Enhancing Patient Safety by Promoting the Use of the Electronic Medication Administration Record During the Preparation of Injectable Medications: A Quality Improvement Project

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Enhancing Patient Safety by Promoting the Use of the Electronic Medication Administration Record During the Preparation of Injectable Medications:

A Quality Improvement Project

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## Table of Contents

Abstract.........................................................................................................................4

Introduction..................................................................................................................6

  Problem Description.....................................................................................................6

  Available Knowledge...................................................................................................9

  Rationale....................................................................................................................13

  Specific Aims...............................................................................................................15

Methods.......................................................................................................................16

  Context.......................................................................................................................16

  Intervention................................................................................................................18

  Study of the Intervention...........................................................................................19

  Measures....................................................................................................................20

  Analysis.......................................................................................................................21

  Ethical Considerations...............................................................................................23

Results..........................................................................................................................24

Discussion....................................................................................................................31

  Summary....................................................................................................................31

  Interpretation..............................................................................................................32

  Limitations................................................................................................................35

  Conclusions...............................................................................................................37

References....................................................................................................................40

Appendix A: Visual Reminder.....................................................................................42
Appendix B: Informed Consent
Abstract

**Background:** Patient safety is a top priority for registered nurses (RNs) while caring for individuals in the healthcare setting. Of the various responsibilities of an inpatient RN, administering injectable medications pose significant risks to patients if done incorrectly. Given these known risks, the RNs of an inpatient medical-surgical microsystem were studied during the process of preparing these medications.

**Local Problem:** Through observations \((N = 20)\), it was noticed that 13 (65%) of the preparations were done at a location referred to as the nurse server counter. This is problematic since this location does not provide the RN with access to the electronic medication administration record (eMAR), meaning that these preparations were done without verifying the *Seven Rights of Medication Administration*. These findings generated this quality improvement (QI) project and the specific aim to decrease the percentage of RNs that prepare injectable medications at this location from 65% to 50% by July 29, 2022.

**Methods:** A pre-implementation survey, assessing the RNs’ knowledge of safe medication practices and how often they access the eMAR during medication preparation was distributed. This survey facilitated in outlining the intervention, including the plan to gather an additional 20 observations. The Plan-Do-Study-Act model of improvement was selected as the framework for this project. Descriptive statistical analysis was used to analyze the results.

**Intervention:** The intervention began with an informed consent process, which allowed RNs to agree to participate. Educational meetings were held with the participants which reviewed topics relating to the importance of safe medication practices. Then, visual reminders were put on display throughout the microsystem which were meant to redirect RNs to prepare medications with the eMAR open. The RNs were then observed as they prepared injectable medications.
Finally, the participants were asked to complete a survey which assessed the effectiveness of the intervention.

**Results:** Six RNs provided consent to participate in the intervention. The project was terminated after collecting only 10 observations given this cycle’s deadline of July 29, 2022. Of the 10 observations of preparing injectable medications ($N = 10$), one (10%) was done at the nurse server counter. Additionally, five of the six RNs completed the post-implementation survey. The responses indicate that the educational meetings were helpful in enhancing the RNs’ knowledge of safely preparing medications for their patients, but also that observer bias was present during the observations.

**Conclusions:** Although it appears that the specific aim was met, only 10 observations were collected. Additionally, the presence of observer bias interfered with the data collection process, indicating that the results do not reflect the actual practices of the RNs. However, the responses from the survey indicated that the intervention efforts did enhance the RNs’ knowledge of safe medication practices and identified the need to improve access to the eMAR throughout the microsystem.

**Keywords:** patient safety, electronic medication administration record, injectable medications, *Seven Rights of Medication Administration*, quality improvement
Introduction

Problem Description

Registered nurses (RNs) working in the inpatient setting are responsible for various tasks to help advance patient care. Of these tasks, the preparation and administration of medications tend to be emphasized given the potential to cause patient harm if these processes are done incorrectly. While all medications can cause adverse effects, injectable medications, like those given via intravenous push (IVP) and subcutaneously, are known to carry greater risks since they are administered directly into the circulation or body tissues. Also, errors are more likely to result from injectable medications given the complex preparation process. Prior to administration, nurses must manually withdraw the medicine by first puncturing the vial with a needle that is attached to a syringe. Once the tip of the needle is in contact with the medication in the vial, the nurse then pulls back the plunger of the syringe to remove the desired amount. This process, known as the traditional method of preparation, requires the preparer to have adequate dexterity and psychomotor skills to be able to execute this correctly. As a result, the preparation of these medications has been identified as a critical part of the medication administration (MA) process and must be regarded as such by those responsible for providing medications to patients.

Since nurses are responsible for MA, they are expected to verify medication orders throughout the processes of preparing and administering medicine. The *Five Rights of Medication Administration* serve as reminders for RNs to ensure that the right patient receives the right dose of the right drug via the right route at the right time (Hanson & Haddad, 2021). Nurses are expected to be familiar with these rights upon entry into practice and are reminded of their importance throughout their professional career. Some healthcare settings, including the microsystem that was studied throughout this project, adhere to an additional two *rights*
(documentation and reason). Collectively, these are known as the *Seven Rights of Medication Administration*. To promote the adherence to the rights of MA, several healthcare organizations have incorporated certain technologies, such as barcoded medications, scanners, and an electronic medication administration record (eMAR), to support RNs during MA. When used concurrently, these advancements help to ensure RNs provide medications to their patients as directed which can reduce the risks of adverse effects and medication administration errors (MAEs).

Barcoded medications, scanners, and the eMAR are key components that make up the barcode medication administration (BCMA) system. The purpose of BCMA is to reduce the risks related to human error during MA. Though this works in theory, it is known to be less effective in practice due to barriers like inadequate access to technology at locations where medications are prepared and nurses’ beliefs that they are familiar enough with the order details of commonly prescribed medications. Unfortunately, BCMA is not present in all healthcare facilities because of its associated costs and technology requirements. However, the addition of BCMA is increasing due to its known impact on intercepting MAEs before they reach the patient. For the settings where BCMA is present, it is considered best practice to utilize all components of the system, including the order details within the eMAR, during active medication preparation and administration (Smeulers et al., 2015). Nurses are expected to adopt the use of BCMA into their practice to verify the rights of MA and protect their patients from preventable harm.

To further investigate the barriers to accepting the BCMA system and performing the *Seven Rights of Medication Administration*, the RNs of an inpatient medical-surgical microsystem were observed during the preparation and administration of injectable medications. Prior to creating an actual data collection plan, general observations were made to identify trends
in the RNs’ MA practices. The initial observations suggested that the nurses tend to prepare most injectable medications at the counter at the nurse server station. It was believed that this was the preferred location because this is where the necessary supplies for preparing these medications, like needles, syringes, and alcohol wipes, were stored. However, this was identified as a problem because there is no access to the eMAR at this location, indicating that these medications were being prepared without considering the rights of MA, including the right dose. Because of this realization, the decision was made to conduct further observations to better describe this problem.

Over the course of two months, the RNs were observed during the preparation of injectable medications a total of 20 times. Common medications that were prepared during these observations included subcutaneous insulin, subcutaneous heparin, and IVP pantoprazole. These observations were gathered during the 7:00am-7:00pm shift throughout the Monday-Friday five-day week. Of the 20 observations, 13 (65%) preparations were completed at the nurse server counter. In other words, 65% of the observed preparations were completed without accessing the eMAR and verifying the dosage during this process. The results from these observations suggest the need for changing this common practice and initiated this quality improvement (QI) project.

Given the consequences that this problem can have on patient safety, thoughtful consideration was given while identifying an intervention to improve this process. Because the microsystem’s RNs are the individuals responsible for MA, a pre-implementation survey was distributed to the RNs which assessed their perceptions and beliefs regarding safe preparation of injectable medications. 16 RNs were identified as being directly involved with patient care, which includes the processes of MA. Nine (56.3%) of the RNs successfully completed the survey. At the start of the survey, the nurses were asked if they believe that they safely prepare
and administer injectable medications to their patients. Seven (77.8%) of the RNs responded as doing this *Always* and two (22.2%) responded as *Often*. Additionally, when asked to report the frequency at which the RNs refer to the eMAR while actively preparing injectable medications, the responses were as follows: *Always* \( (n = 1 \ [11.1\%]) \), *Often* \( (n = 4 \ [44.4\%]) \), and *Sometimes* \( (n = 4 \ [44.4\%]) \). Though these responses support the idea that the observed practices are a problem, more information was needed to help inform a practical intervention. When asked where the RNs prefer to prepare these medications, 100% responded that their preferred location is the counter at the nurse servers. The nurses identifying this location as their preferred spot to prepare injectable medications provided insight that the nurse server station is the ideal location to include in the intervention. This is because it has the most potential to redirect the RNs to access the eMAR during preparation. The survey also asked the nurses if they believed placing a computer at this counter would encourage them to view the eMAR during preparation; the results show that eight (88.9%) of the respondents found this to be a good idea. This is important to note because it suggests that the potential cause of this problem is due to a lack of access to technology at the staff’s preferred location for preparing medications. Finally, the RNs were asked if visual reminders to access the eMAR during preparation would encourage them to incorporate this process into their practice. The responses were as follows: *Yes* \( (n = 3 \ [33.3\%]) \), *Maybe* \( (n = 6 \ [66.7\%]) \), and *No* (0%). The results from this question indicate that reminders and continuous education on the importance of referencing the eMAR while preparing injectable medications may help to improve the current practice.

**Available Knowledge**

Despite the importance of accessing the eMAR during medication preparation, as suggested by best practice guidelines, recent evidence shows that RNs are reluctant to adhere to
these guidelines for several different reasons. A systematic review analyzing the knowledge and behaviors of RNs as they prepare and administer injectable medications to patients in the inpatient setting was conducted by Luokkamäki et al. and published in 2020. According to this review, RNs providing their patients with the wrong dose of a drug is a common cause of MAEs and is typically due to the failure to double-check the prescribed information (Luokkamäki et al., 2020). During the data collection process, the researchers conducted various searches across databases, like Cochrane and PubMed, and ultimately included a total of 22 studies within the 2007-2017 timeframe. The analysis of these studies defined several key processes in the overall medication administration process, with preparation as one of them. After reviewing each of the studies, the researchers conclude that several of the identified MAEs were caused by insufficient checking practices during the preparation phase (Luokkamäki et al., 2020). Highlighting this finding supports the need for RNs to adequately use their resources, like the eMAR, when handling medications.

An observational study published in 2018 by Hertig et al. attempted to identify the known risks associated with preparing injectable medications via traditional practice. While providing context to the article, the researchers state, “an estimated 44% of nurses administer injectable medications more than 5 times per shift” (Hertig et al., 2018, p. 60). Given how common these medications are used in practice, they are associated with error rates as high as 97.7%, with 48% of these errors taking place during the preparation or administration phases (Hertig et al., 2018). The investigators collected data through observations at three different healthcare sites in various locations throughout the United States during 2015 and 2016. The RNs that participated in this study were either assigned to the group that would prepare and administer ready-to-administer products or to the group that was responsible for preparing and administering medications via
traditional practice. The observation period began as soon as the RN removed the medication from the automated dispensing cabinet and concluded once the medication had been administered to the patient. To provide the observers with objective criteria to define an error, the researchers created an eight-step process for both observational groups that served as guidelines for the phases of administration. An error was defined as “a deviation of the observed medication preparation and administration from the previously defined steps or any deviation from the original medication order” (Hertig et al., 2018, p. 62). At the conclusion of the data collection process, a total of 337 hours of direct observations throughout all sites were completed. Of the 329 observations, 260 errors were reported, including 235 due to errors with traditional practice preparation and administration techniques (Hertig et al., 2018). An example of an observed error during this method of medication administration was incorrect labeling of syringes once the medication was removed from the vial. Given the added steps during traditional practice preparation, RNs have a greater risk of making an error when working with these medications which puts the patient at a greater risk for harm. This risk potential directly applies to this microsystem, as many of the injectable medications ordered for patient use require preparation via a vial and syringe.

Though the implementation of BCMA technology is known to reduce the occurrence of MEs, research supports the finding that nurses are still reluctant to completely accept BCMA as part of their nursing practice. An observational study was designed to investigate this further by observing 44 RNs while they prepared and administered a total of 884 medications to 213 patients (Mulac et al., 2021). Of the 213 patients included in the study, a total of 30 (14.1%) patients’ medications were prepared incorrectly by RNs (Mulac et al., 2021). However, for 11 (36.7%) of the 30 patients, the use of the eMAR informed the RN of the error and prevented
them from administering the medication to the patient (Mulac et al., 2021). These results support
the need for RNs to incorporate the components of BCMA into their MA practices to promote
patient safety. The article concludes by suggesting that RNs should be observed frequently for
their adherence to BCMA and double-checking practices, much like the observations that were
made within the microsystem during the pre-implementation phase of this QI project. The
findings from these assessments can identify specific barriers to implementation which is useful
when planning interventions to help combat these challenges.

To better support RNs during the preparation and administration of injectable
medications, Smeulers et al. (2015) conducted a systematic review in which they identified
specific quality indicators to enhance these processes. As published within the article, “quality
indicators are explicitly defined and measurable items referring to the structure, processes, or
outcome of care” (Smeulers et al., 2015, p. 2). After reviewing the articles, a total of 21 quality
indicators were identified (five structure indicators, including the implementation of reporting
systems; eleven process indicators, like documenting adverse events and verifying high alert
medications; and five outcome indicators, such as patient reactions to medication errors). The
researchers then classified each of these indicators based on their relevance to the rights of MA.
Once this was completed, it was noticed that most of these indicators directly relate to the RNs
responsibility to provide patients with the right dose of their medication (Smeulers et al., 2015).
To ensure that the correct dose is given during MA, the researchers conclude that certain quality
indicators, such as implementing electronic verifications, specific medication-based protocols,
and providing staff with visual reminders, were found to be most effective (Smeulers et al.,
2015). The information presented throughout this systematic review was instrumental to the
process of identifying an appropriate intervention for this QI project.
The articles included within this review of the available knowledge helped to better understand the pre-implementation state of the identified microsystem. Moreover, they have facilitated in recognizing the most appropriate, evidence-based intervention to guide change. Given the risks for harm associated with injectable medications, RNs must be cautious during the preparation and administration of these medications to help protect their patients from avoidable errors. Continuous education is suggested to provide RNs with updated information regarding patient well-being and safe medication handling, including best practices for preparing medications (Luokkamäki et al., 2020). Additionally, it is recommended that unit leaders observe RNs during their MA practices, as this is the best way to identify opportunities for improvement based on the actual habits of RNs during medication handling (Mulac et al., 2021). Ultimately, based on the available evidence and survey responses from the microsystem’s nursing staff, it was believed that the intervention that would be most impactful on the MA practices of the RNs was the implementation of visual reminders to access the eMAR during the preparation of injectable medications.

**Rationale**

The model that will guide this quality improvement project is the Plan-Do-Study-Act (PDSA) cycle. As described by the Agency for Healthcare Research and Quality, the PDSA model helps to guide QI projects by organizing the planning process, creating specific steps to guide change, evaluating outcomes, making improvements based on the outcomes, and then attempting to create change again (Agency for Healthcare Research and Quality, 2020). According to the text by Nelson et al., the focus of the PDSA cycle is to experiment change ideas and collect data to determine if an intervention created a meaningful improvement (Nelson et al., 2007). Furthermore, this model is beneficial because it can be completed quickly and does not
require extensive resources, including money (Nelson et al., 2007). Quality improvement is a process that requires careful planning and patience. Given the benefits of utilizing the PDSA cycle and the significance of the identified problem, this model for improvement is a great framework for this QI project.

**Plan**

During the planning phase of this QI project, 20 observations were made of the microsystem’s RNs during the preparation of injectable medications. Also, the pre-implementation survey was distributed during this phase, as the responses helped in planning the intervention. The responses and observations served as the pre-implementation data and helped to describe the state of the microsystem prior to the intervention. The intervention was identified and carefully planned during this phase of the PDSA cycle. Also, during this phase, the Project Leader (PL) was assigned as being the individual responsible for leading the intervention. A timeline was created for when the intervention will be implemented and when the data analysis process will begin. Additionally, this phase included the process of creating the education and visual reminders that were part of the formal intervention process.

**Do**

This step includes the process of carrying out the intervention, as organized during the previous phase. The team responsible for directing the project, as identified during the Plan step, provided the RNs with education regarding the importance of safe medication preparation practices and then observed those who consented to participate in the project during medication preparation. While these observations were made, documenting the findings was an essential part of this phase, as they would then be analyzed in the subsequent phase. Furthermore, the QI team made note of strengths and weaknesses of the intervention which will help guide future PDSA
cycles for this project. During the final week of the intervention, the participants were also asked to complete a post-implementation survey which assessed their knowledge regarding safe medication practices and the usefulness of the visual reminders.

**Study**

Following the data collection process, the QI team analyzed the results and reflected on the overall success of the intervention. During this step, the QI team compared the actual results with the project’s *Specific Aim*. Data analysis was planned to be performed using descriptive and inferential statistics as described throughout the subsequent sections of this project. Once this was completed, the team then debriefed the members of the microsystem regarding the results of the intervention and worked to identify future potential changes that will help advance the improvement process. This phase also included the process of summarizing the lessons learned by both the QI team and the RNs that participated in the project.

**Act**

The final step of this cycle included the process of determining if the intervention should be modified or abandoned. Given the understanding that QI is a continuous process, it was expected that this project will require additional PDSA cycles. Based on the lessons learned from this cycle, the QI team will modify the current intervention (or create a new one) to better meet the project’s *Specific Aim*. See *Conclusions* for information regarding the ideal next steps of this project.

**Specific Aims**

As described throughout the *Problem Description*, 13 (65%) of the 20 witnessed preparations of injectable medications were observed to have been completed at the counter located at the nurse servers. Because this location is not equipped with the technology required to
access the order details within the eMAR, these medications were prepared while disregarding the rights of MA, including the right dose. This is a dangerous practice that places patients at risk for harm due to the increased likelihood for the RN to make a medication error. Given these potential consequences to patient safety, the specific aim of this QI project was to decrease the percentage of RNs that prepare injectable medications at the nurse server counter from 65% to 50% by July 29, 2022. Interventions to achieve the aim of this project included providing education on the importance of adhering to the rights of MA and creating visual reminders at the nursing servers to redirect the RNs to access the eMAR while they prepared injectable medications. The implementation of these visual cues was thought to accomplish the aim of this project given the review of the evidence as analyzed within the Available Knowledge.

Furthermore, this QI intervention was meant to meet the global aims of this project which were to promote the usage of the electronic medication administration record and reduce the risk for medication errors. This is critical as it directly relates to patient safety which is a priority for nursing practice. It was expected that the microsystem’s RNs would be observed to utilize the eMAR more frequently given the implementation of this intervention; however, future PDSA cycles would be needed to accomplish the specific aim.

Methods

Context

Medication errors have the potential to occur during any of the steps involved in medication administration. However, the medication preparation process is known to carry significant risks as this is the point in the process where the dose must be drawn up correctly based on the prescribed amount that is reported in the patient’s electronic medication
administration record. Because of the risk potential during this process, the proposed intervention for this quality improvement project took place during the medication preparation phase.

To help support the implementation of this QI project, a thorough cost/benefit analysis was conducted which considered the costs associated with the intervention in comparison with the known costs of medication errors. According to the World Health Organization, the global cost of reported errors, including a patient receiving the incorrect dose of their medication, is estimated to be $42 billion (World Health Organization, 2017). From a national perspective, the United States Food and Drug Administration reports that they receive more than 100,000 medication error-related claims each year (United States Food and Drug Administration, 2019). Furthermore, the Academy of Managed Care Pharmacy states that the added costs to care for injuries associated with medication errors originating in hospitals is around $3.5 billion each year (Academy of Managed Care Pharmacy, 2019). Given that MAEs are regarded as preventable events, any intervention to enhance the safety during the medication administration process would contribute towards lowering these known costs.

Because of the survey responses by the microsystem’s RNs (see Problem Description), it was decided that creating visual reminders and distributing them throughout the unit was the most practical initial intervention to meet this project’s specific aim. Ideally, this intervention would have included the addition of a computer at the nurse server counter, so that the RNs could access the eMAR at their preferred preparation spot. However, the addition of a computer is associated with a cost that exceeds the budget of this QI project. Given this consideration, the decision was made to pursue the idea of utilizing visual cues about the importance of viewing the order details during the preparation of injectable medications due to the minimal cost requirements and ability to be implemented by July 29, 2022.
Intervention

The first part of this multifaceted intervention began with sharing the survey results with the nursing staff of the microsystem as this heightened their awareness to the local problem and provided more context to their responses. The results were displayed in the form of a PowerPoint presentation, so that visuals could complement the data. This presentation also included a brief educational portion regarding the importance of accessing the eMAR during the preparation of injectable medications, given the increased risk for harm to patients if administered incorrectly. This presentation was emailed to 100% (N = 16) of the RNs responsible for medication administration and was also shared with the microsystem’s three nursing managers. Also, printed copies were provided for the unit to view during moments of downtime, should they not access the electronic copy that was sent via email.

Once the awareness portion of the intervention was completed, the implementation process continued with creating visual displays to serve as reminders to view the eMAR while actively drawing up the medications. Since the counter at the nursing server was reported to be the preferred location for medication preparation, the graphic was on display here to remind most, if not all, of the RNs of this intervention. Additionally, the visual was placed on the door of the medication room, which is where medications are securely stored, so that the RNs could see it as they enter and exit the room. Because disruptions can alter the RN’s focus during MA, the visual was intended to remind, not distract. To ensure this, the dimensions did not exceed 8.5 x 11 inches. The visual contained a red octagon, resembling a stop sign, containing the phrase, *STOP; Don’t forget to access the eMAR during med prep!* (See Appendix A). This was meant to increase the RNs’ accountability to the intervention since they were being reminded during the active process of preparing medications.
The team responsible for the implementation of this project was comprised of the Clinical Nurse Leader (CNL) student who served as the Project Leader and a CNL who works within the organization, but on a larger medical-surgical microsystem. The CNL acted as a mentor to the PL during the entire QI process. The microsystem’s RNs were also key stakeholders as they were responsible for the preparation and administration of medications. Their involvement allowed for the implementation of this QI project; therefore, it was essential to consider their feedback when designing this project.

**Study of the Intervention**

The intervention was studied by comparing the pre- and post-implementation observation data. Prior to the intervention, 20 observations were made in which RNs prepared injectable medications. 13 (65%) of the observations were of nurses preparing medications without reference to the eMAR at the supply counter. During the post-implementation period, the PL planned to observe 20 additional medication preparations and record the frequency at which RNs prepare medications at the counter. The collected data was then used in determining the impact of the intervention because it measured the frequency of RNs that did not consult with the order details during this process. Observing the same amount of medication preparations would help to keep the data consistent given the identical sample sizes. In addition to the post-implementation observations, the RNs were surveyed again to assess the safety of their MA practices and to record the frequency at which they access the eMAR during this process. The results from these datasets were presented in terms of percentages and frequencies (see *Results*). Additionally, the combined results were planned to be analyzed using inferential statistics, in the form of a paired t-test, to evaluate the impact that the intervention had on the RNs’ MA practices.
Measures

The rationale for gathering data through observations was made because of previously identified discrepancies between reported and actual adherence to policies, including BCMA. The microsystem’s staff described their total adherence to the double-checks put in place by verifying the Rights of Medication Administration. However, it was observed that this is not the case, hence the reasoning behind this QI initiative. By collecting data through observing this process and then surveying the staff, the PL could better understand the practices in place and the barriers to safely preparing medications for patients, including lack of access to the eMAR. For the purpose of this QI project, observations were considered complete and successful when the PL could visualize the RN from the point of leaving the medication room to the moment when the RN begins to prepare an injectable medication without accessing the eMAR’s order details. The conclusion of the observation process could be done at any location where the medication was drawn up, including the RN station, medication room, and the counter at the nurse server and supply cabinets.

Since this intervention began with an educational component, the ability for the staff to comprehend the information presented by the PL was also considered when evaluating the outcomes. To ensure that the staff understood the importance of incorporating the eMAR into their MA practices, opportunities for on-going learning in the form of the printed presentation on display in the staff conference room and availability for the PL to be present on the unit to field for questions and feedback from the staff was provided throughout the duration of the process. This was particularly helpful as it incorporated various learning styles, like visual and auditory.

Ultimately, the success of this intervention was determined by comparing the results with the specific aim of this project. It was anticipated that achieving the specific aim would require
several cycles of the Plan-Do-Study-Act model; therefore, this project would not be considered an overall failure if the aim was not achieved after one cycle of data collection. Additionally, when making post-implementation observations, the PL planned to observe these processes during the Monday-Friday, 7:00am-7:00pm shifts, as this is when the pre-implementation data were collected and would contribute towards data accuracy. Since this project was conducted within a microsystem that the PL did not hold a formal position in, it was critical to acknowledge the possibility of the staff having competing priorities which may interfere with their participation during the intervention phase. If this were the case, the PL would re-evaluate the current state of the microsystem and make the necessary adjustments to the plan of this project.

To determine the validity of collected data through observations, a systematic review by Ferguson et al. (2018), exploring best practices for conducting observational data, was analyzed. After searching various databases, the researchers included 12 studies that satisfied their search criteria. From these studies, the authors proposed implications to practice when collecting observational data, including the ideal number of observations. Based on their review, the researchers believe that there is no definitive number of observations needed to ensure total validity and reliability of data. However, as the number of observations increase, so do both indicators (Ferguson et al., 2018). The studies included for review felt that upwards of ten observations were sufficient to obtain dependable data (Ferguson et al., 2018). Given these findings, the decision to include 20 observations for data collection is consistent with the psychometric considerations as outlined throughout the review.

**Analysis**

The results from both the pre- and post-implementation observation data were summarized with quantitative analysis. Descriptive analysis illustrates the results by indicating
the percentage and frequency of RNs who prepare injectable medications with and without accessing the eMAR. Inferential statistics would also be used during the analysis, as it aids in understanding the impact that the intervention had on the microsystem’s RNs. A paired t-test would be conducted to compare the pre- and post-implementation observations and survey responses to determine if the visual reminders were responsible for accomplishing the specific aim of this project.

During the analysis process, it was essential to understand the variation within both datasets. Of the variables present, time had a significant impact on both the data collection and evaluation steps. With respect to the timeline of this project, there was approximately two months available for the intervention to be implemented and the post-implementation data to be collected. Ideally, the 20 observations would have been collected within two-to-three weeks. However, had the 20 observations not been made, the time frame for data collection would have to be extended which would allow for less time to evaluate the data; this was the case for this project. Conversely, the pre-implementation data were gathered over the course of two months. This allowed for the PL to successfully observe the preparation process 20 times. The time allotted for this project serves as another example of time being a limiting factor for the success of the intervention. The quality improvement process is known to be a continuous process of planning, intervening, evaluating, and adjusting as needed. Only one cycle of the PDSA model was completed during this project, which limited the change potential. Finally, observations were planned to have been made during Monday-Friday from 7:00am-7:00pm, meaning that information about the RNs who work during the opposite shift (7:00pm-7:00am) would not be included in the data. This limited the ability to prove the impact of the intervention on the microsystem since only a fraction of the professionals involved would be observed.
Another opportunity for variation was the potential for the response rates to fluctuate between the pre- and post-implementation phases. The pre-implementation survey had a 56.3% (n = 9) response rate. Ideally, more of the RNs would have participated in the post-implementation survey; however, this was addressed when analyzing the results of this project.

**Ethical Considerations**

As stated by the American Nurses Association, “life and death decisions are a part of nursing, and ethics are therefore fundamental to the integrity of the nursing profession” (American Nurses Association, n.d., Ethics and Human Rights section). The aim of this QI project was to enhance RNs’ likelihood of double-check the dosing with the prescription information in the eMAR. This outcome allows for patients to safely receive medications while being cared for in the acute care setting, a concept that relates to nurses providing care that is consistent with the profession’s ethical obligations. While patients were not the primary population of interest throughout this project, the intervention was aimed at ensuring RNs safely prepare the medications that are then administered to patients, meaning they would also benefit from the success of this project. All patient identifiers, including name, date of birth, medical record number, and room assignment during admission, were excluded from this project to respect patient confidentiality.

With respect to the ethical considerations of the professionals that were observed, it is important to note that the PL did not inform the RNs that they were being observed during this process. The rationale behind this was to avoid observer bias and to gather data that reflects the actual practices of the staff. Information about the observed RNs, including their name, was not recorded to promote confidentiality. Once these observations were completed, the RNs were then made aware of the local problem. The survey that was distributed to the staff was voluntarily
completed, as there were no repercussions should someone choose not to complete it. Also, the responses were kept anonymous to promote honest feedback. One of the survey items allowed for the RNs to provide a free text response describing their personal barriers to consulting with the eMAR during medication preparation. These responses were then reviewed and taken into consideration during the intervention planning phase. Incorporating their input allowed for the PL to promote staff engagement to both the problem and the importance of the intervention by allowing them to take part in the planning process. Prior to implementing the intervention, the RNs were asked to complete an informed consent document that allowed for them to agree or disagree to participate in the next step of the project (See Appendix B).

Approval for this project was given by the microsystem’s leadership team, including the Unit Managers and Unit Educator. Additionally, the University of New Hampshire’s Nursing Department Quality Review Committee approved this project as meeting the criteria for a QI project, which is exempt from Institutional Review Board review.

Results

The intervention phase of this project began on June 20, 2022, with the microsystem’s RNs completing an informed consent to participate. This process was expected to begin prior to this date; however, coordinating with the staff to begin the enrollment period took longer than anticipated due to planned vacation times and delayed responses. The informed consent process concluded on June 27, 2022, with six \( (N = 6) \) RNs enrolled to participate. This is a modified end date, as it was planned to be completed by June 24. However, by this date, five RNs had agreed to participate which was less than the ideal enrollment of six-to-eight participants. Because of this, the informed consent process was extended to accommodate for further enrollment. Once
six RNs were enrolled to participate, the informed consent process ended and the education meetings began on June 27. During this time, the Project Leader met with the enrolled RNs and reviewed the pre-implementation survey results to heighten their awareness of the local problem. Also, during this education session, the PL reviewed important concepts for safe medication administration, like the Seven Rights of Medication Administration and how to appropriately utilize the BCMA system. The education concluded with the review of policies related to safe MA practices as published by the organization. The educational sessions were planned to end on July 8, 2022; however, to better accommodate the RNs’ schedules, they continued until July 11. These meetings took place in the microsystem’s conference room and lasted around 10 minutes in duration. The implementation of the visual reminders began on July 5, 2022. On this date, the PL placed three visuals throughout the microsystem (one in the medication room where the medications are dispensed and two at the nurse server station where the medication supplies are stored). Once these visuals were put on display, the observations began with the RNs. To conform with the end date of this PDSA cycle, the observations ended on July 15, 2022. It was planned that the PL would observe 20 preparations of medications as completed by the RNs who consented to participate in this QI project. However, by July 15, the PL was only able to observe 10 preparations given the limited number of injectable medications ordered for the microsystem’s patients during this timeframe. The final portion of the intervention began on July 11 with the distribution of the post-implementation survey to the participants. The survey was activated and sent via email on July 11 and expired on July 15, 2022, at 9:00pm, marking the conclusion of the intervention. Figure 1 illustrates the overall timeline of the intervention.
Once the intervention was completed, the results were analyzed. To best track the various phases of the intervention, a Microsoft Excel spreadsheet was created that tracked which RNs have enrolled, the date of their informed consent, the date of their education session, the date(s) that they were observed, and the date they were sent the post-implementation survey. Each participant was assigned a number that was used to track their involvement in the project without recording their name. The observational data were also tracked on this spreadsheet, making note of the location where the medications were prepared. The data collection process was planned to be considered complete once a total of 20 observations were collected, but the process was terminated at 10 observations given the deadline for this PDSA cycle. Of the 10 preparations of injectable medications that were witnessed by the PL, one (10%) was completed at the nurse server counter, one (10%) was completed at the computers at the nurses’ station, and eight (80%)
of the instances included the RN gathering the supplies at the nurse server station and bringing them into the patient’s room. Figure 2 provides a visual of these results.

**Figure 2**

*Location of Injectable Medication Preparation*

![Pie chart showing the location of injectable medication preparation](chart.png)

- Nurse server counter: 10%
- Nurses’ station computers: 10%
- Patient’s room: 80%

*Note.* There were a total of 10 observations ($N = 10$).

Though the observational data were the primary datapoints used to determine the success of this project, the RNs were also asked to complete a post-implementation survey which assessed their understanding of safe MA practices following the intervention. All six of the participants were emailed the survey and asked to complete it prior to the last day of the intervention (July 15, 2022). Once it was closed, there was an 83.3% ($N = 5$) response rate. The survey items, presented on a five-point Likert scale, assessed the RNs’ knowledge of safe medication practices and allowed for them to provide feedback regarding the effectiveness of the intervention. When asked if their knowledge of safe MA practices had improved following the education portion of the intervention, the responses were as follows: Strongly agree ($n = 2$ [40%]), Agree ($n = 2$ [40%]), and Neither agree nor disagree ($n = 1$ [20%]). Additionally, the
survey asked the participants to respond if the use of the visual reminders encouraged them to access the eMAR while preparing medications, the responses were as follows: *Strongly agree* ($n = 1$ [20%]) and *Agree* ($n = 4$ [80%]). The survey continued by asking the RNs if they believe they safely prepare injectable medications for their patients in which three RNs (60%) responded *Always* and two (40%) responded *Often*. Furthermore, the RNs were asked if they refer to the eMAR while they actively prepare injectable medications, the responses were as follows: *Often* ($n = 4$ [80%]) and *Sometimes* ($n = 1$ [20%]). Finally, given the potential for the presence of observer bias to interfere with the results, the survey asked the participants if the presence of the observer made them more likely to access the eMAR during the preparation process. The responses to this survey item are as follows: *Strongly agree* ($n = 2$ [40%]) and *Agree* ($n = 3$ [60%]). Table 1 presents these responses as a mean, standard deviation, and range. The five-point Likert scale items were assigned a numerical value (1-5) for statistical analysis purposes with *Strongly disagree* and *Never* (1) to *Strongly agree* and *Always* (5), respectively.

**Table 1**

*Descriptive Statistical Analysis of Post-Implementation Survey Responses*

<table>
<thead>
<tr>
<th>Survey Item</th>
<th>$M$</th>
<th>$SD$</th>
<th>$R$</th>
</tr>
</thead>
<tbody>
<tr>
<td>I believe that the education portion of this project enhanced my knowledge</td>
<td>4.2</td>
<td>0.8</td>
<td>1-5</td>
</tr>
<tr>
<td>of safe medication practices</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>The visual reminders encouraged me to access the eMAR while I prepare</td>
<td>4.2</td>
<td>0.4</td>
<td>1-5</td>
</tr>
<tr>
<td>injectable medications</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>I safely prepare injectable medications to my patients</td>
<td>4.6</td>
<td>0.5</td>
<td>1-5</td>
</tr>
<tr>
<td>I refer to the eMAR while I am actively preparing injectable medications</td>
<td>3.8</td>
<td>0.4</td>
<td>1-5</td>
</tr>
<tr>
<td>When I am being observed, I am more likely to access the eMAR while</td>
<td>4.4</td>
<td>0.5</td>
<td>1-5</td>
</tr>
<tr>
<td>preparing injectable medications</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

*Note.* Range (R), electronic medication administration record (eMAR).
The intervention phase of this QI project was planned to begin in the beginning of June and be completed by the second week of July. However, several variables interfered with this plan, resulting in a delay in beginning the implementation of the intervention. A major obstacle to this project was that the microsystem’s leadership team had taken days off throughout the weeks. This negatively impacted the timeliness of this project because it resulted in delayed responses to emails and questions by the PL regarding the logistics of the project. Aside from days off, another barrier to the implementation of this project was that the RNs did not complete the informed consent within the week allotted. This led to the extension of the enrollment process which required the next steps of the intervention to be delayed, as well. Furthermore, the level of engagement from both the unit leaders and RNs varied based on the microsystem’s current priorities. This microsystem is experiencing staff shortages, as most healthcare settings are, which caused the RNs to feel less inclined to participate in this project given the misconception that their involvement would increase their workload. Given this consideration, the PL carefully explained the time commitment to this project to the staff. After confirming that there were no extra requirements to their workload, enrollment began to increase. The data collection process was forced to end prior to collecting 20 observations. After being on-site at the microsystem for several days, the PL was only able to observe 10 instances of injectable medication preparations. Upon further investigation, it was realized that the majority of the patients that the enrolled RNs were caring for were being transitioned to oral medications since they were being discharged during that shift. Additionally, of the six enrolled RNs, four were serving as charge nurses. While serving in this role, they were not given a patient assignment, which meant they were not responsible for medicating patients. This was the primary reason why the PL was unable to observe 20 total preparations.
While there were several barriers to implementing this intervention, the planning process was done diligently to expect some of these obstacles, so it was simple to restructure the timeline for implementation. However, the PL did not anticipate for the lack of opportunities to observe RNs during their medication preparations, so this is considered to be a limitation of the project. Because of the limited opportunities to observe the participants, the results were unable to be analyzed using inferential statistics, as planned, which is considered to be another limitation of this project. Furthermore, given the difficulties to collect enough observations, the PL had to be on-site more than planned, for a total of 36 hours, which is regarded as an unexpected cost of this project.

During the planning process, it was believed that there would be a degree of missing data since it was anticipated that the observations would be collected during the Monday-Friday 7:00am-7:00pm timeframe. However, to allow for more participants, the PL allowed for RNs who work the opposite shift to be eligible, resulting in the education sessions and observations to be completed during the 7:00pm-7:00am shift, as well. Though the hours were extended during the Monday-Friday week, the PL was not on-site during the weekends; therefore, data reflecting the MA practices during this time was not captured. Finally, while observing the nurses, the PL noticed other RNs that were still preparing medications at the nurse server station. However, these nurses did not provide consent to be included in the data collection process, so these findings were excluded from the results. Because of these considerations, the results do not adequately reflect the success of this QI project.
Discussion

Summary

The findings of this project suggest that the percentage of RNs that prepare injectable medications at the nurse server counter went from 65% to 10%. While this may seem like the specific aim of this project was met, the sample size of observations varied between the pre- and post-implementation phases. Given this discrepancy, it cannot be concluded that a true improvement was made. Regardless of the number of observations collected, the PL terminated the intervention on July 15, 2022, to accommodate for the predetermined deadline of this QI initiative, as set during the Plan phase. The overall key findings include an increased awareness of safe medication practices, attention to workflow considerations, and the benefits of visual reminders.

Increased Awareness of Safe Medication Practices

This project excelled at raising awareness of safe medication practices throughout the microsystem. Because of the importance of patient safety and implementing best practices regarding safe nursing care, the project’s global aim was set to promote the usage of the electronic medication administration record to reduce the risk for MAEs during medication preparation and administration. By providing the RNs with education around this and implementing the visual reminders, it appears that the global aim was met, which is regarded as a strength of this improvement project. This was primarily made evident after analyzing the post-implementation survey results.

Workflow Considerations

While reviewing the survey responses, the RNs reported their interest in having a computer placed at more convenient locations throughout the microsystem, including the
medication room and the nurse server station. Initially, it was believed that referencing the eMAR while actively preparing injectable medications was not being done because of a potential knowledge deficit. However, the results from this intervention suggest that a lack of knowledge is not necessarily what was deterring the RNs from doing this during MA. Based on the survey results, it appears that the microsystem’s workflow does not support the use of the eMAR during this phase of medication administration. The RNs identifying a need for more efficient access to technology throughout the unit is also regarded as a strength of this project, since this information is useful when planning a future PDSA cycle to improve this process.

**Benefits of Visual Reminders**

While observing the participants, it was noticed that the majority of the preparations were being done at the patient’s bedside, rather than at the nurse server counter. Since this location provides the RN access to the order details, this is another key finding from this project. Not only does preparing medications at the bedside allow for the RN to adhere to the policies regarding BCMA and the *Seven Rights of Medication Administration*, but it also allows for the patient to become more involved in their care. Additionally, the survey responses from the participants identified that they also found the visual reminders to be an effective method of reminding them to access the eMAR during this process.

**Interpretation**

Since 20 observations were unable to be collected, the results cannot be used to determine an association between the findings and the intervention. While the results show a decrease in the percentage of nurses who prepare injectable medications at the nurse server station, it appears that the concept of observer bias is what has led to these findings. The survey
The results of this quality improvement project are similar to the findings from other publications that studied the process of medication preparation and the use of technology to enhance the safety of MA. According to the systematic review by Smeulers et al. (2018), visual reminders helped to support nurses during their medication administration practices. Specifically, the implementation of these visual reminders provided nurses with additional support to ensure that they are adhering to the Seven Rights of Medication Administration (Smeulers et al., 2018). These findings relate to this QI project given that the visual reminders seem to have enhanced the process of referring to the eMAR while actively preparing medications.

As mentioned, the idea of observer bias played a role in the results of this project. Other publications have addressed this concept and how it may skew the results when gathering data via observations. The observational study, organized by Mulac et al. (2021), discussed this idea in detail given the results from their project when studying how nurses use the BCMA system when providing medications to patients. As described in this study, the researchers agreed that the presence of an observer applied a level of pressure on the nurse to use the technology correctly and modified their behavior to reflect what they thought was expected of them during the MA process (Mulac et al., 2021). This may have been a subconscious behavior change, but still created a discrepancy between the observed process and the actual process, that is, when an observer is not present. These findings relate to this QI project because the Project Leader found that the nurses were more likely to gather the medication supplies and then take them into the patient’s room to prepare since there is access to the eMAR at this location. However, when reviewing the responses from the pre-implementation survey, the nurses unanimously agreed that
their preferred location to prepare medications was at the nursing server station. To respect the privacy of the patients, the PL did not enter the patient’s room once the nurse went in, so the remainder of the preparation process was not observed to completion. However, while on the unit, the PL noticed that other nurses who did not consent to participate in this project were still preparing medications at the nurse server counter. Since these nurses did not consent to participate, this data was not included in the data collection process. Given these findings, it is possible that the presence of the observer (PL) encouraged the nurses to do what they felt was expected of them during this process and prepare the medications at the patient’s bedside.

Throughout the planning phase of this project, it was believed that there would be an improvement from the pre-implementation observations. This was thought to be the case given the idea of observer bias and the pressure that the nurses may have felt while being observed. Though an improvement was expected, it was not anticipated that there would be a 50% change. Based on the results, it appears that the percentage of nurses who prepare injectable medications at the nurse server station has decreased from 65% to 10%. While this is ideal, it is not representative of the actual practices in place throughout the microsystem. This is said due to the observed behaviors of the nurses who did not consent to participate in this intervention. A likely reason for the discrepancy between observed and anticipated outcomes is the influence of the observer during the process.

Despite the possibility that observer bias interfered with the results, this project had a positive impact on the nursing staff and patients, as it promoted the adherence to the Seven Rights of Medication Administration, a concept aimed at protecting patients from harm when receiving medications. Additionally, this positively impacted the nursing staff since it encouraged them to utilize the BCMA system responsibly and verify the medication orders while
preparing the medications for their patients. In doing this, the nurse is more likely to catch mistakes before they reach the patient. Furthermore, this QI project positively impacted the overall microsystem given the presence of the visual reminders throughout the unit. While only a fraction of the nurses consented to participate, the other nurses responsible for patient care were still exposed to these reminders and may have found themselves gathering their medication supplies and preparing them at a location equipped with the eMAR. Guiding an intervention that enhances the process of medication administration is critical given the importance of patient safety; therefore, this project positively impacted the overall microsystem and healthcare system. Additionally, this initiative has the opportunity to be sustained beyond this Plan-Do-Study-Act cycle, should another nurse decide to continue with this project. Because of this potential, there is the possibility for furthered improvements and the likelihood to the meet the specific aim, which touches upon the opportunity costs of this project.

**Limitations**

There are several limitations to the findings of this quality improvement project. The majority of these limitations are related to the predetermined deadline for this project. Given the deadline of July 29, 2022, only one PDSA cycle was able to be completed. The QI process is known to be a continuous process that requires multiple PDSA cycles to achieve optimal outcomes. Because of this, the one completed PDSA cycle was not significant enough to create meaningful change within this microsystem. Since there was limited time to complete the intervention portion of this QI project, the PL was unable to extend the enrollment phase any longer, which meant only six RNs were able to participate. The limited number of participants meant that there would be minimal opportunities to observe the process of preparing injectable medications. The findings from the 10 instances that were observed were unable to be used to
determine the success of the intervention since the pre-implementation data were based on 20 observations. Additionally, only five out of the six participants completed the post-implementation survey, so the responses do not reflect the beliefs of all of the RNs who participated.

Other limitations were due to the proposed data collection plan for this project. While observational data best reflect the actual practices of RNs during MA, the PL was the only individual who was observing these instances. Since the PL could not be present at all times, the results represent a fraction of the actual instances of medication preparation. Furthermore, it was determined that the presence of the observer during this process encouraged the RNs to perform how they thought they were expected to, a concept known as observer bias. Due to the limitations of this QI project, it cannot be concluded that the implementation of visual reminders to access the eMAR during the preparation of injectable medications was effective enough to guide change within this microsystem.

In an attempt to limit observer bias, the PL sat at the nurses’ station during the times when the participants were going to prepare injectable medications for their patients. This location was chosen given its proximity to the nurse server counter. It was believed that by sitting here, the PL would be able to observe from a distance, so that the RNs would not feel like they were being watched. However, the participants would typically dispense the medications and then approach the PL indicating that they were ready to be observed. While this was helpful for the PL to know when the observations were going to occur, it confirmed the presence of observer bias. Since there were no other locations for the PL to sit and have a visual of the nurse server counter, this location remained as the primary vantage point throughout the duration of the intervention which interfered with the data collection process.
Finally, the generalizability of these results is limited to microsystems with similar constraints regarding access to the eMAR at areas where medications are prepared. Microsystems with adequate access to the technology at their medication preparation stations are less likely to experience the same problem as the microsystem that was studied throughout this project. Therefore, it is believed that only units with similar barriers to accessing the eMAR will find value in reviewing this project in attempts to improve their microsystem. However, these findings support the importance of end user considerations when planning and organizing a microsystem. If the staff are expected to adhere to policies, the environment must support the workflow. These considerations are relevant to all microsystems.

Conclusions

In studying the process of preparing injectable medications, individuals are able to learn more about their own personal practices related to medication administration. Additionally, this brings heightened awareness to the importance of patient safety as it directly relates to the Seven Rights of Medication Administration. This project identified that inadequate access to the eMAR was the primary reason as to why the RNs were not referring to the medication orders while preparing injectable medications for their patients. Discovering this allows for additional ideas when planning future cycles for this QI project.

This project is particularly sustainable given that there were no economic costs associated with planning or carrying out the intervention. Moreover, since patient safety is a major concern for the current healthcare system, the need to study how RNs prepare and administer medications for their patients will always be in demand, indicating that the topic will continue to be relevant. However, the PL found this project to be somewhat unsustainable at times due to the need to be physically present on the unit to carry out the phases of the intervention. In order to make this
project more sustainable for future cycles, it is recommended that someone who is more familiar with the microsystem staff and who works on the unit already be the individual to lead the efforts for this project. This will allow for the leader to be on-site on a more regular basis which will allow for better observations.

While reviewing the results with the CNL who served as the mentor to the PL throughout this project, it was mentioned that these results could be presented to other nursing leaders and managers who are involved in the planning of new patient units that are currently under construction at the hospital that this microsystem is located in. The participants’ emphasis on wanting more efficient access to the eMAR at locations where they prepare medications may be able to contribute towards how the new units are designed, as well as inspire modifications to existing units. This may include ensuring that the patient’s rooms are equipped with adequate space for medication preparation or providing computers at the nurse server counter. The potential to contribute towards the planning process for the future patient units highlights the impacts that this QI project has on the overall process of enhancing patient safety when preparing medications.

The results of this project indicate that this process needs to be furthered examined to best support nurses during medication preparation and to ensure that patients are remaining free from harm when in the hospital environment. The survey responses from the participants brought awareness as to why they were not observed to have accessed the eMAR during the pre- and post-implementation observations. Given the impact that the visual reminders had on accessing the eMAR, as identified by the post-implementation survey responses, it is suggested that these visuals remain on display to serve as continuous reminders. Since the RNs agreed that they would be more likely to refer to the medication orders if there was better access to the
technology throughout the unit, it is recommended that at least one computer be placed at the nurse server counter. If this can be done, then it is recommended that future PDSA cycles study the actual use of the newly placed computer(s) to determine if this was the true barrier.

The results from this PDSA cycle suggest that future cycles must be completed to further improve the current process of preparing injectable medications. Recommended next steps include identifying at least one new PL, since this PL will no longer be working within this microsystem. This PL should have an understanding of the overall quality improvement process and be equipped with the basic skills necessary to lead a process improvement project. Additionally, a conversation should be engaged in with the microsystem’s management staff to explore the feasibility of relocating a computer from the nursing stations to the nurse server counter. If this can be accomplished, this should be the basis of the next PDSA cycle. It would be beneficial for the PL to study the use of the technology by observing participants during their medication preparation practices and by assessing their satisfaction with the placement of the computer. In furthering this project, a more valid attainment of the specific aim is likely to occur which will contribute towards enhancing the safety checks in place to protect patients from harm.
References


Appendix A

Visual Reminder

STOP

Don’t forget to access the eMAR during med prep!
Appendix B

Informed Consent

Welcome to this quality improvement project!

I am interested in improving the process of preparing injectable medications to enhance patient safety. For this project, you will be presented with the results from the previous survey and background information regarding the local problem. Then, visual reminders will be placed in various locations around the unit to remind RNs to utilize the eMAR during active medication preparation. Following this, those that agree to participate will then be observed during the preparation of injectable medications. You will also be asked to participate in another survey that will assess your knowledge regarding medication preparation and patient safety. Your responses will be kept completely confidential.

A total of 20 observations will be collected amongst those who agree to participate. The education session should take around 10 minutes and the survey should take you around 10 minutes to complete. Your participation in this project is optional. You have the right to withdraw at any point during the process. The Project Leader, Michael Ferrone, can be contacted at Michael.Ferrone@unh.edu.

By clicking the button below, you acknowledge:

- Your participation in this quality improvement project is voluntary.
- You agree to be observed during the preparation of injectable medications.
- You are 18 years of age.
- You are aware that you may choose to terminate your participation at any time for any reason.

I consent and will participate

I do not consent and do not wish to participate

If you consent to participate in this project, please provide your first and last name. If you do not wish to participate, please respond with "N/A".

Please note, this information is necessary for the purposes of knowing who to collect observation data from and who to send the survey to. When collecting observations, the Project Leader will not document the names of those being observed. Additionally, the survey will not ask for your name or other identifiable information.