles to encourage RN input. Information from the fishbone diagram was assessed and incorporated into this project as appropriate.

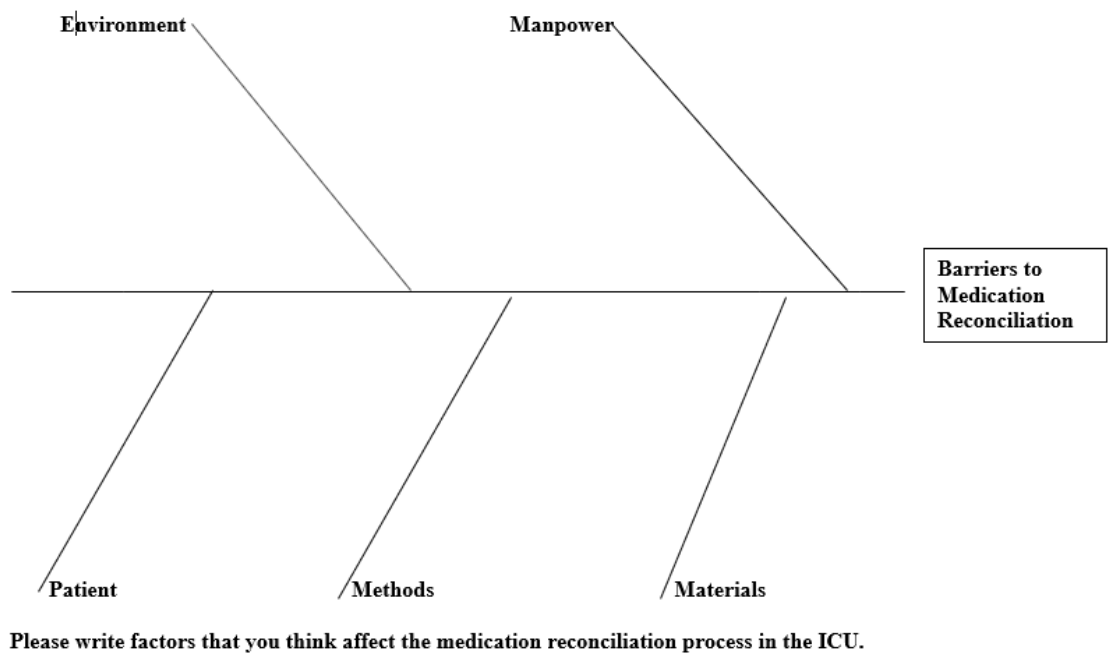


Figure 2. Fishbone diagram.

The flowsheet. The current medication reconciliation form is part of the Initial Physical Assessment (IPA) that nurses complete on each patient admitted to the medical center. The part of the electronic IPA form that involves a patient's current medications was reproduced in a paper form and was referred to as the med rec flowsheet in this project. It was not a permanent part of the medical record (Appendix A). Consultations with the ICU nurse educator and the Director of Clinical Transformation were sought for the approval of the use of the med rec flowsheet. The project's med rec flowsheets were printed at the facility and stored at the nurse's stations.

Collecting data. The author collected medication reconciliation data from the EHR as well as the med rec flowsheet RN survey developed by the author and completed by the ICU RNs (Appendix B). The EHR data were used to assess compliance with the medication reconciliation policy and the RN data were used to assess whether the med rec flowsheet was an efficacious tool.

EHR data. Medication reconciliation data were obtained from the EHR over three, four-week periods of time: baseline, implementation, and post implementation. Each week, a convenience sample of ten patient who met the inclusion criteria were selected and their EHRs were evaluated for medication reconciliation completeness using three descriptive categories: completeness at 20 hours of admission, areas of incompleteness at 20 hours of admission, and if changes were made within 20 to 44 hours after admission.

Completeness was defined based upon a medication entry with all of the corresponding fields i.e. name, dose, frequency, and last time taken or if the healthcare provider entered that no medications were taken. Patient inclusion criteria included

patients directly admitted to the ICU with a minimum stay of 20 hours. The family member or surrogate had to speak English and be available to complete the med rec flowsheet, or the patient could complete the flowsheet if judged to be physically and cognitively able. Run charts were constructed to graphically display the data. Run charts display study variation over time and make change visible to determine whether the change is an improvement (Langley et al., 2009).

The med rec flowsheet was given to the patient's family member or surrogate to complete while the RN admitted and stabilized the patient. If no family member was available, the patient could complete the med rec form if physically and cognitively able. If the patient was unable to participate or the family choose not to participate, the patient was not included in the study. Patients transferred from another unit were not included in this study. This ensured that the new process of the med rec flowsheet was effective in aiding in the completion of medication reconciliation without bias of a prior medication reconciliation report listed in the patient's EHR.

Once the patient was admitted, the RN reviewed the form for completeness with the family/surrogate and patient as appropriate. The RN then entered the information in the EHR. After the information was entered, the RN gave the med rec flowsheet to the charge RN who gave the flowsheet to the ICU nurse educator. If the RN believed the med rec flowsheet was not complete, it remained in the patient's room on the bulletin board or on the counter as a visual reminder for the RN to complete. The charge or roles RN for the shift were asked to verify if the med rec flowsheet was complete and assisted as necessary. The roles RN positions include membership on the rapid response, code blue, trauma, and code stroke teams.

A sound medication reconciliation process is a fundamental component of patient safety. This process is in alignment with the AHRQ and TJC initiatives of linking medication reconciliation with quality and patient safety regulatory requirements (Gleason et al., 2012). The AHRQ guidelines encourage the use of the EHR to gather an accurate best possible medication list (BPML), achieve improved access to patient medication information, and empower patients to know what medications they are prescribed (Gleason et al., 2012).

A representative from the information technology department was consulted to assist with the development of the measures and to retrieve the medication reconciliation data from the EHR. Gleason et al. (2012) emphasized the importance of gathering data in the decision making process. Therefore, collecting baseline and post-intervention data was done to drive decisions regarding the success of this author's project and were used to determine whether further changes were necessary to assist the facility with its medication reconciliation process. Collection and analysis of baseline data assisted with determining the focus of the project; implementation and post-implementation data collection and analysis determined the success of the intervention.

RN data. A RN survey was developed and attached to the med rec flowsheet which was completed each time the RN used the med rec flowsheet (Appendices A and B). The RN survey inquired about the usefulness of the med rec flowsheet and the new process; completed surveys were given to the charge RN who gave the completed survey to the ICU nurse educator. The data were assessed and then reviewed with the stakeholders.

The survey included the following: years of experience as a RN and if specialty critical care nurse credentials were held; the reception of the family, surrogate, or patient when asked to complete the med rec flowsheet; if the RN found the process helpful in completion of the electronic medication reconciliation; whether the use of the med rec flowsheet changed the amount of time needed to complete the medication reconciliation, and if so, the number of minutes; and what changes in the medication reconciliation process the RN recommended.

The project. A brief overview of the QI project was presented at the RN shift huddles twice daily, for seven days prior to implementation to inform and educate the RNs about the new process. The author presented the information at some of the huddles, the charge RN presented the information if the author was not present. Information about the med rec flowsheet was displayed in the ICU breakrooms. The charge and roles RNs were informed about the 30-day QI project and their responsibilities.

Do

The *Do* is the phase of the cycle where the plan is carried out and the changes are tested (Provost & Murray, 2011). Once Internal Review Board approval was obtained from California State University, Long Beach and approval of the project by the medical center, implementation began. The proposed change included a bundle of activities to improve the medication reconciliation process and included three phases over a 12-week period of time:

- Phase 1 - four weeks of baseline data collection; informed the charge and roles RNs of the QI project; posted the fishbone diagram posters; the week prior to

implementation, staff RNs educated in shift huddles; information posted in breakrooms about the QI project;

- Phase 2 – four weeks of implementation and use of the med rec flowsheet with weekly data collection; continued RN education and reinforcement; and
- Phase 3 – four weeks of post implementation weekly data collection.

Study

The *Study* phase compares the data and analyzes the results (Langley et al., 2009). The author analyzed and compared the baseline medication reconciliation data with the data obtained during the implementation and post-implementation phases. The outcome measures were graphed using run charts. The first run chart illustrates the numbers of medication reconciliations that were completed in 20 hours and who collected the information on the y-axis and weeks on the x-axis. A run chart was graphed that identifies the frequency of missing (i.e. incomplete) data related to dose, frequency, and last time taken on the y-axis and weeks on the x-axis. A final run chart was developed to demonstrate whether a change in medication reconciliation information was made between 20 and 44 hours of admission.

The RN survey was used to collect the RNs' perception of the process. Firsthand information provides insight from the lived experiences of the RNs and aids in understanding the process. The survey results were assessed, and a summary of barriers and what was learned from the process were compiled and used for further improvement.

Act

The *Act* phase is taking rationally based action founded on what was learned and refining the cycle (Langley et al., 2009). Weekly results were shared with the ICU RNs

for educational purposes and transparency. The stakeholders reviewed the results and are deciding if it will be beneficial to develop another PDSA Cycle.

During this phase, predictions are assessed (Langley et al., 2009). This project was a change that some saw as helpful, and others as onerous. RNs who practiced prior to implementation of the EHR found this change (a paper and pen med rec form) to be positive since it was familiar, allowed time for the RN to admit the patient, and kept the family occupied in a meaningful way. Others saw it as an unnecessary extra step and did not view this process as beneficial. This process may positively affect the Hospital Consumer Assessment of Healthcare Providers Survey scores, a national public report on patients' perceptions of their hospital care, by improving the patient experience or it may have no impact (Sanchez et al., 2014).

REVIEW OF LITERATURE

The purpose of this QI project was to develop, implement, and evaluate a multimodal nurse driven intervention to improve medication reconciliation in a large urban adult ICU. The following section on the review of literature evaluates the quality of literature and its application to the proposed project.

The search included the following databases: Cumulative Index to Nursing and Allied Health Literature Plus, PubMed Central, Google Scholar, and Web of Science. The search employed the following terms: *medication reconciliation* and *intervention*, *medication reconciliation* and *ICU*, and *medication reconciliation* and *errors*. Medical Subject Heading terms included medication reconciliation, medication error, and intensive care unit. Search limits were set to peer reviewed and published in English within the last five years. Literature related to pediatrics, outpatient setting, pharmacology, and primary care were not included.

Grey literature, case studies, protocols, and editorials were excluded. Literature which focused on delivery of an intervention in an adult ICU with the intent to improve medication reconciliation, the prevalence of medication reconciliation errors in an adult ICU, barriers to reconciliation errors in an adult ICU, and measures of medication reconciliation errors were sought. Reference lists were searched to identify further appropriate publications. Search topics by database and total number of articles are listed in Appendix C.

From all sources, 30 full text articles were reviewed, 20 articles remained after removing duplicates, and six were omitted due to non-relevance. Of the 14 studies included in this review, three were of a qualitative design and utilized interviews, focus

groups, and observations of individuals directly involved with the medication reconciliation process. The 11 quantitative studies included four systematic review and one meta-analysis, the remaining studies had descriptive designs or a quality improvement focus.

Medication Reconciliation Definitions

The term medication reconciliation was coined in 2005 by TJC and there are differences in the definitions used by various organizations (Almanasreh, Moles, & Chen., 2016). The Institute for Health Improvement (IHI), the World Health Organization (WHO), and TJC all have slight variations of the definition. The IHI definition is the most simply stated; obtain a list of all medications a patient is on and compare these medications against the medication ordered upon admission, transfer, and discharge. The WHO definition is the most loosely written and does not specify the medication reconciliation must be completed upon transfer or discharge. The WHO definition is patient centered and includes partnering with the patient to ensure medication reconciliation completeness (Almanasreh et al., 2016).

The term best possible medication list (BPML) is frequently addressed in the literature and is a first step in the medication reconciliation process (Hughes, 2016). The BPML is a comprehensive, systematically obtained list of a patient's current medications (Johnston, Saulnier, & Gould, 2010). The gold standard for obtaining a BPML involves a pharmacist completing the process (Pandolfe, Crotty, & Safran, 2017).

The Agency for Healthcare Research and Quality (AHRQ) described the process of medication reconciliation as obtaining, verifying, and documenting a BPML (Gleason et al., 2012). This QI project entailed obtaining a BPML by partnering with the patient

and family. The QI project practice change involved obtaining from the family and patient, if able, a written list of the patient's current medications including the dose, frequency, and last time the medication was taken. Then the RN, via an interview, verified the medications with the family and patient, and lastly the RN documented the information in the EHR.

Measures of Medication Reconciliation Discrepancies

A systematic review by Almanasreh et al. (2016) included 95 studies and identified three standardized classifications for medication discrepancies resulting from medication reconciliation. The three medication discrepancy classifications were: the Medication Discrepancy Tool, the APS-Doc, and a taxonomy for unintended medication discrepancy. The three classifications included 11 to 48 various types of medication discrepancies. In 22 studies, medication reconciliation errors were classified using relevant published studies and tools based on other researchers, and the number of error categories ranged from 2 to 50 (Almanasreh et al., 2016). The heterogeneity of standardized measurements for medication reconciliation discrepancies make the evaluation of medication reconciliation challenging.

Research shows performing a thorough medication reconciliation minimizes errors, bridges gaps, and ensures completeness, which decreases medication related errors (Schnipper et al., 2018). Therefore, the foundation for a complete and accurate medication reconciliation is a medication management system developed by executive leadership which supports obtaining a BPML by using a systematic approach based on patient partnership, evidenced-based policies and procedures on medication reconciliation, and a robust QI process (Almanasreh et al., 2016).

Prevalence of Medication Reconciliation Errors

A meta-analysis by Mekonnen, Abebe, McLachlan, and Brien (2016) showed that the use of an electronic medication reconciliation intervention reduced the frequency of unintended medication discrepancies. The most common error being omission of a medication (Lombardi et al., 2016; Mekonnen et al., 2016). As healthcare systems become more complex the risk for medication errors particularly at transitions of care increases (Mekonnen et al., 2016; Shah et al., 2015). The literature supports that evidenced based interventions improve the process of reconciliation significantly (Kim et al., 2018; Mekonnen et al., 2016; Schnipper et al., 2018). Obtaining an accurate medication reconciliation is an ongoing problem in hospital settings; however, appropriate interventions to improve the process of reconciliation can decrease errors related to medication reconciliation justifying the need for this project.

Gleason et al. (2012) stated that the patient is the best source to recall medication information, however, this may be compromised when an individual is critically ill. Utilizing the family, the patient's medication containers, or calling the patients pharmacy for this information are appropriate alternatives to completing a BPML. The intent of this QI project was to increase medication reconciliation completeness at the project setting by partnering with the family and patient to obtain a BPML.

Medication Reconciliation Improvement

There are several approaches supported in the literature to improve the medication reconciliation process. The literature shows that having a medication list or card, bringing medication containers from home, and patient medication education improve the medication reconciliation process (Adhikari, Tocher, Smith, Corcoran, & MacArthur,

2014; Almasreh et al., 2016; Kim et al., 2018). Organizations with a commitment to medication reconciliation, EHR, electronic alerts, and iterative refinement minimized medication reconciliation discrepancies (Mekonnen et al., 2016; Sanchez et al., 2014; Schnipper et al., 2018; Seidling & Bates, 2016). In addition, the advent of the EHR has been a benefit since it allows for shared data, and timely evaluation and reconciliation (Mekonnen et al., 2016).

A QI project by Schnipper et al. (2018) conducted in six U.S. cities involved implementation of an 11-item evidenced based toolkit to decrease medication discrepancies. The toolkit included obtaining an accurate medication history from all sources and interventions to empower patients to take ownership of their medication list (Schnipper et al., 2018). In addition, the toolkit emphasized QI principles, assembling a team, and phased implementation. Facilities participating in this study implemented any of the 11 components to improve access to preadmission medication sources, with a minimum implementation of a BPML. According to Schnipper et al. (2018) medication reconciliation completeness improved in the participating facilities with implementation of a multifaceted medication reconciliation QI project. Therefore, the author's project was designed to change the medication reconciliation process by directly asking patients family members or the patient to complete a form listing the patient's current medications. This process allowed the collection of a BPML and was designed to empower the family member by including them in the admission process.

Patient-centeredness is essential in promoting safe and effective care. Patients and families with positive dispositions about safety and engagement in their healthcare experience less adverse events and report improved satisfaction (Kim et al., 2018;

Sanchez et al., 2014). Patient input improves care and integrating patients and families as active team members decreases errors (Kim et al., 2018). A strategy to promote patient centered care is to engage patients and families in the medication reconciliation process, which is the intent of this project. A systematic review by Mongkhon, Ashcroft, Scholfield, and Kongkaew (2018) found the medication reconciliation process reduces hospital readmissions related to medication non-adherence, therefore, patient inclusion in this process is a key factor and should be explored as a strategy to improve the process of medication reconciliation. Having families complete the med rec flowsheet is a step towards patient centered care and documentation of a complete and accurate medication reconciliation.

Implementation Process

The actual process of medication reconciliation varies across settings. Four of the eight articles reviewed for this project evaluated the process of initial medication reconciliation and noted medication data were typically obtained from the patient, family, or caregiver via interview. Many researchers, however, did not reference how the information was documented and entered into the EHR (Andreoli et al., 2014; Bosma et al., 2018; Lombardi et al., 2016; Pascual et al., 2014; Schnipper et al., 2018). In the Lombardi et al. (2016) study, 42% of medication reconciliation records involved the patient as the sole source of information. Studies by Mekonnen et al. (2016) and Seidling and Bates (2016) focused on the implementation of a standardized paper form; however, they did not discuss whether the patient, family, or RN completed the form.

An interview process to complete the medication reconciliation utilized RNs in two studies (Andreoli et al., 2014; Pascual et al., 2014). In other articles if mentioned, a

pharmacist, pharmacy intern, or medical doctor conducted the interview. Articles by Andreoli et al. (2014), Bosma et al. (2018), and Lombardi et al. (2016) referred to the process as an: interview guide, medication verification interview, or a structured interview. However, the specific questions asked during the interview were not mentioned. Sanchez et al. (2014) were the only researchers who noted the interviewers received training. As shown in these studies, a standardized multi-disciplinary data-collection methodology was not represented in the literature.

In one article, the medication reconciliation process was divided into two parts: the basic medication reconciliation which included obtaining a BPML upon admission then entry of the data in the medical record by a RN and the full reconciliation which involved pharmacy staff checking the list against additional sources to identify discrepancies using a structured approach (Shah et al., 2015). In a similar fashion, the use of a two-step process was used in this QI project; first by collecting a BPML from the family and secondly by reviewing the information with the family and patient.

A systematic approach is necessary to effectively evaluate the process of medication reconciliation. However, there is little published research on the medication reconciliation process. According to Seidling and Bates (2016), the execution of an intervention is rarely described in published research; therefore, intricate knowledge regarding implementation of an intervention is often unknown. The idea of medication reconciliation is straightforward. Nevertheless, conceptualization and implementation of a multidisciplinary and multistage process is challenging (Almanasreh et al., 2016).

No single source of an individual's medication history is fully accurate or reliable per Almanasreh et al. (2016). Two studies discussed a two-source verification process for

medication reconciliation (Adhikari et al., 2014; Shah et al., 2015). Adhikari et al. (2014) verified medications from the patient, the medical record, medication containers, and relatives. Shah et al. (2015) verified medications from the patient, the individual managing the medications, prescriptions, and the patient's medical doctor. The studies by Mekonnen et al. (2016) and the Seidling and Bates (2016) on medication reconciliation concluded a singular implementation plan is not often reproducible due to differences in processes, constraints, resources, transferability, and generalizability of a singular intervention to another setting. The aim of this QI project was to determine what would be the best process of medication reconciliation at the medical center of interest.

In order for health care facilities to determine which interventions produce the most success in the process of medication reconciliation, changes in process need to be implemented, and an iterative improvement process ensued until the problem is remedied. The review of literature did not generate any studies related to conducting a QI project utilizing direct family and patient involvement to increase partnership and drive safe patient care as a medication reconciliation strategy. Furthermore, there is limited published data describing the details of an evidenced based interview for medication reconciliation. This project focused on examining whether patient/family recorded medical information followed by RN review would improve the process and workflow of medication reconciliation at the author's project site.

Barriers to Medication Reconciliation

Barriers to completion of the medication reconciliation are frequently reported in the literature and include patient attributes, time constraints, and system factors. Researcher groups in three studies noted the following patient attributes that interfered

with obtaining a BPML: immigrant status, language barrier, low health literacy, delirium, dementia, severity of illness, perception that noninvolvement will affect care, and polypharmacy (Aghajani et al., Andreoli et al., 2014, 2016; Kim et al., 2018). System barriers for medication reconciliation include implementing a new EHR, adding more verification practices, and poor communication and cooperation between healthcare professionals (Härkänen, Blignaut, & Vehviläinen-Julkunen, 2018; Schnipper et al., 2018).

Time constraints for the RN completing the medication reconciliation were noted in two studies (Schnipper et al., 2018; Shah et al., 2015); with 21 minutes as the average time a RN spends per patient on medication reconciliation (Schnipper et al., 2018).

Physicians and RNs involved with medication reconciliation spend less time than pharmacists, related to such factors as: medication knowledge, high patient-nurse ratio, differences in interview skills, limitations in work load, level of responsibility, perceived lack of time, and stressful conditions (Aghajani et al., 2016; Härkänen et al., 2018). In this QI project, the influence of time spent on medication reconciliation was assessed by asking RNs via a survey conducted during the implementation phase to identify if the practice change (using the med rec flowsheet) influenced the time spent on medication reconciliation.

The expectation that this project would improve the process of medication reconciliation was based in part on the time constraints of the RN and obtaining a BPML in a timely manner. The author posited if the family or surrogate completes the med rec flowsheet, this would free up time for the RN to spend on other activities. In addition, it

was thought that giving the family the flowsheet to complete may ensure a complete list of a patient's medication and aid in the medication reconciliation process.

Conclusion

The literature review supported the following: there are challenges with obtaining a complete medication reconciliation across settings, especially in the ICU; multiple barriers to the process have been identified; iterative refinements of the process decreases medication reconciliation errors; and patient and family engagement improves the likelihood of a BPML. The literature review is not clear on what successful implementation entails and little is published on the actual implementation of the medication reconciliation process. Medication reconciliation discrepancy measures and terms are not used consistently, making interpretation and application challenging. The goal of this QI project was to implement the stated interventions to improve medication reconciliation and to add to the body of literature to improve the process.

METHODS

The purpose of this QI project was to develop, implement, and evaluate a multimodal nurse driven intervention to improve medication reconciliation in an adult ICU. The aims of this project were to:

1. Develop a bundle of activities to improve medication reconciliation.
2. Implement the bundle.
3. Evaluate if the bundle improved the process and offer recommendations.

This QI project revised the current medication reconciliation process at the project setting by having a family member or surrogate complete a paper flowsheet (Appendix A) prior to the usual process of a face to face RN patient/family interview related to medication reconciliation. A script was generated for the RNs to use when discussing the med rec flowsheet with the patient/family (Appendix D). At the time of this QI project, the standard of practice did not include the paper and pen med rec flowsheet, and only included a patient and or family interview. The methodology section addresses the following: aspects of the design, setting, measures, ethical considerations, process intervention, and evaluation.

Design

A QI approach was used to implement a practice change with the inclusion of a paper and pen tool to improve medication reconciliation in an adult urban ICU. Evaluation of the intervention involved collection and analysis of data pre and post intervention.

Setting

The setting for this QI project was a level II trauma center with 453 patient beds located in Southern California. The adult ICU where this project was conducted has 43-beds; the ICU was currently undergoing a yearlong remodeling plan, so the number of beds during implementation of the project varied slightly.

Patient Samples

The case mix in the ICU included high acuity adult medical-surgical, trauma, and neurological patients. Patient inclusion criteria included: direct ICU admission, ICU stay of 20 hours or greater, English speaking, and family member or surrogate willing to complete the flowsheet, or patient completing the flowsheet if clinically stable and cognitively intact. Exclusion criteria included: transfer to the ICU from another in-patient unit, non-English speaker, ICU stay of less than 20 hours, no family/surrogate present if the patient could not complete the form, or family/surrogate member refusal to complete the flowsheet.

Nurse Samples

There were 132 staff RNs employed in the ICU during the QI project implementation. The majority of the RNs had a bachelor's degree in nursing, and many are board certified as a Critical Care Registered Nurse by the American Association of Critical Care Nurses. There were seven charge RNs assigned to this unit including the day and night shifts and 15 RNs assigned to identified roles positions.

Stakeholders

The stakeholders for this QI project included the ICU director, nurse educator, and clinical nurse specialist, all of whom had practiced for more than 20 years, had master's degrees in nursing, and had been employed by the facility for more than a

decade. The stakeholders were involved with the planning of this QI project and were consulted throughout the process. The pharmacy supervisor was consulted during the planning phase to discuss current practices, the new process, and data collection procedures for extrapolating medication reconciliation documentation located in the EHR. The Director of Clinical Transformation was consulted to develop the paper med rec flowsheet. The Director of Professional Nursing Education was informed of the QI project as well. A letter on facility letterhead in support of the QI project was obtained from the director of professional nursing education and from the university (Appendix E).

Measures

The two outcomes measured for this QI project were RNs perceptions of medication reconciliation efficacy and the percentage of complete medication reconciliations in the EHR. The first outcome, perception of medication reconciliation efficiency was measured with an author generated tool titled Survey of RN Perception of New Medication Reconciliation Process (Appendix B). The second outcome, the rate of complete medication reconciliations in the EHR, was measured using three categories: completeness at 20 hours of admission, areas of incompleteness at 20 hours of admission, and if changes were made within 20 to 44 hours after admission. Completeness was defined if a medication was entered with all of the corresponding fields, i.e., name, dose, frequency, and last time taken or if the healthcare provider entered that no medications were taken.

Survey of RN Perception of New Medication Reconciliation Process

The RN survey is an eight-item self-administered paper and pen survey developed by the author to reflect critical elements of the process change (Appendix B). The survey

asked RNs about their perceptions of the addition of the paper and pen tool, the family's reception of the tool, and if the tool changed the amount of time needed to complete the medication reconciliation in the EHR. The survey included six closed and two open ended responses. Face validity of the survey was assessed using five RNs employed in the medical centers cardiac care unit (CCU). Appropriate changes were made to increase face validity of the survey after feedback was provided by the CCU RNs.

The survey was paperclipped to the paper med rec flowsheet. The survey data were analyzed to gain front-line insight and feedback to assist with medication reconciliation improvement. Survey response rates, time used for the new process, and question responses were evaluated to assess if the flowsheet was a useful tool to aid the RNs with the medication reconciliation process.

The survey included items to evaluate any negative sequelae from the practice change. Balancing measures help to ensure an improvement in one area does not negatively affect another. The first item queried whether the use of the flowsheet assisted the RN in completing the medication reconciliation in the EHR. The second item sought to know if the flowsheet required extra time by the RN. The third item addressed the reception of the family, surrogate, or patient when asked to complete the flowsheet. If findings from the survey indicated the flowsheet did not aid the RN, was time consuming, or if the flowsheet was perceived negatively by the family/surrogate, the process would need to be reevaluated.

The first measure for the survey was calculated by counting the number of yes responses to the question "did the flowsheet aid you in completing the medication reconciliation prior to recording the patient's medication list in Epic" divided by the total

number of surveys collected. The second measure was calculated by assessing the responses of more time, less time, or no change to the question did using the med rec flowsheet change the time spent entering data in the EHR over the number of survey responses. The time in minutes was assessed if indicated on the survey. The third measure was calculated by assessing the reception of the family, surrogate, or patient when asked to complete the med rec flowsheet divided by the total number of responses collected. There are four possible responses for the reception of the family, each of these was measured.

Medication Reconciliation

Baseline, implementation, and post implementation data were collected over 12 weeks. During each of the four week timeframes, a convenience sample of 10 patients who met the inclusion criteria were selected and data from their medication reconciliation documentation report listed in the EHR were collected and analyzed. Information was collected from Epic, the EHR at the facility, and the following data were captured: age, gender, ICU admission time, medication reconciliation complete within 20 hours and 44 hours, Glasgow Coma Scale (GCS), language, individual completing the med rec flowsheet, and medication(s) name, dose, frequency, and the last time the medication was taken prior to admission as listed on the med rec flowsheet. Data were entered into an Excel spread sheet and run charts were created to compare the three time periods. Three metrics were used for the measures for each run chart:

- Medication reconciliation completeness at 20 hours was defined as EHR submissions and documentation of a patient's medications with all of the corresponding fields (i.e. name, dose, frequency, and last time taken) included.

The numerator represents the number of patients with medication reconciliations complete and entered into the EHR within 20 hours of admission; the denominator represents the total number of patients in the sample;

- Medication reconciliation incompleteness at 20 hours was defined as EHR submission of a patient's medication reconciliation with omission of information related to a medicine(s) dose, frequency, and or last time taken at 20 hours. The percentage of submitted forms that lacked any of these data divided by the total number of submitted forms was calculated. In addition, a second calculation was completed to determine the degree of omission. For this calculation, the author determined the total number of patient medications reported for each of the groups and multiplied this number by three to represent dose, frequency, and time. The numerator for this calculation represent the number of medication fields that were not entered in the EHR for each of the three groups of patients; the denominator represent the total number of possible fields for each of the three groups to determine medication information completeness: and
- Change(s) made to the medication reconciliation in the EHR between 20 and 44 hours after admission was also investigated. The total number of changes to the EHR between 20 and 44 hours of admission in each of the three periods was reported.

Ethical Considerations

Approvals from the Institutional Review Boards from the facility and California State University Long Beach were obtained to ensure ethical standards were followed. This QI projects offered minimal risk to the patient, RN, or facility.

Medical Record

The medical facility used Epic as the EHR and health data base system. The author of this paper was the sole investigator and accessed Epic to collect the medication reconciliation data using the authors sign-on and password after approval was granted by the facility and California State University, Long Beach's Institutional Review Boards (Appendix E). Data were de-identified and aggregated mitigating the risk of bias and ensuring ethical considerations were followed. Data privacy and security provisions were safeguarded under the Health Insurance Portability and Accountability Act of 1996. The de-identified medication reconciliation data were recorded on the facility's computer system for safeguarding. A unique identification number was assigned to each participant of the QI project. The author used the ICU nurse educator's office to access Epic for data collection purposes; the office was locked when not in use.

Nurse Survey

The Survey of RN Perception of New Medication Reconciliation Process Survey did not include information which could identify the RNs with the exception of years of experience and if a Critical Care Registered Nurse Certification was held. The survey was paperclipped to the med rec flowsheet to reduce user non-response. The completed surveys were given to the charge RN who gave the forms to the ICU nurse educator, the completed surveys were stored in the ICU nurse educator's locked office. Data from the surveys were recorded on the facility's computer for safeguarding. Intellectus Statistics, a software program, was used to analyze the data. After completion of the QI project, the surveys were disposed of in the confidential recycle bin at the facility.

Process Intervention for Fishbone Diagram

The author emailed and spoke with the charge RNs to inform them of the QI project, posting of the fishbone diagram, and their responsibility to discuss the fishbone diagram in the daily huddles for seven consecutive days starting on a specific date. This occurred the week prior to posting of the fishbone diagrams. The author posted the two fishbone diagrams two weeks prior to project implementation and removed the diagrams once implementation of the QI project started.

Process Intervention for New Medication Reconciliation Process

The author emailed and spoke directly with the charge and role RNs to inform them of the QI project, provided education about the new process, and discussed their responsibilities. This occurred 14 days prior to implementation of the QI project. For seven days prior to the QI project implementation, during the shift huddles, the charge RN educated and informed the staff RN of the QI project, the paper med rec flowsheet, and survey for medication reconciliation. Information on the QI project was posted in the ICU breakrooms. The author took part in providing education at some of the shift huddles and was available for questions.

The PDSA Cycle framework was utilized for this QI project. The primary change for the project's medication reconciliation process was to distribute the printed med rec flowsheet which was given to the patient's family member, surrogate, or patient to complete while the RN admitted the patient. The family member/surrogate was asked to complete the flowsheet to the best of their ability and was instructed to give the med rec flowsheet to the RN once it was completed. If there was no family member/surrogate present, the patient was able to complete the form if clinically stable and cognitively intact. Once the patient was admitted, the family/surrogate and patient, if able, reviewed

the flowsheet for completeness with the RN. The RN then entered the data in the EHR with the goal of medication reconciliation completeness.

The staff RNs gave the completed med rec flowsheet to the charge RN who gave the flowsheet to the ICU nurse educator. The flowsheets were stored in the ICU nurse educators' locked office. Incomplete flowsheets were left in the patient's room for a visual reminder to complete the form. The flowsheet was posted to the bulletin board or placed on the counter for a visual reminder that the medication reconciliation was not complete. The roles RNs for the shift assisted as necessary either with the interview process or entering the medication information in the EHR. The flowsheets were used when generating Epic medication reconciliation reports during the implementation phase of the project. The author accessed the medication reconciliation reports from the EHR of the selected patients. The flowsheets were disposed of in the facility's confidential disposal bin at the end of the QI project.

PDSA Cycle Elements

Plan

- Review facilities medication policy and pertinent literature;
- Identify stakeholders;
- Convert electronic med rec to a paper flowsheet (Appendix A);
- Develop RN survey (Appendix B); and
- Collect and analyze weekly baseline data from 10 EHRs on medication reconciliation.

Do

- Educate charge RNs about fishbone diagrams;

- Post fishbone diagram (Figure 2) for 14 days, discussion in daily huddles by shift lead RN for first seven days;
- Educate charge and roles RNs about med rec flowsheet and responsibilities 14 days prior to implementation (Appendices A and D);
- Educate staff RNs about med rec flowsheet in daily huddles by charge RN for seven days prior to implementation;
- Implementation of med rec flowsheet for 30 days with RNs surveys;
- Collect and analyze weekly data from 10 EHR on medication reconciliation which participated in the QI project;
- Remove flowsheets from unit after 30 days; and
- Collect and analyze weekly post implementation data on medication reconciliation from 10 EHRs.

Study

- Analyze baseline, implementation, post-implementation data;
- Analyze RNs surveys;
- Create run charts and bar graphs; and
- Review data with stakeholders.

Act

- Summarize findings;
- Review barriers; and
- Offer recommendations for improvement and sustainment.

Evaluation

The QI project was evaluated in two ways. Evaluating compliance with the facility's medication reconciliation policy on completeness of the medication reconciliation in the EHR entailed an analysis of the run charts and comparisons to demonstrate whether the med rec flowsheet improved the process. The RNs survey responses were analyzed to determine if the med rec flowsheet was viewed as an effective data collection tool from front-line perspectives.

To ensure rigor of the quantitative data obtained from the EHR, the author double checked all entries. To ensure strength of the qualitative data obtained from the RNs surveys, the data were entered in the collection tool by the author and double checked by the author. The author had no bias to the outcome of the QI project and all data were accurately presented.

RESULTS

This section presents the results of the data analysis of the medication reconciliation QI project. Data analysis of the complete and incomplete medication reconciliations during the three phases was conducted using SPSS. The results of the Survey of RN Perception of the New Medication Reconciliation Process were analyzed using Intellectus Statistics software. A brief summary of the activities surrounding the QI project is also presented.

Pre-Implementation Data and Activities

Fishbone Diagram

Two fishbone diagrams posters were displayed from September 19th through October 3rd in the ICU breakrooms (Figure 2). Information about staff RN involvement in the project was distributed via facility email and at the twice daily shift huddles during the first week the posters were displayed. The author was present during four of the shift huddles and discussed the relevance of the QI project and importance of RN input on the fishbone diagrams. The author also met one-on-one with several of the RNs to explain the QI project and encourage the RNs to write factors on the posters they believe affected the medication reconciliation process in the ICU.

Ten RNs wrote comments on the fishbone diagram posters. The common themes were the medication reconciliation should be completed by a pharmacist or medical physician, the process was not clear, and medication reconciliation was not a priority due to high patient acuities. Considering there were 132 RNs employed in the ICU during the time of the QI project, a response rate of 10 is minimal. Upon discussion with several RNs, the author found that some of the charge RNs did not discuss the fishbone diagram

posters during the huddles, many RNs did not regularly check their facility email, and many did not use the breakrooms for their designated work break times.

Baseline Medication Reconciliation Data Collection

From September 12th through October 3rd, a convenience sample of the medical records files of 40 patients were reviewed and medication reconciliation data were collected by the author who accessed patient files via their EHR for the following:

- Medication reconciliation completeness at 20 hours was defined as EHR submissions and documentation of a patient's medications with all of the corresponding fields (i.e., name, dose, frequency, and last time taken) included. The numerator represents the number of patients with medication reconciliations complete and entered into the EHR within 20 hours of admission; the denominator represents the total number of patients in the sample;
- Medication reconciliation incompleteness at 20 hours was defined as EHR submission of a patient's medication reconciliation at 20 hours with omission of information related to a medicine(s) dose, frequency, and or last time taken. The percentage of submitted forms that lacked any of these data divided by the total number of submitted forms was calculated. In addition, a second calculation was completed to determine the degree of omission. For this calculation, the author determined the total number of patient medications reported for each of the groups and multiplied this number by three to represent dose, frequency, and time. The numerator for this calculation represent the number of medication fields not entered in the EHR for each of the three groups of patients; the denominator

represent the total number of possible fields for each of the three groups to determine medication information completeness: and

- Change(s) made to the medication reconciliation in the EHR between 20 and 44 hours after admission was also investigated. The total number of changes to the EHR between 20 and 44 hours of admission in each of the three periods.

In the baseline group of 40 patients, a medication reconciliation was submitted for 37 (92.5%) of the patients at 20 hours. Of those 37 patients, 11 had various omissions in medication information with the percentage of a medication reconciliation completeness at 70.3% (N=26). Of the 11 incomplete submissions, five had doses and frequencies omitted (45.5%). The last dose taken omission occurred in all 11 (100%) of the incomplete submissions. The 11 incomplete forms had a total of 85 medications and 255 fields (i.e. dose, frequency, and last time taken). Of the possible 255 medication fields there were eight (3.1%) missing fields for each both total dose and frequency omissions. The total number of last time taken omissions was 69 (27%) (Tables 1, 2, and 3).

During the QI project implementation phase the medication reconciliation was updated more consistently at 76.7% prior to implementation, 96.3% during implementation, and 100% was obtained during the four weeks after implementation. This shows this process was beneficial since the RNs were attentive to missing information and updated the medication reconciliation accordingly. Table 4 demonstrates the pattern of changes in medication reconciliation postings within 20 to 44 hours after admission.

Table 1

Medication Reconciliation Submission and Completeness within 20 Hours: Baseline, Implementation, Post-Implementation Phases

	Baseline	Implementation	Post-Implementation
	N, %	N, %	N, %
Group Total	40	17	40
Did not submit	(3, 7.3%)	(0, 0%)	(0, 0%)
Submitted	(37, 92.5%)	(17, 100%)	(40, 100%)
Complete	(26, 70.3%)	(15, 88.2%)	(40, 100%)
Incomplete	(11, 29.7%)	(2, 11.8%)	(0, 0%)

Table 2

Dose, Frequency, and Time Omissions in Medication Reconciliation EHR Submissions within 20 Hours by Implementation Phases

	Baseline	Implementation	Post-Implementation
	N, %	N, %	N, %
Group submissions	37	17	40
Incomplete forms	(11, 29.7%)	(2, 11.8%)	(24, 60%)
Missing data			
Dose(s)	(5, 45.5%)	(1, 50%)	(10, 41.6%)
Frequency	(5, 45.5%)	(1, 50%)	(9, 37.5%)
Time last taken	(11, 100%)	(1, 50%)	(24, 100%)

Table 3

Total Dose, Frequency, and Time Omissions in Incomplete EHR Medication Reconciliation Submissions within 20 Hours by Implementation Phase

	Baseline	Implementation	Post-Implementation
Incomplete forms	11	2	24
Number of medications	85	14	106
Total data fields	255	42	318
Missing data fields			
Dose(s)	(8, 3.1%)	(1, 2.4%)	(21, 6.6%)
Frequency	(8, 3.1%)	(1, 2.4%)	(19, 6%)
Time	(69, 27%)	(1, 2.4%)	(168, 52.8%)
Total missing fields	(85, 33.3%)	(3, 7.1%)	(208, 65.4%)

Table 4

Change in Medication Reconciliation Submissions within 20 to 44 Hours After Admission by Implementation Phases

	Baseline	Implementation	Post-Implementation
Count	7	2	24
% change	18.9%	11.8%	60%
Count	30	15	16
% no change	81.1%	88.3%	40%
Total counts	37	17	40
Forms without changes			
Count	30	15	16
Forms that should have changed			
Counts	7	1	0
% should have changes	23.3%	3.7%	0%

Implementation Data and Activities

Medication Reconciliation

Implementation of the QI process ran from October 10th through November 7th. Information on the new process was distributed to the staff RNs via facility email on October 3rd and 10th. Posters describing the new process were posted in the breakrooms during this time period. The author met with the four charge RNs prior to October 3rd to review the new process and discuss the information to be presented in the daily shift huddles. The charge RNs then presented information on the new process during the huddles from October 3rd through the 10th. The author was present at four of the huddles to deliver the information. Clipboards with attached pens, the RN script, med rec flowsheet, and RN survey were placed at each of the four nurses' stations and replenished on a regular basis. The author was to present information on the QI project on October 8th during a monthly staff meeting; however, the meeting was cancelled by the manager due

to staffing issues, an EHR upgrade, and a White Glove Survey in preparation for an upcoming TJC Survey.

The first week of implementation was October 10th through 17th, unfortunately no RN implemented the new process, so no data were collected for this week. During this time there were 47 direct admits from the emergency department (ED) to the ICU. Upon examination as to why this occurred several factors were discovered and included the following: the clipboards and accompanying documents were removed in preparation for the White Glove Survey and were not replaced afterwards; the staff meeting was re-scheduled and subsequently cancelled again; the charge RNs were not discussing the new process during the huddles; the RNs were not regularly reading their emails; the RNs were struggling with the new EHR upgrade; the facility had a mandatory class on improving patient care; and the unit was short staffed due to high RN turnover.

The author decided to motivate and inform the staff on an individual basis to increase awareness and buy-in of the new process. Of the 132 RNs, the author personally spoke with approximately 70. Staff RNs were approached outside of patient rooms, when they appeared to be not too busy. Information was provided visually and orally in less than three minutes and a food incentive was provided. The majority of the RNs were receptive and thought the new process would assist them with completing the medication reconciliation form in the EHR.

October 18th through 24th was the second week of implementation. Five RNs used the new process based on the QI project and completed the RN survey. During this time there were 55 direct admits from the ED to the ICU. When the author questioned some of the RNs as to why the new process was not used some of the response were: “the med

rec was completed in the ED, the patient had no meds, there was no family, and the patient was intubated”.

October 25th through 31st was the third week of the QI project implementation. Seven RNs used the new process based on the QI project and completed the RN survey. During this time there were 26 direct admits from the ED to the ICU. When the author questioned some of the RN as to why the new process was not used some of the response were: “the patient was transferred out of the ICU, the patient and family did not speak English, and the patient only had two meds so it wasn’t necessary”.

November 1st through 7th was the fourth and final week of the QI project implementation. Five RNs used the new process however, only four completed the RN survey. During this time there were 39 direct admits from the ED to the ICU. When the author questioned some of the RNs as to why the new process was not used, the responses were similar to prior remarks “there was no family and the patient was intubated, the pharmacist did the med rec, and they speak Spanish only”.

The author planned on the new medication reconciliation process being used with 40 patients. However, due to a multitude of factors, the new process was only used on 17 patients. Of the 17 patients, a medication reconciliation was submitted for 17 (100%) of the patients at 20 hours. Of the 17 patients, two had omissions in medication information with the percentage of a medication reconciliation completeness at 88.2% (N=15). Of the two incomplete submissions, there was one omission each for dose, frequency, and last time taken (50%). The two incomplete forms had a total of 14 medications and 42 fields (i.e. dose, frequency, and last time taken). The missing fields for total dose, frequency,

and last time taken omission in these two medication reconciliations totaled three (7.1%) (Tables 1, 2, and 3).

Other Factors Investigated

Data on age, gender, admission time, GCS, English speaking, individual collecting information (RN, pharmacist, or physician), and individual giving information were also collected as to whether these factors could be associated with the outcome measures of interest. Specifically, the author was interested to see whether any of these factors would influence whether the medication reconciliation was complete in 20 hours, if there was a change to the medication reconciliation within 44 hours of admission, and the completeness of the information provided for number of medications including dose, frequency, and last time taken.

GCS was assessed and documented on 96 patients, GCS was not documented on one patient. Of the 96 patients, 72 had a GCS between nine and 15 with medication reconciliation submission of 97.3%. Eleven patients had a GCS between four and eight with medication reconciliation submission of 91.7%. Ten patients had a GCS less than three with a medication reconciliation submission of 100%. The medication reconciliation submissions were completed at a higher percentage on individuals with lower GCS scores (Table 5).

Table 5

*Glasgow Coma Scale and Medication Reconciliation Submissions (N=96) within 20**Hours*

Glasgow Coma Score	9 – 15	8 - 4	3
Count	72	11	10
Med Rec Submitted	97.3%	91.7%	100%
Count	2	1	0
Med Rec not Submitted	2.7%	8.3%	0%
Total Counts	74	12	10

Age was documented on 94 patients. Three patients were admitted without their age documented, this occurs when an unconscious patient is admitted without any form of personal identification or is unaccompanied. The majority of the patients were between 51 and 75 (N=49, 52.1%) years of age, 26 (27.7%) patients were age 76 or older, and 19 (20.2%) were between the ages of 18 and 50. Medication reconciliation was more likely to be submitted for patients in the younger age groups (Table 6). Albeit, the percentage difference was small.

Table 6

Age Range and Medication Reconciliation Submissions (N=91) within 20 Hours

Age Range by Years	18 – 50	51 - 75	≥76
Count	19	48	24
Med Rec submitted	100%	98%	92.3%
Count	0	1	2
Med Rec not submitted	0%	2%	7.7%
Total counts	19	49	26

Thirty-three medication reconciliation were updated in the EHRs between 20 and 44 hours after admission with percentages calculated based on age ranges. An update occurred in 18.2% (N=6) for patients ages 18 to 50, for patients between 51 and 75 years medication reconciliations were updated 51.5% (N=17), and 30.3% (N=10) for patients 76 years and older (Table 7).

Table 7

Age Range and Medication Reconciliation Changes (N=33) between 20 and 44 Hours

Age range by years	18 - 50	51 - 75	≥76
Count	6	17	10
% med rec change	18.2%	51.5%	30.3%
Count	14	27	13
% med rec not changed	25.5%	50%	23.6%
Count	0	4	3
% should have changed	0%	14.8%	23.1%
Total counts	20	47	26

Time of admission was assessed using three categories. Admissions during the day shift totaled 35 (36.1%), night shift admissions were 38 (39.1%), and admissions that occurred with one hour of change of shift totaled 24 (24.7%) (Table 8). The data demonstrates change of shift was not an issue in submitting the medication reconciliation during this project. Interestingly, the day shift had a higher percentage of incomplete medication reconciliations completed in the EHR.

Table 8

Unit Admission Time and Medication Reconciliation Submissions Within 20 Hours

ICU Admission Time	Day Shift	Night Shift	Shift Change
Count	35	38	24
% Admission	36.1%	39.1%	24.7%
Count	33	37	24
Med Rec Submitted	94.2%	97.3%	100%
Count	2	1	0
Med Rec not Submitted	5.8%	2.7%	0%
Total Counts	35	38	24

RN Perception Survey

In total, 16 RNs completed the Survey of RN Perception of the New Medication Reconciliation Process (Appendix B): zero the first week – October 10 through 17, five the second – October 18 through 24, seven the third – October 25 through 31, and four the fourth week – November 1 through 7. The first query in the survey was whether the med rec flowsheet aided the RN in completing the medication reconciliation in the EHR. Fifteen of the 16 (93.8%) RNs responded to this question and all responded “yes” (Appendices F and H).

RNs were queried whether using the flowsheet required more time, less time, or no change related to the time they spent entering data in the EHR with 15 of the 16 answering this item. Twelve out of 15 (80%) respondents indicated that time was saved (i.e., required less time) and the most frequent range of time saved was between 6 to 10 minutes (Appendices F and H).

RNs were asked about the reception of the family, surrogate, or patient when asked to complete the med rec flowsheet. There are four possible responses from which

to select, and all 16 RNs answered this question. A neutral response was selected by 11 (68.8%) of the RNs which was the most common response given when the RN asked a family member or others with the patients to complete the form. A positive response was given in four (25%) requests and one RN (6.3%) had a family member refuse to complete the form (Appendices F and H).

Years of experience as an RN and Critical Care Registered Nurse designation were assessed. The mean number of years of experience as a RN was 5.8. Six of the 16 (37.5%) had a Critical Care Registered Nurse designation; the majority of RNs participating in this survey were not Critical Care Registered Nurse designated (Appendix F).

Post-Implementation Data and Activities

Medication Reconciliation

On November 7th, the clipboards, QI project med rec flowsheets, and information posters were removed from the ICU. From November 8th through December 5th post-implementation data were collected using the same process as utilized during the baseline process; a convenience sample of 40 patients were selected and their EHR medication reconciliation information, 10 per week, was assessed for medication reconciliation completeness. Information on age, gender, admission time, GCS, English speaking, individual giving information, individual collecting information, if the medication reconciliation was complete in 20 hours, if there was a change in the medication reconciliation within 44 hours of admission, and the number of medications including dose, route, frequency, and last time taken were also collected.

In the post-implementation group of 40 patients, a medication reconciliation was submitted for all 40 (100%) patients within 20 hours of admission. Of those 40 patients, 24 submissions had various omissions in medication information with the percentage of a medication reconciliation completeness at 40%. Of the 24 incomplete submissions, 10 had a dose omitted (41.7%), nine had a frequency omitted (37.5%), and 24 had the last time taken omitted (100%). The 24 incomplete forms had a total of 106 medications and 318 fields (i.e. dose, frequency, and last time taken). The missing fields for total dose was 21 (6.6%), missing fields for total frequency was 19 (6%), and the total of last time taken omissions was 168 (52.8%) (Tables 1, 2, and 3).

DISCUSSION

Medication reconciliation is a vital part of safe patient care and improving the safe use of medications in hospitals has been a Joint Commission National Patient Safety Goal since 2009 (Shah et al., 2015; TJC, 2020). The Institute of Medicine's report *To Err Is Human: Building A Safer Health System* drew attention to the lethal medical errors occurring in U.S. hospitals and subsequent studies suggest the rates of medical errors are high and possibly increasing (Bosma et al., 2017; Classen et al., 2011; Kohn et al., 2000; Lopez-Martin et al., 2014). The goal of this QI project was to improve the completeness of medication reconciliations for patients directly admitted to an ICU.

Key Findings

The key findings of this study indicate the medication reconciliation process can be improved by increasing awareness of the importance of a complete and current medication list and utilizing a paper and pen format to collect this information is beneficial. Medication reconciliation submission was 92.5% prior to implementation of the QI project and 100% during the four weeks of implementation and sustained for the four weeks following implementation (Table 1). Medication reconciliation completeness was 70.3% (N=40) at baseline, 88.2% (N=17) during implementation, and 100% (N=40) during the post-implementation phase (Table 1).

In health care the goal is perfection, obtaining submission and completion rates of 100% on medication reconciliations should not be cause for celebration: instead this should be the status quo. The improvement in medication reconciliation submissions and completeness during the implementation phase and sustainment during the post-implementation phase may be attributed to the paper and pen format and the process of

including the family members, surrogate and patient, if possible, to obtain a BCML, the RNs awareness that the author with support from the facility was collecting data for a QI project, and the RNs heightened awareness of the importance of the medication reconciliation process.

The Survey of RN Perception of the New Medication Reconciliation Process showed favorable responses to support the QI project. Family reception was neutral at 68.8%, 93.8% of the RNs responded that the process helped in completing the medication reconciliation, and 75% of the RNs responded that time was saved (Appendices F and H).

Unanticipated Findings

Missing Medication Fields at 20 Hours

The most frequent incomplete data (i.e. dose, frequency, and last time taken) documented in the EHR was the last time taken. At baseline this value was 27% (N=69), during implementation this value was 2.4% (N=1), and 52.8% (N=168) during the post implementation phase. Total missing fields were 85 (33.3%) at baseline, 3 (7.1%) during implementation, and 208 (65.4%) post implementation (Table 3). Of note, nurses during the implementation phase were more vigilant in updating the medication reconciliation after 20 hours. Of the incomplete submissions, GCS was less than 10 during baseline data collection for individuals with missing fields at 27.3% (N=14), 0% (N=0) during the implementation phase, and 37.5% (N=24) of individuals during the post implementation phase. The data show that individuals with a lower GCS that had missing medication fields were only represented in the baseline and post implementation phases. Patients with a low GCS are not neurologically intact and not able to give reliable information.

Change to the Medication Reconciliation within 44 Hours

The author reviewed the medication reconciliation in Epic 24 hours after the initial 20 hour window to establish if any necessary changes were made. During the QI project implementation phase the medication reconciliation was updated (i.e. missing medication information was added) more consistently at 96.3% than prior to implementation at 76.7% and improve to 100% during the four weeks after implementation (Table 4). It is surprising that after the implementation phase, medication reconciliations updates increased to 100%, the highest during the third phase of data collection (Table 4). This could be attributed to the increased awareness of the medication reconciliation process, having the reminder posters in the breakrooms, the author's presence encouraging the RNs to obtain a complete and current medication reconciliation within 20 hours of admission and to update the medication reconciliation as necessary, and the Hawthorne effect on the staff RNs.

Individual Completing the Medication Reconciliation

Data were collected on who completed the medication reconciliation. RNs completed the medication reconciliation on 64 (67.4%), registered pharmacists completed 31 (32.6%), and physicians completed two (2.1%) of the medication reconciliations (Appendix G). In accordance with Senate Bill 1254 which was approved in September of 2018, the pharmacy department must obtain the medication reconciliation upon admission for high-risk patients. The bill allows each facility to define high-risk patient. Criteria for high risks patients at the facility were defined as the following: an age greater than 65 and having more than 10 medications or having one of seven stated medical diagnoses, receiving anticoagulants or antiplatelets mediations with the exception of

aspirin, being a transplant recipients, admission from a skilled nursing facility, and having a hospitalization or emergency room visit within 30 days of the admission.

Considering the ICU is a high risk environment it is surprising that 67.4% of the medication reconciliations were completed by RNs. This could be due to a change in practice that some RNs were unaware that the pharmacy must complete the medication reconciliations on high risk patient. This change was adopted the summer prior to this QI project. Per Pandolfe et al. (2017) the gold standard for completing a medication reconciliation involves a pharmacist collecting information on current medications; however, during this QI project the rate of incomplete data were lower when a RN completed the process (Appendix G). Because of this QI project, staff RNs experienced an increased awareness of obtaining a complete medication reconciliation and family participation had a positive effect. Patient input improves care and integrating patients and families as active team members decreases errors (Kim et al., 2018). This QI project occurred during the fourth month after Senate Bill 1254 went into effect at the facility. This change in responsibility and workload may have negatively affected the pharmacy department.

Glasgow Coma Scale and Medication Reconciliation

Individuals with the lowest GCS had the highest percentage of complete medication reconciliations within 20 hours of admission. This could be due to families recognizing the urgency of the situation and more likely to have accompanied the patient to the hospital to give health information. The group with the highest GCS had the lowest percentage of complete medication reconciliations (Table 5). This could have been related to patients not being able to recall their medication, not having a list of their

medications, and family not accompanying the patient due to the perception that the patient was not that ill. The RN may have been more likely to complete the medication reconciliation in a timely manner if the patient was viewed as being gravely ill. Of note, the percentage change among the three groups was small.

Age Range and Medication Reconciliation

The percentage of medication reconciliations submissions at 20 hours of admission was the highest for patients ranging in ages from 51 to 75 years (N=48, 52.3%). For patients 76 years and older medication reconciliation completeness was 19 (20.1%) and those 18 to 50 years fared the worst at 20.8% (Table 7). Because younger individuals are usually prescribed fewer medications and are less likely to have dementia, this is an interesting finding. Perhaps patient in the age range of 51 to 75 years are better educated about their medications, are aware of the need to have a written list of medications, or brought their medications to the hospital.

When age and change to the medication reconciliation within 44 hours were cross tabulated, the data showed patients in the age range of 51 to 75 years were more likely to have incomplete information initially. Nonetheless, within 44 hours of admission this age range was more likely to have the omitted medication information entered in the Epic. In addition, there was a medication reconciliation change made in Epic for 48.9% of patients in this age group; however the percentage change should have been 64.5% (Table 7). This could be due to a family or surrogate providing the information, the patient being able to recall the medications after being stabilized, or the patient understanding that omission of some of their medications could be detrimental to one's

health. Pearson chi-square testing demonstrated no significant relationship between age and medication reconciliation completeness ($p=0.533$).

Unit Admission Time and Completeness of Medication Reconciliation

The time of shift the patient was admitted to the ICU and medication reconciliation completeness in 20 hours was cross tabulated. The data showed that 100% of patients admitted within one hour of shift change had a medication reconciliation (N=24) submitted by the 20th hour of admission (Table 8). Historically, change of shift is not an ideal time to admit a patient due to the increased workload at this time and the propensity for errors to be made. Perhaps due to the RNs understanding of this phenomena, there was heightened teamwork leading to medication reconciliations being completed per the facility's policy. Day shift had a completion rate of 94.2% (N=35) and night shift had a completion rate of 97.3% (N=38) (Table 7). The author anticipated that the day shift would have the highest rate of medication reconciliation completeness because a family member may be more likely to accompany a patient during the day, during the night shift there would be less sleep deprivation of the RNs, patients and families, and more seasoned RNs working on the day shift.

Limitations

The author acknowledges limitations to this study with a small sample size being a disadvantage. Seventeen patients and or family members completed the med rec flowsheets and 16 RNs completed the RN perception survey. The author anticipated 40 patients and RNs being involved with the new process. This shortfall could be due to persistent short staffing, the Epic upgrade which occurred during the QI project implementation, the Simply Better Experience, the White Glove Survey, lack of

knowledge regarding the QI project due to not reading emails or being present during the shift huddles, and the author not being able to present the QI project at the monthly staff meetings because of meeting cancellations.

Biases

This QI project was conducted using a convenience sample, in one urban ICU, and recruitment was voluntary. These issues can lead to sampling bias and the sample not being representative of the population. The author was previously employed in the ICU and had contributed to educating approximately one-third of the ICU RNs. This could have led to individuals not wanting to participate or if they did participate giving more favorable responses on the Survey of RN Perception of New Medication Reconciliation Process.

Reliability and Validity

Efforts to enhance reliability and validity of the tools were used in this QI project. The author used the proven model of PDSA and the data were consistently collected and coded. External validity is in question since the population size was small, only one ICU was used, and the QI project was only implemented for four weeks. A repeat PDSA cycle with similar results and ideally a larger sample size would increase external validity and reliability.

Recommendations

The generalizability of the results are limited due to the small sample size, single location, and convenience sampling. Completing the medication reconciliation is the responsibility of the RNs for patients not deemed high risk per the facility policy. Based on the positive findings of this QI project, the author recommended that the manager of

the ICU require all RNs to participate in a repeat PDSA cycle to validate the findings. Involvement and enthusiasm about the repeat cycle needs to be supported by the ICU manager and charge RNs for RN staff buy in and active participation. If the repeat PDSA cycle has favorable results the process should be repeated on other units in the facility. If the repeat cycle has unfavorable results another PDSA cycle should be implemented with appropriate changes to ensure success. After iterative changes to refine the process, implementation hospital wide should ensue.

Implications

The results of this QI project support a paper and pen format to collect medication data from family members, surrogates, or the patient, if able. This format can lead to a more complete medication reconciliation process and save time for the RN. This QI project reinforces the value of those in leadership positions promoting and being involved with a process change. Without supportive leadership, even the most exciting and robust projects may be unsuccessful. This QI project demonstrated that medication reconciliation is a multi-faceted and interdisciplinary process and there is a continued need to improve the process of medication reconciliation. This can be achieved by attaining incremental improvements for safe patient care.

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[10351&rfr_id=info%3Axri%2Fsid%3Aprim](https://search-proquest-com.csulb.idm.oclc.org/docview/1902047874?accountid=10351&rfr_id=info%3Axri%2Fsid%3Aprim)

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APPENDIX B

RN Survey

Survey of RN Perception of New Medication Reconciliation Process

Thank you for participating in this QI project.

Please fill out this survey after completing the PTA med list with the paper form.

Give this survey to the charge RN with the completed med rec form.

What was the reception of the family member, surrogate or patient when you asked them to complete the paper med rec form?

Positive Neutral Negative Refused Not Available

If refused please ask why and state reason:

Stop here, if refused or not available and give survey to charge RN.

Did the paper med rec form aid you in completing the prior to med list in Epic?

Yes No

Did using the paper med rec form change the amount of time you spent entering data in Epic?

More Time Less Time No Change

Estimate the time difference: _____

Years of experience as a RN: _____

Do you have a CCRN designation: Yes No

What changes would you like made to the medication reconciliation process? Do you have any comments you wish to share?

Thank you for completing this survey and helping to improve the med rec process.

Please contact Sharon Konrad at Sharon.konrad@csulb.edu with questions.

APPENDIX C

Database Search Topics and Journal Articles

Topic	Titles Retrieved and Reviewed	Abstracts Reviewed	Articles Included
medication reconciliation AND intervention	CINAHL Plus 9/9 PubMed Central 51/51 Google Scholar 275/100 Web of Science 55/55	CINAHL Plus 5 PubMed Central 3 Google Scholar 8 Web of Science 8	CINAHL Plus 4 PubMed Central 1 Google Scholar 1 Web of Science 2/1D
medication reconciliation AND ICU	CINAHL Plus 2/2 PubMed Central 56/56 Google Scholar 259/100 Web of Science 10/10	CINAHL Plus 2 PubMed Central 8 Google Scholar 7 Web of Science 3	CINAHL Plus 1 PubMed Central 5 Google Scholar 1/1D Web of Science 1
medication reconciliation AND errors	CINAHL Plus 40/40 PubMed Central 312/80 Google Scholar 699/100 Web of Science 81/81	CINAHL Plus 8 PubMed Central 13 Google Scholar 8 Web of Science 12	CINAHL Plus 4/1D PubMed Central 7/4D Google Scholar 1/1D Web of Science 3/3D

Note. D = duplicate

APPENDIX D

RN Script

ICU RN: Please give the attached the Med Rec Flowsheet to the patient, patient's family member or surrogate upon admission to the ICU. Ask them to complete the form as completely as possible then return it to you. The form has space for 11 medications, please give the individual completing the form additional forms as necessary. After the form(s) has been completed please review the Med Rec Flowsheet with the family member, surrogate, and patient if able for completeness and ask if any other medications are being taken including over the counter medications. Use the Med Rec Flowsheet to complete the PTA med list in the IPA in Epic.

Please include ONLY the following patients:

1. Direct ICU admission with an expected stay of 20 hours or greater
2. English speaking
3. Family member, surrogate, or patient willing to complete the form

Once you have used the Med Rec Flowsheet to enter the data, complete the attached survey, then give the flowsheet and survey to the charge nurse.

Thank you!

APPENDIX E**IRB Letters****CALIFORNIA STATE UNIVERSITY, LONG BEACH****OFFICE OF RESEARCH & SPONSORED PROGRAMS**

DATE: August 2, 2019

TO: Sharon Konrad, MSN
FROM: CSULB IRB

PROJECT TITLE: [1473614-1] Medication Reconciliation: A Quality Improvement Project
REFERENCE #: 20-024
SUBMISSION TYPE: New Project

ACTION: DETERMINATION OF NOT RESEARCH WITH HUMAN SUBJECTS
DECISION DATE: August 2, 2019

Thank you for your submission of New Project materials for this project. The California State University, Long Beach Institutional Review Board has determined this is a Quality Improvement Project but does not meet the definition of human subject research under the purview of the IRB according to federal regulations.

We will retain a copy of this correspondence within our records.

If you have any questions, please contact our office at IRB@csulb.edu. Please include your project title and reference number in all correspondence with this committee.

This letter has been electronically signed in accordance with all applicable regulations, and a copy is retained within California State University, Long Beach Institutional Review Board's records.



MemorialCare Research Administration
Human Research Protections Program

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Fountain Valley, California 92708
memorialcare.org

DETERMINATION OF ACTIVITY NOT REQUIRING IRB REVIEW QUALITY IMPROVEMENT

Martha Zepeda, DNP, RN-BC
Director, Profession Nursing Education
Inservice Education
Long Beach Memorial Medical Center

July 19, 2019

MHS Project # 949-19 - Medication Reconciliation: A Quality Improvement Project

A designated member of the Human Research Protections Program has reviewed the above indicated application for *Activity Not Requiring IRB Review* and determined the proposed activity meets the criteria for a Quality or Performance Improvement Project (Quality Project) on July 19, 2019.

Quality improvement activities implementing a practice to improve the quality of patient care and collecting patient or provider data for clinical, practical, or administrative purposes must be maintained consistent with applicable rules, regulations, and MHS policy. This includes relevant procedures outlined in HRP SOP 303, *Activity Not Requiring IRB Review*.

You are responsible for notifying MemorialCare Research Administration prior to implementing changes to the proposed activity as this may affect project determination(s) and status.

Please note, in submitting non-research Quality Improvement projects to journals or for presentations, the submitter should avoid using terminology indicating "research" as having been done. For example, terms such as "researched", "investigation", and "discovered" all suggest research rather than a Quality Project was conducted.

APPENDIX F
RN Survey Data

Frequency Table for Nominal Variables

Variable	<i>n</i>	%
help_w_PTA_med_list		
2	15	93.75
Missing	1	6.25

Note. Due to rounding errors, percentages may not equal 100%.

Frequency Table for Nominal Variables

Variable	<i>n</i>	%
change_in_time		
1	1	6.25
2	2	12.50
3	12	75
Missing	1	6.25

Note. Due to rounding errors, percentages may not equal 100%.

Frequency Table for Nominal Variables

Variable	<i>n</i>	%
family_reception		
1	1	6.25
2	11	68.75
3	4	25
Missing	0	0

Note. Due to rounding errors, percentages may not equal 100%.

Frequency Table for Nominal Variables

Variable	<i>n</i>	%
CCRN		
1	10	62.50
2	6	37.50
Missing	0	0

Note. Due to rounding errors, percentages may not equal 100%.

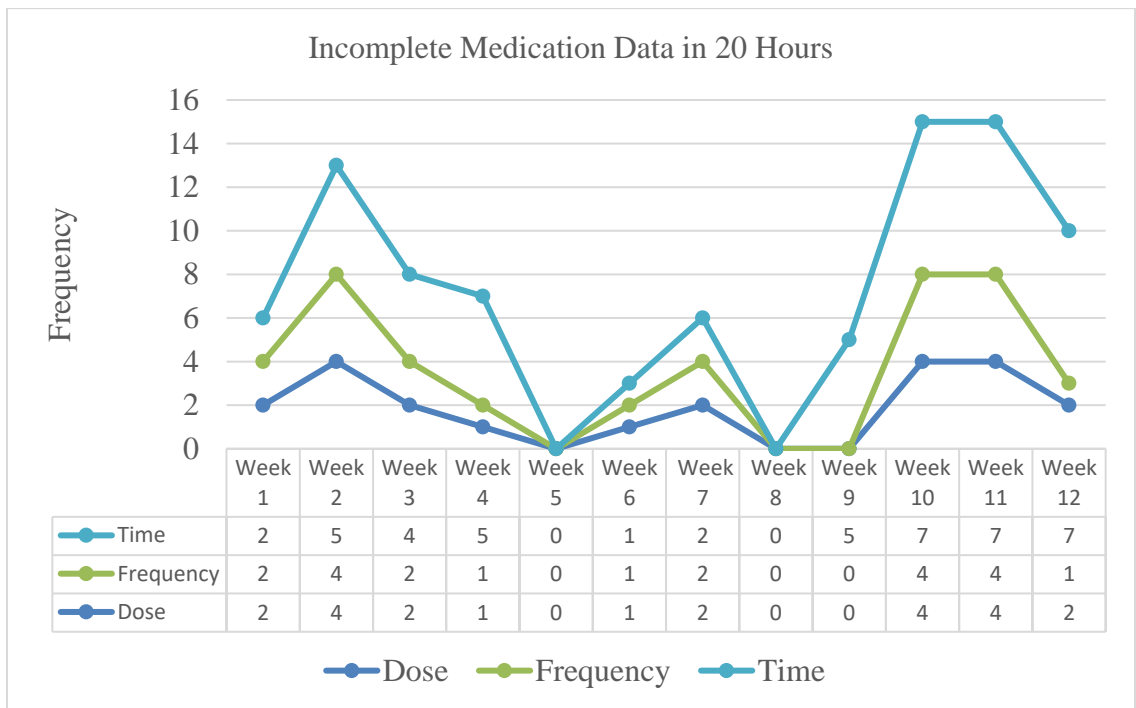
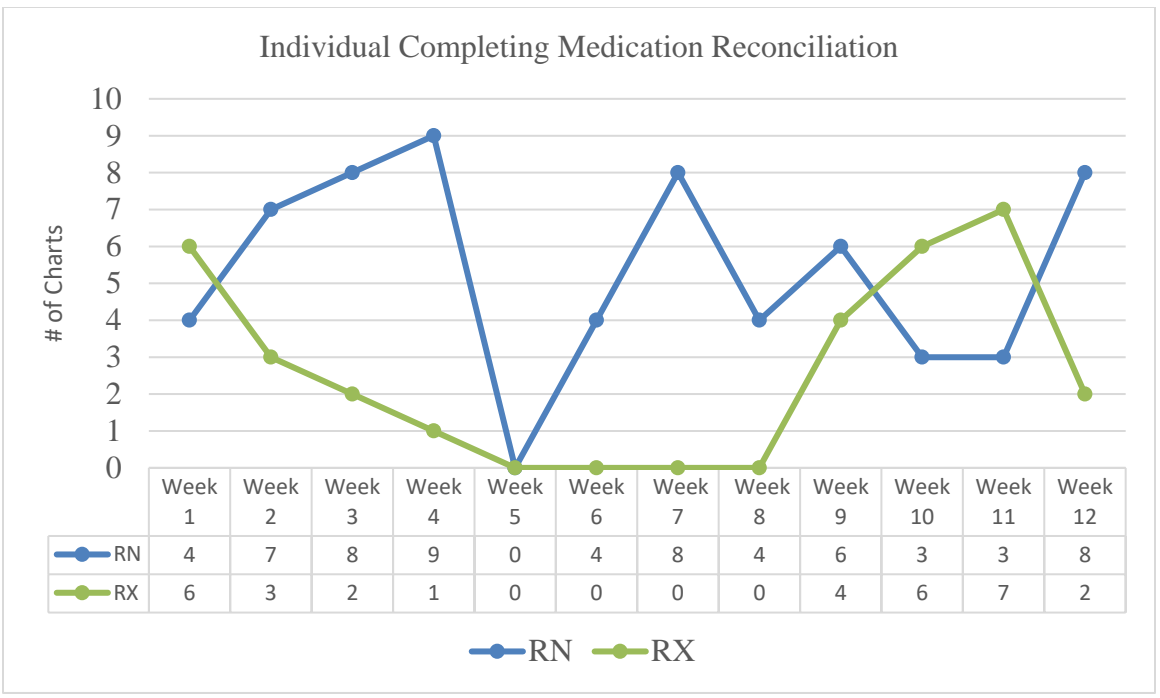
Summary Statistics Table for Interval and Ratio Variables

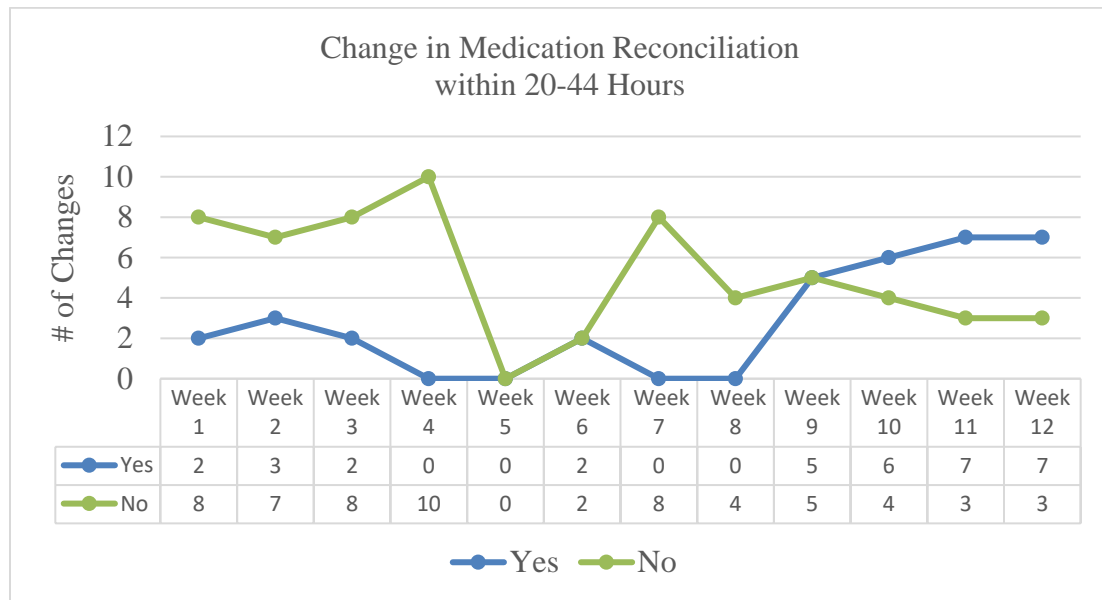
Variable	<i>M</i>	<i>SD</i>	<i>n</i>	<i>SE_M</i>	Min	Max	Skewness	Kurtosis
years_exp	5.81	5.06	16	1.26	1.00	22.00	2.15	4.63

Note. '-' denotes the sample size is too small to calculate statistic.

APPENDIX G

Medication Reconciliation Run Charts





APPENDIX H

RN Survey Bar Graphs

