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Post-Cesarean Section Pain Management Using Pre-built Computerized Order Entry Sets

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## Abstract

### *Problem*

Electronic medical records (EMR) have helped decrease common medication errors. However, prescribing errors are still elevated. Creating pre-built order sets can decrease medication errors for post-cesarean section women.

### *Methods*

This project used an evidence-based practice approach to create new order sets. Women undergoing a cesarean section between January 15, 2021 and April 14, 2021 received the new order sets. A retrospective data review was conducted pre and post-implementation between the dates of October 15, 2021 and April 14, 2021 to view medication errors.

### *Results*

Before implementation of the order sets, there were 239 cesarean deliveries and eight errors reported via Safety and Environmental Management Systems (SEMS) reports, and 45 errors reported via pharmacy intervention documentation reports. After implementation of the order sets, there were 281 cesarean deliveries. Reported errors via SEMS and pharmacy reports were decreased to 3 and 25 respectfully. Top medication errors reported via pharmacy reports pre-implementation were duplicate acetaminophen (n = 14, 29.79%) and overlapping ibuprofen and ketorolac (n=11, 23.40%) and post-implementation were duplicate ondansetron IV (n=11, 37.93%) and duplicate acetaminophen (n=8, 27.59%). According to SEMS reports, overlapping ibuprofen and ketorolac was the only error reported pre-implementation (n=8, 100%) and post-

implementation errors included duplicate acetaminophen (n=1, 33.3%), overlapping ibuprofen and ketorolac (n=1, 33.3%), and duplicate oxycodone (n=1, 33.3%).

*Implications for Practice*

Order sets can provide pain control to post-cesarean section women. By decreasing medication errors, patients are kept safe from preventable mistakes. Using pre-built order sets can decrease provider error and thus medication errors.

*Keywords:* cesarean section, pain management, order sets

## Post-Cesarean Section Pain Management Using Pre-built Computerized Order Entry Sets

Medical errors can result in serious adverse effects for the patient and are the most common type of error in healthcare. In 2019, a study done by Johns Hopkins explained medical errors are now the 3<sup>rd</sup> leading cause of death in the United States (Daniel, 2019). Errors can harm a patient and occur at any point in the medication delivery process including the prescribing, dispensing, transcribing, administering, or the monitoring phase (Kruer, Jarrell, & Latif, 2014; Lavan, Gallagher, & O'Mahony, 2016). Many errors are caused by the nonexistence or underuse of safety nets to catch errors before reaching the patient (Daniel, 2019).

On average, prescribing errors occur 8.8 times per every 100 medication orders. Given the high number of errors, electronic medical records (EMRs) were developed (Lavan et al., 2016). Since 2009, EMRs have simplified order entry and decreased prescribing errors by providing order options. In labor and delivery units, duplicate order entry is common due to computerized provider order entry (Wetterneck et al., 2011). A high rate of medication errors is often the result of providers being busy while inputting orders (Lavan et al., 2016). Order fatigue can occur causing providers to ignore flagged medication alerts resulting in medication duplications. By creating pre-built order sets until discharge for post-cesarean section pain management, providers have less room for errors when prescribing medications. According to the article to Err is human, "The problem is not bad people in healthcare, but good people working in bad systems that need to be made safer" (Kohn, Corrigan, & Donaldson, 2000).

In 2017, the national cesarean section rate increased to 32% from 31.9% in 2016 and from 20.7% in 1996 (Hamilton, Martin, Osterman, Driscoll & Drake, 2018). Today,

approximately one in three deliveries will be cesarean sections (Smith, Young, Blosser, & Poole, 2019). With the rate being so high, it is vital to customize a pain management order set specifically for these patients. Further, because a cesarean section is major abdominal surgery, pain is expected. However, with proper medications, these patients can achieve adequate pain control.

The American College of Obstetricians and Gynecologists (ACOG) found pharmacologic and nonpharmacologic methods for treating postpartum pain are necessary. Specifically, after a cesarean section, multimodal pain management is preferred due to differing mechanisms of action to relieve pain (ACOG, 2018). Finding a balance between adequate pain control and a safe postpartum experience for the patient is essential for recovery. A review of the literature can help determine what evidence-based protocols have been implemented for pain control in post-cesarean deliveries. This quality improvement project will focus on post-cesarean pain management during the inpatient postpartum period.

In a large, urban, Midwestern, teaching hospital with a labor and delivery unit, there is an opportunity to build computerized provider order entry (CPOE) order sets in the EMR for post-cesarean pain management. Between January and June 2020, 112 pharmacy intervention documentation reports and 33 Safety and Environmental Management Systems (SEMS) reports for duplicate medication orders and errors in the EMR were found. The purpose of this quality improvement project was to create standard pain management order sets reflecting current practice recommendations for patients undergoing a cesarean section to reduce duplicate medication entry. The Iowa Model for Evidence-Based Practice guided this project. The aim of this project was to develop pre-

built pain management order sets for post-cesarean section deliveries in the EMR to decrease medication error rates by ten percent over three months. The question for study was: In post-cesarean section deliveries, how do new pain management order sets in the EMR affect duplicate medication entry and medication errors within three months of implementation? The primary outcome measures of interest included duplicate medication entries and errors, type of error, whether the error reached the patient, and if the error caused harm to the patient. The secondary outcome measure was the use of the new order sets.

### **Review of Literature**

For this literature review, CINAHL, PubMed, and Science Direct were the databases used. Keywords used were *opioid use*, *opioid prescribing patterns*, *postpartum*, *pain management*, *medication errors*, *duplicate orders*, and *ACOG guidelines*. No Boolean operators were used. In the initial search, there were 107 publications generated. To refine the search, *opioid use* was changed to *opioid prescribing patterns*. The inclusion criteria were any women undergoing a cesarean section. The exclusion criteria were women undergoing a vaginal delivery. After this refined search, the number of publications retrieved was 14. A total of 14 publications were selected for this literature review.

The World Health Organization (WHO) created a stepwise, multimodal pain management approach to treat cancer-related pain, which is also used for acute pain and postpartum pain situations (ACOG, 2018). The three-tier multimodal approach begins with low doses of non-opioid analgesics before increasing to higher doses of non-opioid and opioid medications (ACOG, 2018). Tier one begins with non-opioid analgesics,

including acetaminophen and nonsteroidal anti-inflammatory drugs (NSAIDs). Tier two adds mild opioids such as oral tramadol, oxycodone, hydrocodone, codeine, and morphine at low doses. Tier three, which is only used after all previous medications have failed, incorporates more potent opioids, including parenteral morphine, hydromorphone, and fentanyl (ACOG, 2018).

Current clinical practice guidelines state post-cesarean section pain management is treated with alternating scheduled NSAIDs and acetaminophen (ACOG, 2018). Smith et al. (2019) alternated NSAIDs and acetaminophen, which considerably controlled pain for the majority of patients who underwent a cesarean section. A new post-cesarean section order set was created consisting of scheduled ketorolac every six hours, alternating with acetaminophen every six hours for the first 24 hours. After 24 hours, ketorolac was replaced with ibuprofen every eight hours, still alternating with acetaminophen every six hours for the remainder of the postpartum hospital stay (Smith et al., 2019). This method resulted in a 75% reduction in total morphine milligram equivalents used for pain management per hospital stay (Smith et al., 2019). Pre-implementation 120 morphine milligram equivalents were used per stay and post-implementation 30 morphine milligram equivalents were used (Smith et al., 2019). This study also found that post-cesarean section pain can be managed without scheduling opioids medications every four to six hours (Smith et al., 2019).

Using a multimodal combination of agents with different mechanisms of action can effectively manage pain during the post-cesarean section period (ACOG, 2018). Neuraxial opioids should be given immediately post-cesarean section to provide pain relief before starting oral medications (ACOG, 2018). Hedderson et al. (2019) used a pain



management routine consisting of intrathecal opioids followed by acetaminophen and NSAIDs every six hours. Oral oxycodone was given for breakthrough pain. Another recommendation is the possible use of local anesthesia to help with immediate post-cesarean section pain that can be delivered via wound infiltration. Gabapentin can also be used as part of a pain control regimen. Conversely, there is a lack of evidence on the actual effects of the medication on pain control (ACOG, 2018).

Currently, ACOG (2018) recommends using the stepwise multimodal approach for both postpartum vaginal and cesarean deliveries. Early oral intake of pain medications, early ambulation, and removal of the urinary catheter are all components of a quick recovery and shorter length of hospitalization (ACOG, 2018). These three tasks along with reducing opioid exposure, avoiding prolonged fasting, and educating the patient on the goals and expectations of surgery can enhance the recovery period by decreasing the surgical stress response and maximizing recovery (Hedderson et al., 2019). Enhancing the recovery can reduce the amount of pain medication needed in the postpartum hospital stay.

Post-cesarean pain can be managed without scheduling opioids. A quality improvement program was implemented in postpartum women that transformed opioids from a scheduled medication to an as-needed medication for pain management (Smith et al., 2019). Oxycodone five-milligram tablets were available every four hours as needed for pain in this order set (Smith et al., 2019). The goal of the study was to determine whether the pain was controlled using a multimodal approach while decreasing the number of opioids used (Smith et al., 2019). Moreover, Nanji, Guo, Riley, & Carvalho (2019), created an order set allowing the patient to take split doses of oxycodone. Instead

of taking the entire dose at once, half was taken at the requested time, followed by the second half an hour later if still desired by the patient. This method of administration decreased the post-cesarean pain level without increasing the number of opioids used and the negative side effects of the medication (Nanji et al., 2019). There was a significant increase in the number of patients that did not consume opioids for pain control throughout the entire hospital stay as a result of this quality improvement process, making it a successful modification in the order set (Smith et al., 2019). Pre-implementation approximately six percent of patients did not consume opioids during the entire hospital stay, compared to post-implementation where up to 19% of patients did not consume opioids during the entire hospital stay (Smith et al., 2019). By splitting the pills, opioid use was lowered significantly, by over 50% in the first 48 hours after a cesarean section, while still relieving the patient's pain (Nanji et al., 2019).

Medication errors can happen in all types of healthcare settings but are more common in the hospital setting (Lavan et al., 2016). The literature surrounding medication safety in obstetrics is limited and few studies have specifically investigated this topic. According to Kfuri, Morlock, Hicks, & Shore (2008), the top ten medications associated with obstetric medication errors were ampicillin, oxytocin, ibuprofen, cefazolin, oxycodone/acetaminophen, ketorolac, magnesium sulfate, terbutaline, gentamicin, and meperidine. During the study period of three years, there were a total of 4583 medication error reports in both labor and delivery and postpartum. This number accounted for approximately 4.8% of all reports submitted in this hospital and over half of the errors took place after the delivery in either the recovery or the postpartum room (Kfuri et al., 2008). Of the medication errors that occurred, 72% of them involved

medication administration and 13% occurred in the prescribing phase (Kfuri et al., 2008). One of the highest causes of error resulting in patient harm was improper doses or quantities (Kfuri et al., 2008). Some examples of prescribing errors include dosing, frequency, substitution, duplicate orders, commission, omission, and form (Lavan et al., 2016). There are multiple causes of prescribing errors, including prescriber knowledge of medications and patient comorbidities, prescriber experience level, patient knowledge regarding medication use, work environment factors such as staffing and workload, and task-related factors such as a clear explanation for how a medication should be administered (Lavan et al., 2016). The administration must be precise for patients to correctly receive their medications.

Providers can also work together to determine appropriate medications and doses for similar patients. An article by Voelker and Schauburger (2018) found that by performing academic detailing and allowing providers to compare themselves against other prescribing obstetricians, the providers decreased their opioid prescriptions post-cesarean section from 100% to 93%. The number of opioid prescriptions decreased in both number and size after the implementation of academic detailing (Voelker & Schauburger, 2018). By comparing providers' opioid-prescribing patterns, the number of opioid prescriptions decreased but were not decreased enough to be a significant post-implementation change (Voelker & Schauburger, 2018).

While the implementation of the EMR and CPOE have decreased medication errors, duplicate medication order entry has increased due to pre-settings present when entering medications (Wetterneck et al., 2011). Offering providers a pre-built CPOE order set can show the common medication regimens with normal doses and frequencies

used for a particular type of patient (Kruer et al., 2014). Building an order set can group orders for frequently recurring tasks (Kruer et al., 2014). To increase safety in CPOE, some simple steps must be followed. First, there must be communication between providers, nurses, and pharmacists about the patient's plan of care (Wetterneck et al., 2011). Next, the entire team must review the order entry and if needed, an order modification can be done. Lastly, the entire team must review the order and agree it is ready for administration (Wetterneck et al., 2011). Completing these steps can decrease the number of errors occurring due to CPOE. A pharmacy order verification system is present in the EMR within the ordering system to show duplicate or incorrect orders by alerting providers or pharmacists of an error before the order is completed. This helps to decrease the chance the medication reaches the patient (Kruer et al., 2014).

Furthermore, the EMR has another safeguard called barcode scanning. Barcode scanning aids in the reduction of medication errors by creating a verification of the medication, dose, route, patient, and time scheduled. Moreover, EMR also shows a log of the medication history for each patient (Kruer et al., 2014). However, when duplicate orders are placed under the same patient, the electronic medication administration record cannot block this medication from being administered until the patient has reached the maximum daily dose of medication. This leaves room for medication errors to occur.

Efficiency inpatient care and medication safety have been improved by the presence of CPOE and the EMR, but problems are still present. By creating order sets entered by one provider rather than multiple providers, the potential for errors can be reduced (Kruer et al., 2014). Order sets reflecting the pain management needs of the majority of post-cesarean deliveries give the provider a directional approach when

prescribing medications (Kruer et al., 2014). Modifications can be made to fit the needs of outlying patients.

The framework that guided this project is the Iowa Model of Evidence-Based Practice. Clinicians use this framework as an approach to interpret research and apply it to the workplace for improvement (Hanrahan, Fowler, & McCarthy, 2019). This model is driven by evidence-based practice that improves the quality of patient care and helps control healthcare costs. By decreasing medication errors, both the patient and hospital benefit (Loma Linda University Libraries, 2020). This quality improvement project follows this model by following the current guidelines for post-cesarean section pain management.

There is a lack of evidence-based research in the field of obstetrics because it is difficult to study pregnant and postpartum patients. Due to the lack of evidence, it is challenging to form a plan to decrease medication errors. Pre-built CPOE order sets completed by one provider are one way to decrease the probability of errors. Completing this evidence-based project contributed to the research growth. Following the multimodal approach discussed above provided the patient with pain relief occurring in the early postpartum period. Opioids should be available as needed but should not be scheduled as a primary pain management method (ACOG, 2018). Having a pre-built order set is an essential guide for providers when placing orders for post-cesarean section deliveries (Kruer et al., 2014). With an order set and proper guidelines in place, post-cesarean section women can be properly treated with pain medication matching the level of pain without medication error.

### **Method**

**Design**

An evidence-based practice approach was used for this project by reviewing the literature for current post-cesarean pain management guidelines. An implementation optimization design approach was used. A retrospective data review was conducted to view duplicate entries or errors between the dates of October 15, 2020 through January 14, 2021. After implementation of the new CPOE order sets on January 15, 2021, a retrospective data review was completed between the dates of January 15, 2021 through April 14, 2021.

**Setting**

A large, urban, teaching hospital located in the Midwest was used for this quality improvement project. The labor and delivery and postpartum units were the locations for change. There are approximately 3,500 deliveries a year at this hospital. In the labor and delivery and postpartum units, there are over 200 nurses, over 75 obstetrics doctors, over 75 anesthesia doctors, one pharmacist, two caseworkers, three social workers, 15 secretaries, 22 patient care technicians, 15 surgical scrub technicians, and one chaplain.

**Sample**

A convenience sample of all females delivering via cesarean section at this hospital between October 15, 2020 and April 14, 2021 were used. Inclusion criteria included patients undergoing a cesarean section during this time frame. Exclusion criteria included patients undergoing a vaginal delivery and all other admissions during this time frame. The sample size was 239 deliveries pre-implementation and 281 deliveries post-implementation.

**Data Collection/Analysis**

Retrospective data collected included any duplicate medication errors, type of error, what medication was involved in the error, if the error reached the patient, and if the patient was harmed from SEMS reports and pharmacy intervention documentation reports. All “near miss” duplicate medication entries that were removed by the pharmacy and appear in pharmacy intervention documentation reports were included.

All data was de-identified and patient names did not appear on the SEMS or pharmacy intervention documentation reports to protect patient identities. Each error documented was given a unique number that was used to log each error found. All data was collected in an Excel spreadsheet and stored on a password-protected computer. Data was analyzed using Intellectus Statistics. Descriptive statistics were performed to view the medication errors found in each report both pre and post-implementation.

### **Approval Processes**

To perform the project, approval was obtained from the labor and delivery manager, the hospital institutional review board (IRB), the university IRB, the doctorate of nursing practice (DNP) chair and committee, and the dean of the graduate school. Parental consent was not needed because the patients used were pregnant. Patients under the age of 18 were also included in the data collection due to being considered emancipated minors while being pregnant. The pain management order sets were given to all patients for pain management so approval from patients was also not needed. Depending on a patient’s allergies and surgical complications, changes were made to the pain management order sets on an individualized basis if needed.

### **Procedures**

The key stakeholders in this project were the obstetricians, anesthesiologists, labor and delivery and postpartum nurses, pharmacist, and the patients delivering at the Women and Infants facility. Meetings were held with a team of stakeholders to construct and evaluate the new post-cesarean section pain management order sets. When the order sets were completed, both were implemented as saved CPOE options in the EMR orders tab. The providers ordering the order sets were educated on the new order sets via emails, small group meetings, huddles at shift change, and reminder cards on provider computers. All patients undergoing a cesarean section starting January 15, 2021 received the new order sets. A retrospective data review was conducted for patients delivering between the dates of October 15, 2020 and January 14, 2021 as well as after implementation between the dates of January 15, 2021 and April 14, 2021. Data was collected from pharmacy intervention documentation reports and SEMS reports. The data was collected in an Excel spreadsheet and descriptive statistics were performed in Intellectus Statistics. Results were then presented to the labor and delivery and postpartum units and the DNP department at the University of Missouri – St. Louis.

### **Results**

During the pre-implementation period (October 15, 2020 through January 14, 2021), there were 239 cesarean section deliveries. During the post-implementation period (January 15, 2021 through April 14, 2021), there were 281 cesarean section deliveries (Appendix A). All women delivering via cesarean section during the pre and post-implementation periods (n=520) were used in the data analysis.

Before implementation of the new CPOE order sets, there were eight errors reported (3.35%) via SEMS reports. Similarly, there were 45 errors (18.82%) reported via



pharmacy intervention documentation reports. After implementation of the CPOE order sets, errors were reduced to three errors (1.07%) via SEMS reports and 25 errors (8.90%) via pharmacy intervention documentation reports (Appendix A). The implementation of the new order sets decreased errors by 62.5% according to SEMS reports and by 44.44% according to pharmacy intervention documentation reports.

Medication errors found during this quality improvement project included both prescribing and administering errors. According to the SEMS reports, before implementation of the CPOE order sets 25% (n=2) of the errors were administering errors and 75% (n=6) were prescribing errors. Both administering errors were due to order timing, allowing medications to be given too close together. After implementation of the CPOE order sets, 100% (n=3) of errors reported via SEMS reports were prescribing errors. The pharmacy intervention documentation reports showed 100% (n=45 and n=25 respectively) of errors were prescribing errors pre and post-implementation. Two types of prescribing errors reported via pharmacy intervention documentation reports included duplicate medication errors and drug-drug contraindications known as overlapping medication errors (Appendix B). Before implementation, there were 28 duplicate medication errors and 17 overlapping medication errors. After implementation, duplicate medication errors were reduced to 22 and overlapping medication errors were reduced to 3 (Appendix B).

Medication errors were analyzed by error event, duplicate or overlapping. The top medication errors reported via pharmacy intervention documentation reports before the implementation of the CPOE order sets were duplicate acetaminophen (n=14, 29.79%) orders and overlapping ibuprofen and ketorolac (n=11, 23.40%) orders (Appendix C).

After implementation, the top medication errors reported were duplicate ondansetron IV push (n=11, 37.93%) and duplicate acetaminophen (n=8, 27.59%) (Appendix C).

According to SEMS reports, the top and only type of medication error reported before implementation of the CPOE order sets was overlapping ibuprofen and ketorolac (n=8, 100%) orders. Medication errors reported via SEMS reports after implementation (n=3) included one duplicate acetaminophen error (33.3%), one overlapping ibuprofen and ketorolac error (33.3%), and one duplicate oxycodone error (33.3%).

According to SEMS reports, 50% (n=4) of the eight medication errors reached the patient before the implementation of the CPOE order sets. After implementation, zero medication errors reached the patient. Out of all reported medication errors found via SEMS reports, zero caused harm to any patients (n=11, 100%). Medication errors found via pharmacy intervention documentation reports were removed in the EMR by either the pharmacist or ordering provider before the error reached the patient. According to the pharmacy intervention documentation reports, when duplicate errors arose both before and after implementation, the provider was called most of the time (n=64, 91.43%) to discontinue one or more of the orders. The pharmacist caught the remaining (n=6, 8.57%) overlapping medication errors and changed the timing to eliminate the overlap.

### **Discussion**

In post-cesarean section deliveries, the implementation of a new pain management order set had a positive impact on duplicate medication entry and medication errors. The goal of this quality improvement project was to implement CPOE order sets on the labor and delivery and postpartum units to reduce duplicate medication entries and errors by ten percent. Errors were examined using two different reports

separately to avoid overlapping of errors and overlapping of patients. Pharmacy intervention documentation reports are placed by the pharmacist when a provider enters an incorrect order and takes just a couple of minutes to fill out. These reports are a safety net to check for errors before they reach the nurse or the patient. When pharmacy intervention documentation reports are filled out, providers are contacted to discontinue one or more incorrect orders or pharmacists change the order timing to prevent overlapping medication errors. Most errors are caught by the pharmacist and these are known as “near misses.” However, some errors do get through this safety net and reach the patient. When this occurs SEMS reports are filed. SEMS reports can be placed by anyone working in the hospital. Reports are placed when something incorrect has occurred in practice. There is a category strictly for medication errors, which was observed for this project. Since each error report is usually entered by different people, both reports could be filled out for one patient about the same medication error. This is the reason reports were viewed and analyzed separately.

Duplicate medication errors and overlapping medication errors were found. Duplicate medication errors involve the same medication that is ordered twice during the same time frame. Overlapping medication errors involve two or more different medications with similar mechanisms of action that are ordered during the same time frame. The overlapping medication errors were considered one error event, thus were grouped and recorded as both medication names when analyzing errors. Certain overlapping medication errors frequently occurred together, illuminating the order sets imperfections in the timing of medications.

Analysis showed there was a 62.5% decrease in errors via SEMS reports and a 44.44% decrease in errors via pharmacy intervention documentation reports. Therefore, errors were decreased by more than our goal of ten percent making the pre-built CPOE order sets a successful implementation for the labor and delivery and postpartum units. Four errors pre-implementation reached the patient but no harm was done to any patients either pre or post-implementation. After the implementation of the new order sets, no errors reached the patient. By decreasing medication errors that reach the patient, patients are kept safe from harmful, preventable mistakes.

Unfortunately, there were a couple of limitations to this project. It was unclear if all women received the new CPOE order sets. The EMR company was unable to provide information about order set compliance due to efforts focusing on the go-live for another hospital. Another limitation to this project was COVID-19. The pandemic hindered the merging of the order sets and therefore two order sets remained. Pre-built orders were selected by the team of stakeholders and providers were educated to use this new specific order set but, the old order set remained available in the EMR orders tab. This allowed providers to choose the old order set when selecting orders if not fully educated on the implementation of the new order sets. Lastly, all error reports entered by providers, nurses, and pharmacists were voluntarily entered and reports were not automatically entered for each error. This meant the pharmacy and SEMS reports may not have captured all errors that occurred.

A recommendation for further study in the future would be to merge the anesthesia and obstetrics order sets. By working with an EMR representative directly, the order sets could be merged into one order set that would replace the two order sets. This

change would result in one provider inputting the order set rather than two providers, leaving less room for error to occur. After merging, a plan-do-study-act (PDSA) cycle would be recommended to make any necessary changes for continuous improvement. Another recommendation for further study is the evaluation of patient charts to determine if the order sets were used for each patient. Evaluating patient charts could also show if medication errors occurred due to the new order set or if errors occurred due to other circumstances. Additional research would require further IRB approval to determine order set compliance. Lastly, it is important to evaluate why ondansetron IV duplicate orders increased with the implementation of the new order sets and prepare for further order set changes.

### **Conclusion**

Providing post-cesarean section women with a standardized pain management regimen is beneficial in the post-operative period to encourage the healing process. The order sets used pre-implementation created many duplicate medication errors due to overlapping orders. This project was successful in reducing the amount of duplicate and overlapping medication entries and errors present after the implementation of the new pre-built order sets. Using CPOE pre-built order sets is beneficial in clinical practice to avoid duplicate medication entry and error.

This project was successful in creating new order sets that decreased the number of medication errors that reached the patient, decreased prescribing errors, and did not cause harm to any patient. Findings from this quality improvement project indicated that CPOE pre-built order sets can reduce the number of prescribing errors and duplicate or overlapping orders in the EMR system. Identifying these errors and correcting them

before reaching the patient can be beneficial to post-cesarean section women in the immediate post-operative period.

## References

American College of Obstetricians and Gynecologists Committee Opinion No. 646

Summary. (2015). *Ethical Considerations for Including Women as Research*

*Participants*. . <https://www.acog.org/->

[/media/project/acog/acogorg/clinical/files/committee-](https://www.acog.org/-/media/project/acog/acogorg/clinical/files/committee-)

[opinion/articles/2015/11/ethical-considerations-for-including-women-as-research-](https://www.acog.org/-/media/project/acog/acogorg/clinical/files/committee-opinion/articles/2015/11/ethical-considerations-for-including-women-as-research-)

[participants.pdf](https://www.acog.org/-/media/project/acog/acogorg/clinical/files/committee-opinion/articles/2015/11/ethical-considerations-for-including-women-as-research-participants.pdf)

American College of Obstetricians and Gynecologists Committee Opinion No. 742

Summary. (2018). *Obstetrics & Gynecology*, 132(1), 252-253.

doi:10.1097/aog.acog0000000000002711

Daniel, M. (2019). Study suggests medical errors now third leading cause of death in the

U.S. *John Hopkins Medicine*.

[https://www.hopkinsmedicine.org/news/media/releases/study\\_suggests\\_medical\\_](https://www.hopkinsmedicine.org/news/media/releases/study_suggests_medical_)

[errors\\_now\\_third\\_leading\\_cause\\_of\\_death\\_in\\_the\\_us](https://www.hopkinsmedicine.org/news/media/releases/study_suggests_medical_errors_now_third_leading_cause_of_death_in_the_us)

Hamilton, B. E., Martin, J. A., Osterman, M. J. K., Driscoll, A. K., & Drake, P. (2018).

Births: Final data for 2017. *National Vital Statistics Reports*, 67(8), 1-13.

Hanrahan, K., Fowler, C., & McCarthy, A. M. (2019). Iowa model revised: Research and

evidence-based practice application. *Journal of Pediatric Nursing*, 48, 121-122.

<https://doi.org/10.1016/j.pedn.2019.04.023>

Hedderson, M., Lee, D., Hunt, E., Lee, K., Xu, F., Mustille, A., . . . Galin, J. (2019).

Enhanced recovery after surgery to change process measures and reduce opioid

use after cesarean delivery. *Obstetric Gynecology*, 134(3), 511-519. doi:

10.1097/AOG.00000000000003406

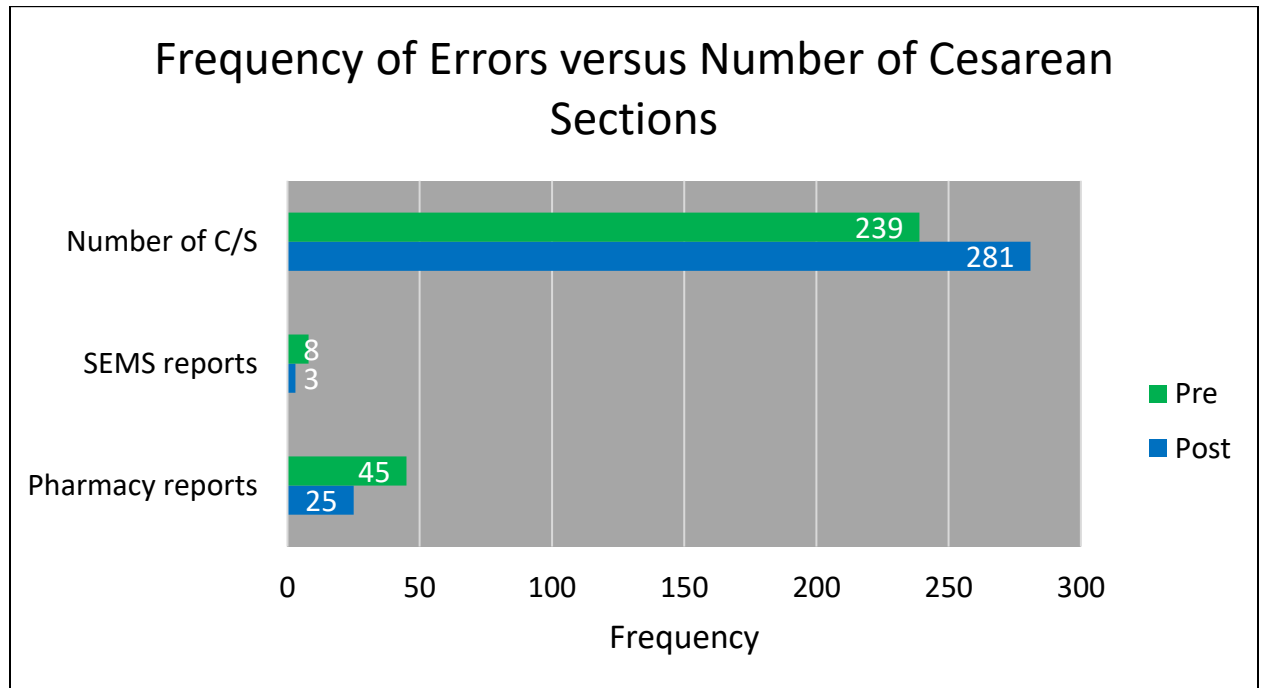
- Kohn, L. T., Corrigan, J. M., & Donaldson, M. S. (2000). To err is human. *National Academies Press (US)*. <https://www.ncbi.nlm.nih.gov/books/NBK225182/>
- Kfuri, T. A., Morlock, L., Hicks, R. W., & Shore, A. D. (2008). Medication errors in obstetrics. *Clinics in Perinatology*, 35(1), 101–117. doi:10.1016/j.clp.2007.11.015
- Kruer, R. M., Jarrell, A. S., & Latif, A. (2014). Reducing medication errors in critical care: A multimodal approach. *Clinical Pharmacology: Advances and Applications*, 6, 117-126. doi: 10.2147/CPAA.S48530
- Lavan, A. H., Gallagher, P. F., & O'Mahony, D. (2016). Methods to reduce prescribing errors in elderly patients with multimorbidity. *Clinical Interventions in Aging*, 11, 857-866. doi: 10.2147/CIA.S80280
- Loma Linda University Libraries. (2020). Nurses' guide to evidence-based practice: Models/Frameworks. *Loma Linda University Libraries*.  
<https://libguides.llu.edu/c.php?g=429445&p=6113812>
- Nanji, J. A., Guo, N., Riley, E. T., & Carvalho, B. (2019). 967: Impact of a post-cesarean analgesia order-set with split doses of oral opioids. *American Journal of Obstetrics & Gynecology*, 220(1), S622-S623.
- Smith, A. M., Young, P., Blosser, C. C., & Poole, A. T. (2019). Multimodal stepwise approach to reducing in-hospital opioid use after cesarean delivery. *The American College of Obstetrics and Gynecologists*, 133(4), 700-706.  
doi:10.1097/aog.0000000000003156
- Voelker, K. A., & Schauburger, C. (2018). Academic Detailing for Postpartum Opioid Prescribing. *The Journal of the American Board of Family Medicine*, 31(6), 944-946.



Wetterneck, T. B., Walker, J. M., Blosky, M. A., Cartmill, R. S., Hoonakker, P., Johnson, M. A., . . . Carayon, P. (2011). Factors contributing to an increase in duplicate medication order errors after CPOE implementation. *Journal of the American Medical Informatics Association*, 18(6), 774-782. doi: 10.1136/amiajnl-2011-000255

**Appendix A**

Figure 1. Frequency of Errors versus Number of Cesarean Sections Pre and Post Implementation



Note. This figure shows the number of cesarean sections both pre and post-implementation and the frequency of medication errors both pre and post-implementation of SEMS reports and pharmacy intervention documentation reports.

**Appendix B**

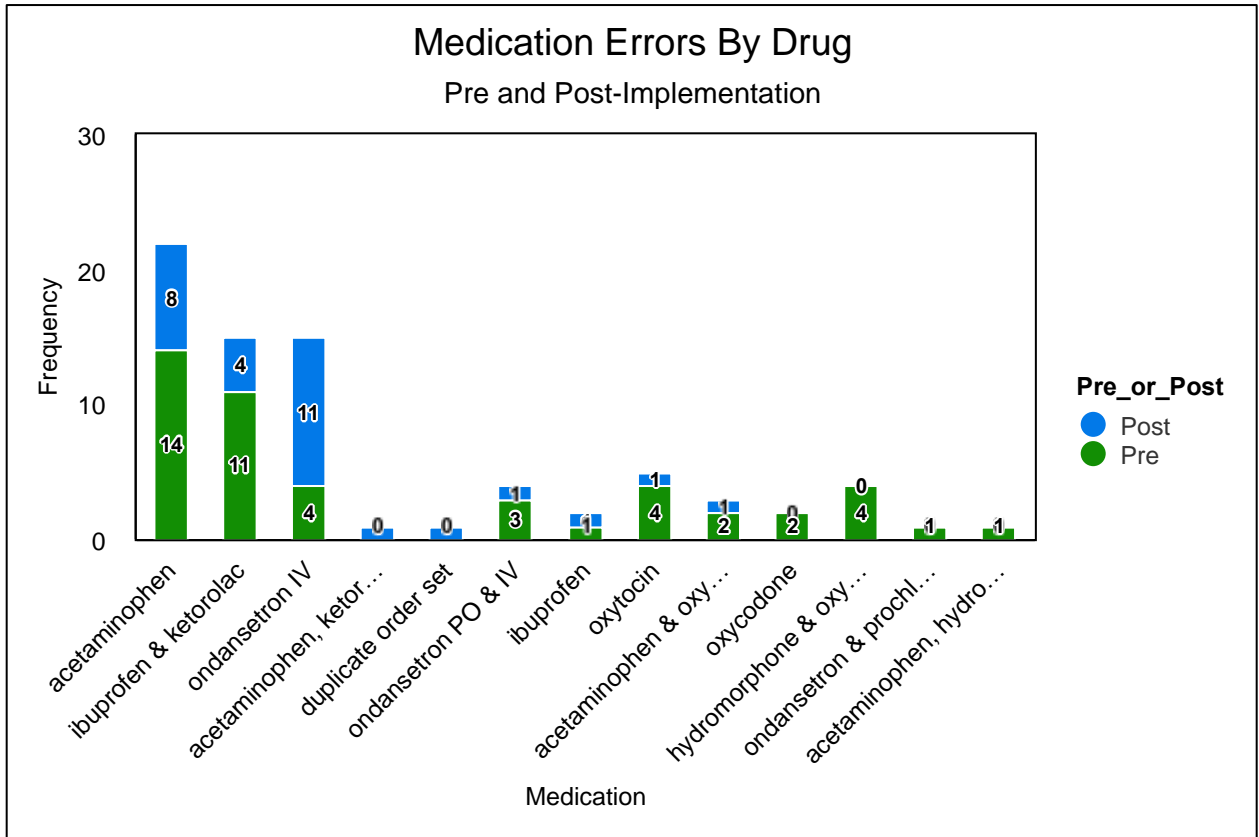
Table 1. Type of Error Pre and Post-Implementation via Pharmacy Reports

	<b>Duplicate Orders</b>	<b>Drug-Drug Contraindication</b>	<b>Total Medication Errors</b>
Pre-implementation	28	17	45
Post-implementation	22	3	25

Note. This table shows the type of medication errors found via pharmacy intervention documentation reports pre and post-implementation. The table also shows the total medication errors pre and post-implementation.

**Appendix C**

Figure 2. Frequency of Medication Errors By Drug Pre and Post-Implementation



Note. This figure shows the frequency of which medication error occurred most often during the pre and post-implementation periods found in Pharmacy Intervention Documentation Reports. Pre-implementation errors are in green and displayed at the bottom of the stacked bar graph and post-implementation errors are in blue and displayed above the pre-implementation errors.