Implementation of a Post Cesarean Multimodal Analgesic Order Set

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A DNP Project Manuscript
Submitted in Partial Fulfillment of the Requirements for the
Doctor of Nursing Practice Degree

School of Nursing, University of Maryland at Baltimore
May 2023

Author Note

We have no known conflicts of interest to disclose.

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Abstract

Problem: A community hospital with approximately 200 elective cesarean deliveries annually did not have a standard order set for multimodal pain management of parturients after elective cesarean section with spinal anesthetic, resulting in high reliance on postoperative opioid use. **Purpose**: The purpose of this quality improvement project was to create and implement an evidence-based, multimodal analgesic order set for use following spinal anesthetic for elective cesarean delivery. **Methods**: A literature review was completed to identify evidence-based best practices for multimodal analgesic regimens after elective cesarean delivery with spinal anesthetic. Information was shared with site stakeholders including nursing, pharmacy, informatics, obstetrics, and anesthesiology teams. A protocol was drafted, approved, and implemented. Compliance with placing the order set for appropriate patients was tracked and communicated to stakeholders on a weekly basis. An education email was provided to the anesthesia department between weeks two and three of the project. **Results**: During the first two weeks after the go-live date, no anesthesia providers utilized spinal anesthetics for parturients undergoing elective cesarean section, and therefore, order set utilization was also zero. During weeks three through fifteen, eighteen patients received spinal anesthesia for elective cesarean section and compliance with utilizing the post-operative order set was one hundred percent. **Conclusions**: The project supported reduction of institutional reliance on postoperative opioids, as the order set provides patients with scheduled non-opioid analgesics. High compliance with the intervention suggests the implementation was successful.

Keywords: postoperative, multimodal, analgesia, cesarean, implementation, elective

Implementation of a Post Cesarean Multimodal Analgesic Order Set

Problem

A 218-bed suburban community hospital in Maryland, with approximately 200 elective cesarean sections (c-section) annually, was expecting an increase in deliveries by approximately 50%. Nationally, approximately one third of all c-sections are considered elective procedures (Hure et al., 2017). Elective c-sections take two hours or less to complete, and are isolated to a specific anatomical location, making them amenable to spinal anesthesia (*Cesarean Procedure*, 2020).

Spinal anesthesia, or subarachnoid block (SAB), is accomplished by placing a needle between the lumbar vertebrae and injecting a single dose of local anesthetic medication into the cerebrospinal fluid (CSF). SAB provides appropriate surgical conditions – relaxation of muscles, analgesia, and anesthesia – for abdominal procedures, while allowing the parturient to remain awake during delivery and bond with the newborn in the immediate post-operative period (Janda & Berger, 1983).

The recovery period after c-section can be complicated by pain, immobility, infection, bleeding, and venous thromboembolism (Quinlan & Murphy, 2015). These complications can jeopardize patient satisfaction and safety, prolong hospitalization, and increase healthcare costs. The addition of an opioid to a SAB can provide pain control for the parturient up to 24 hours post-operatively (Kaufner et al., 2016). Since the medication is administered directly into the CSF, a small dose is needed, and side effects are typically attenuated. This technique can be supplemented with enteral and intravenous non-opioid analgesics, such as ketorolac and acetaminophen, to improve post-operative pain control.

Sub-optimal pain management in the post-operative period reduces the parturient's ability to ambulate adequately, return to normal bowel and bladder function, and meet discharge criteria.

This reduces satisfaction, increases risk of complications leading directly or indirectly to increased length of stay (LOS) and increasing healthcare costs (Figure 1) (C. D. Sutton & Carvalho, 2017)(Chan et al., 2018). Current practice at this facility does not include a standard order set for post-operative analgesia in the parturient undergoing elective c-section with SAB, resulting in significant use of enteral, epidural, and intravenous opioid medications. These medications can cause drowsiness, respiratory depression, nausea, emesis, constipation, and pruritis – a host of undesirable side effects – and are best used as a last resort, or rescue analgesic, when patients experience pain refractory to non-opioid medications. The purpose of this quality improvement (QI) project was to create and implement an evidence-based, multimodal, analgesic order set for use following elective c-section with spinal anesthesia.

Literature Review and Available Knowledge

A root cause analysis (Figure 1) demonstrated the primary problem was post-surgical pain, and a review and synthesis of related literature was completed (Appendix A). Bornstein et al. (2020) found that scheduled 'round-the-clock' acetaminophen as part of a multimodal analgesic protocol after c-section simultaneously reduced parturients' opioid consumption and pain scores. Ganer Herman et al. (2020) were also able to improve early postoperative mobility, secondary to improved pain control, with a similar protocol that included standard scheduled acetaminophen. In 2019, Holland et al. were able to demonstrate that the majority of patients do not require any systemic opioids at all after c-section, as long as robust multimodal protocol including non-opioids analgesia is in place. Their work suggests that opioids should be ordered only on a case-by-case basis for such patients. Kleiman et al. (2020) implemented a full enhanced recovery after surgery (ERAS) protocol, which had components ranging from preoperative counseling and education, to intraoperative fluid management goals, to opioid-sparing postoperative pain

management. Their intervention maintained a small systemic opioid for breakthrough pain in their standard order set, but still resulted in a 38% decrease in postoperative opioid consumption without increase in pain scores. Llarena et al. (2022) were able to achieve over a 60% reduction in postoperative opioid use by removing Percocet (combo oxycodone-acetaminophen) from their standard order set, scheduling oral acetaminophen, intravenous ketorolac, and reserving plain oxycodone for severe pain. In summary, the review of recent literature demonstrated standardized, scheduled, multimodal analgesia (with an emphasis on non-narcotic medications) improved outcomes post-delivery. Parturients receiving such protocols consumed fewer morphine milligram equivalents (MME), and enjoyed earlier mobility with fewer side effects, while maintaining adequate pain control.

Theoretical Framework

The site was predominantly using epidural catheters to manage post-operative pain and providers were unfamiliar with the current best practices in enteral and parenteral post-op analgesic management regimens in the parturient population. Furthermore, as pain is a root cause of other issues experienced by parturients, it is an ideal target for intervention. Creating an order set to be used for all patients after c-section with spinal anesthetic allowed providers to quickly and easily improve their patient outcomes, with minimal change to their existing workflow. As such the primary process goal for this QI project was 100% of elective c-section patients receiving a spinal anesthetic would have the order set entered into the electronic health record (EHR). The original and desired process maps are outlined in Figures 2 and 3, respectively.

To achieve the desired practice change, The Knowledge to Action (KTA) framework (Figure 4), developed by Graham et al. (2007), was used as a model for change. The KTA describes the

process by which knowledge moves from the creation phase to the application phase (White, Dudley-Brown, & Terhaar, 2016, p. 41). The seven phases in the KTA cycle are: (1) Problem identification; (2) Adapt knowledge to local context; (3) Assess barriers to knowledge use; (4) Select, tailor, and implement intervention to promote the use of knowledge; (5) Monitor knowledge use, (6) Evaluate outcomes of knowledge use, and (7) Sustain knowledge use.

The knowledge was adapted to suit the local context by a multidisciplinary coalition consisting of pharmacists, informaticists, physicians, registered nurses (RNs), advanced practice registered nurses (APRNs), and administrators. The primary identified barriers to the utilization of this knowledge were contextual factors, which were assessed and discussed using the Context Assessment Index as described below.

Methods

Context

To assess the context for the proposed project, a Context Assessment Index (CAI) was performed. The CAI appraises three elements (culture, leadership, and evaluation) along a continuum (from 'weak' to 'strong'). All three elements must be 'strong,' for the context to be receptive to change. The scores are averaged for an overall context score. Scores in the culture domain evaluate beliefs, values and assumptions about the way things are done in the setting. Leadership scores evaluate the presence of transformational leaders, who can facilitate person-centered culture and readiness for change. Lastly, settings with effective and consistent evaluation of practice are better able to assess the effects of evidence-based practice implementation (McCormack, n.d.).

The CAI for the project site demonstrated a moderately strong overall context (average score of 74%), with a culture score of 78%, a leadership score of 71%, and an evaluation score of 73%,

suggesting the site will likely support the practice change. The area with the most potential for improvement is the leadership score, which may benefit from ensuring decision-making processes are transparent, teamwork is emphasized, and team members are empowered.

The context for the project also included the providers' current clinical practice. Providers at the site were familiar with computerized provider order entry (CPOE), and already utilized it to write orders to be carried out in the post-operative/post-anesthesia setting. Order sets are a well-known method to improve standardization of care. They are a type of clinical decision support system (CDSS) (R. T. Sutton et al., 2020). With a standard order set, a provider need only remember one thing: to sign the order set, rather than each individual order.

The site belongs to a healthcare system with an existing order set similar to proposed interventions which was tailored to the project site. During and after implementation, use of the knowledge was monitored via the primary process measure, while outcomes were continuously assessed. The knowledge use and associated practice change were sustained by providing continued feedback to staff about compliance with adherence to the intervention, as well as patient outcomes.

Intervention

The intervention was the creation and implementation of a multimodal analgesic order set, which is described in Appendix B. This order set provides comprehensive instructions for nursing care of the patient, ranging from analgesia to diet and activity orders. The intention is patients who receive this order set do not require patient controlled analgesia (PCA) or patient controlled epidural analgesia (PCEA), both of which entail continuous opioid infusions. Due to the scope of this project, collaboration between several members of a multidisciplinary team was a necessity. Members included the site representative, quality improvement project lead (QI-

PL), sponsor, informatics and pharmacy team members, anesthesia providers, obstetrics providers, and patient care staff.

Implementation strategies included shared goal setting and decision making, utilization of a project timeline, and sustainability plan. Regular check-ins with all members of the team were essential to the success of this project. Evaluation is a fundamental behavior of a site wishing to support a practice change, as is transparency. Sharing data on compliance with the process measure (signing the order set) positively reinforced the behavior. Communicating with stakeholders throughout the process facilitated the identification and resolution of barriers and issues, and created a culture of transparent leadership.

Measures

Structure and process measures were selected to assess project implementation and impact. The structure measure was the existence of the order set in the EHR for provider use. Since the site did not previously have an order set, the structure was created. The existence of (or lack thereof) an order set is an objective measure, so validity and reliability for this measure was 100%.

The selected process measure for the project was based on provider behavior, as assessed by compliance with signing the order set prior to transferring care of the patient to the postoperative area. The EHR keeps a time-stamped record of all orders signed, including the time they are signed, and the time the patient is transferred between different care areas. The presence of (or lack thereof) the order set in any specific patient's EHR is an objective measure, so validity and reliability are 100%.

Ethical Considerations

The project was deemed exempt from Institutional Review Board (IRB) review after the University of Maryland, Baltimore Human Research Protections Office found the project met the criteria for a Non-Human Subject Research (NHSR) determination. Hospital IRB review requirements were waived in consideration of the NHSR status of the project. No conflicts of interest were identified during development or implementation. Privacy was protected during data collection for all individuals involved, as all collected data was de-identified. Along with de-identified data from the EHR, the data collection tools are housed in REDCap, a HIPAA-compliant, password-protected server, and were accessed only by authorized users through virtual private network. Aggregated project outcomes were communicated to the site for discussion of the QI effort and external dissemination via poster presentation occurred with site permission.

Results

During the first two weeks of the QI project, no anesthesia providers utilized SAB for parturients undergoing elective c-section, and therefore, order set utilization was also zero. During weeks three through fifteen, eighteen patients received SAB for elective c-section, and the obstetric provider group successfully met the objective for appropriately utilizing the order set in one hundred percent of cases.

A run chart was created for quantitative data analysis of compliance with the intervention. Education of staff is denoted on the run chart (Figure 5). Common cause variation was essentially non-existent in this data set, as compliance rates have existed in only one of two numerical values. Special cause variation appears to exist in relation to the education of staff. The run chart does not exhibit any shifts, runs, trends, or outliers.

Discussion

The QI-PL utilized the 'Reports' feature of the site's EHR to identify all patients who had elective c-section at the site. These charts were then reviewed to determine the type of anesthetic the patient received, and whether or not they had the order set placed prior to transfer of care. The audits were completed on a weekly basis. Patient records were sorted by admission date. Charts were reviewed on Fridays, and included admission dates from the previous Friday (12:00am) through Thursday evening at 11:59pm. In this manner, no records were missed or duplicated.

The overall low number of patients who have met the criteria for this project prompted investigation by the QI-PL, and efforts to increase the number of potentially qualified patients. It was noted the primary limiting factor was the overall lack of patients who received SAB for elective c-section. The QI-PL had several informal 1:1 education sessions with anesthesia providers to determine the causes for low us of SAB. It was found one of the medications commonly used in SAB as a best practice was in short supply in the facility. This issue was rectified. Another barrier was the nursing team lacked familiarity with SAB as a concept, and was requesting the anesthesia providers refrain from using SAB as the anesthetic for elective c-sections in most circumstances. The QI-PL engaged the stakeholders to determine how the site could best be supported in addressing this dynamic, and provided additional educational materials to the nursing educator to assist with staff education.

Conclusions

Compliance with order set utilization has been excellent during the implementation of this quality improvement project. Currently, the site does not have the capability to run reports on precisely how many MMEs patients receive with and without the order set in place Future evaluation of the impact of this project could benefit from this data. Project champions from the

nursing and anesthesia departments have been identified and continue to support this project to ensure sustainability. The implementation required high levels of cooperation and coordination from various disciplines to achieve success. This QI project was designed specifically for this site; however, others' quality improvement initiatives may benefit from the lessons learned, barriers identified, and methods used to overcome those barriers for success.

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Figure 1

Fishbone Diagram/Root Cause Analysis

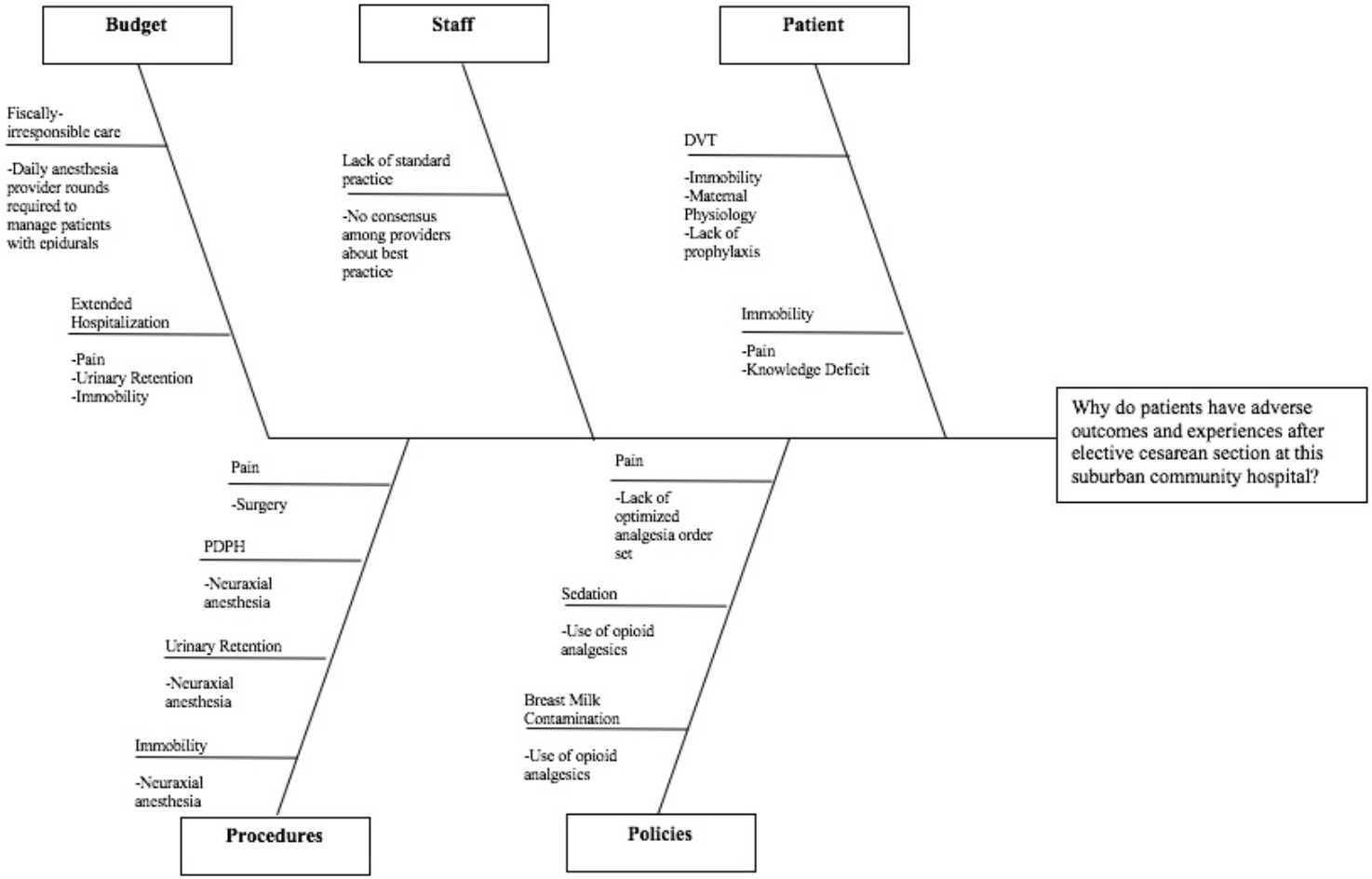
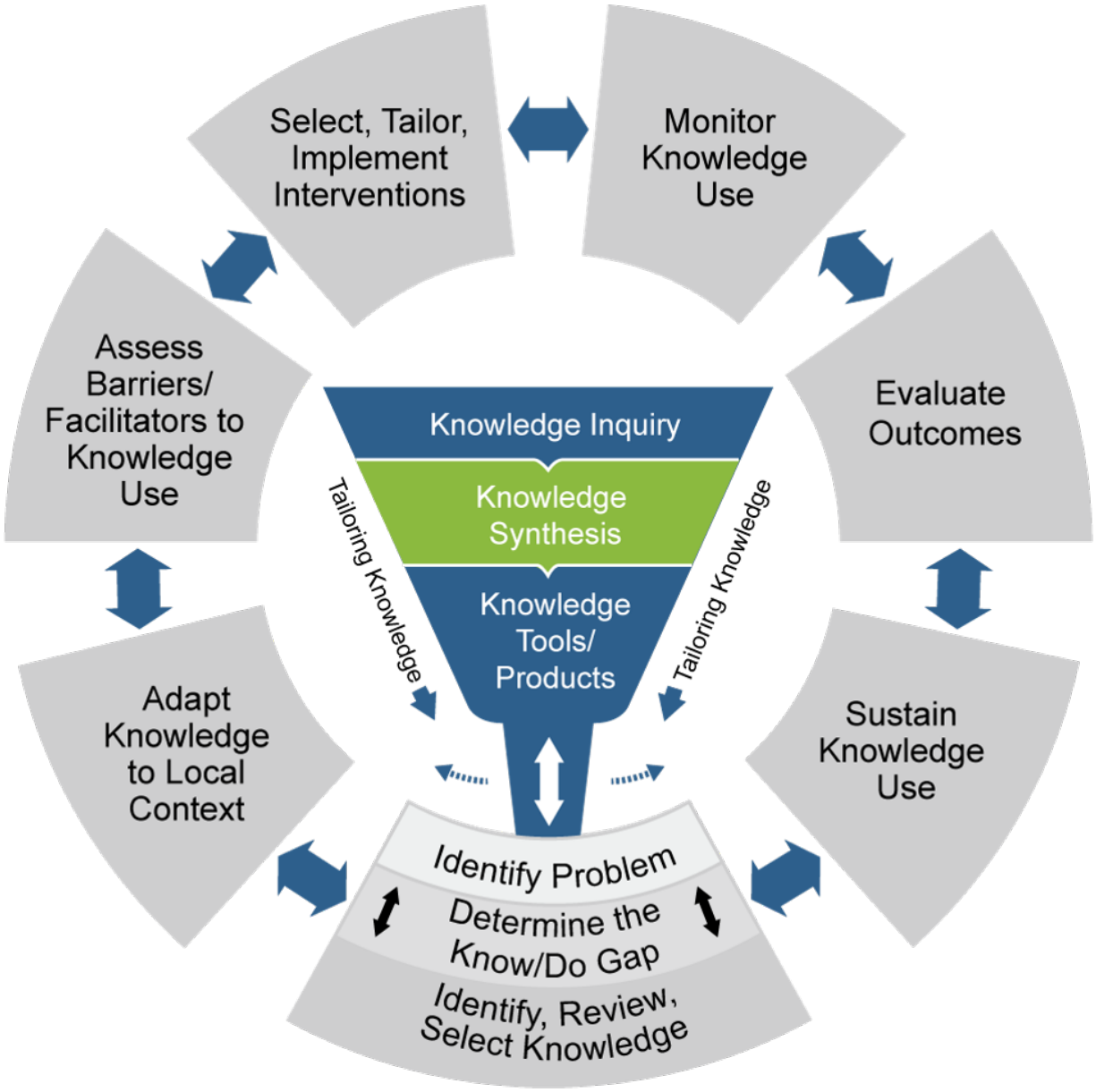


Figure 2

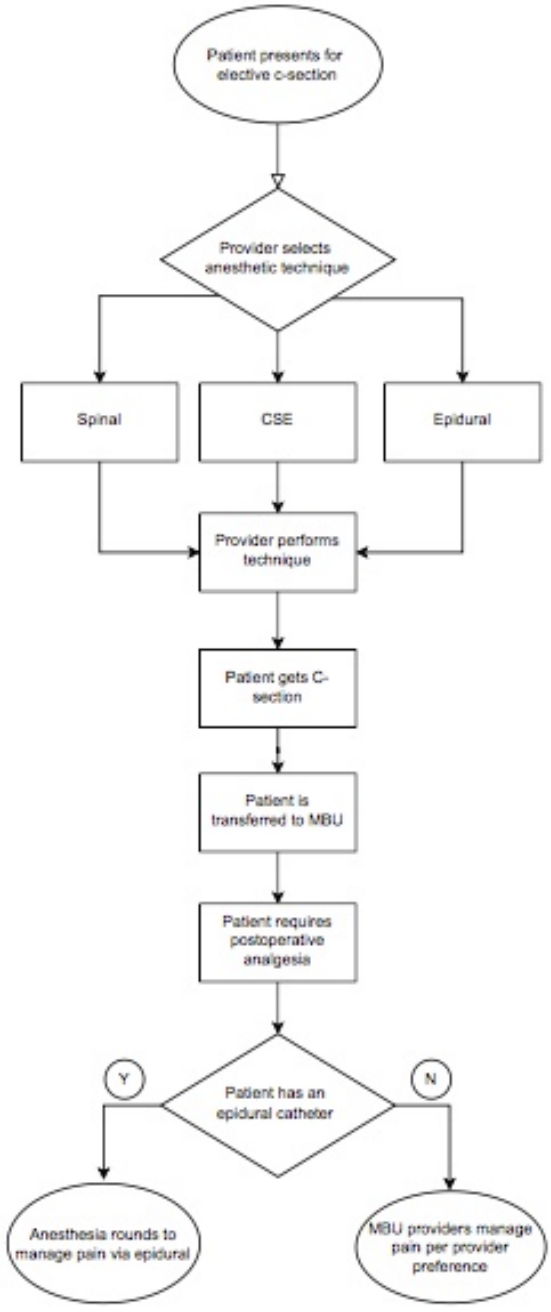
Knowledge to Action Translation Framework



(Crockett, 2019)

Figure 3

Previous Process Map

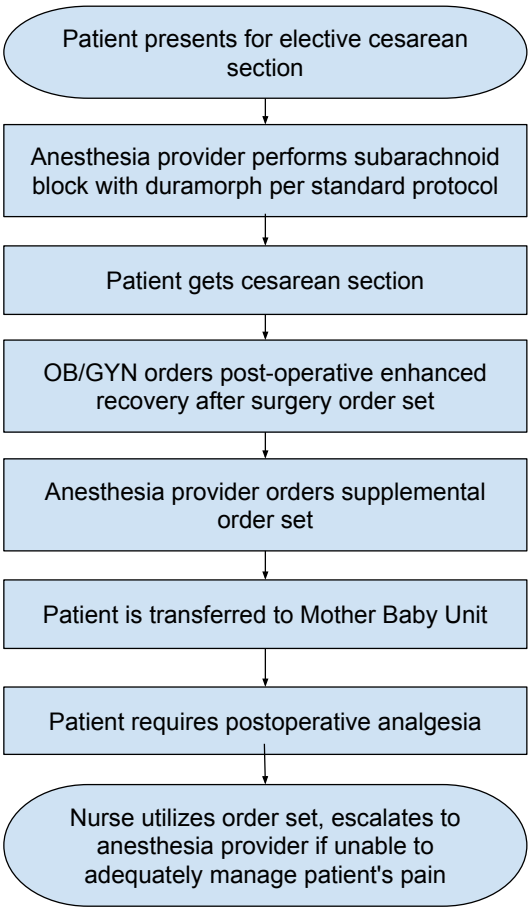


Key:

Oval—Start or end of the process | Rectangle—Step in the process | Diamond—Decision point | CSE, Combined Spinal Epidural | MBU, Mother Baby Unit

Figure 4

Desired/New Process Map

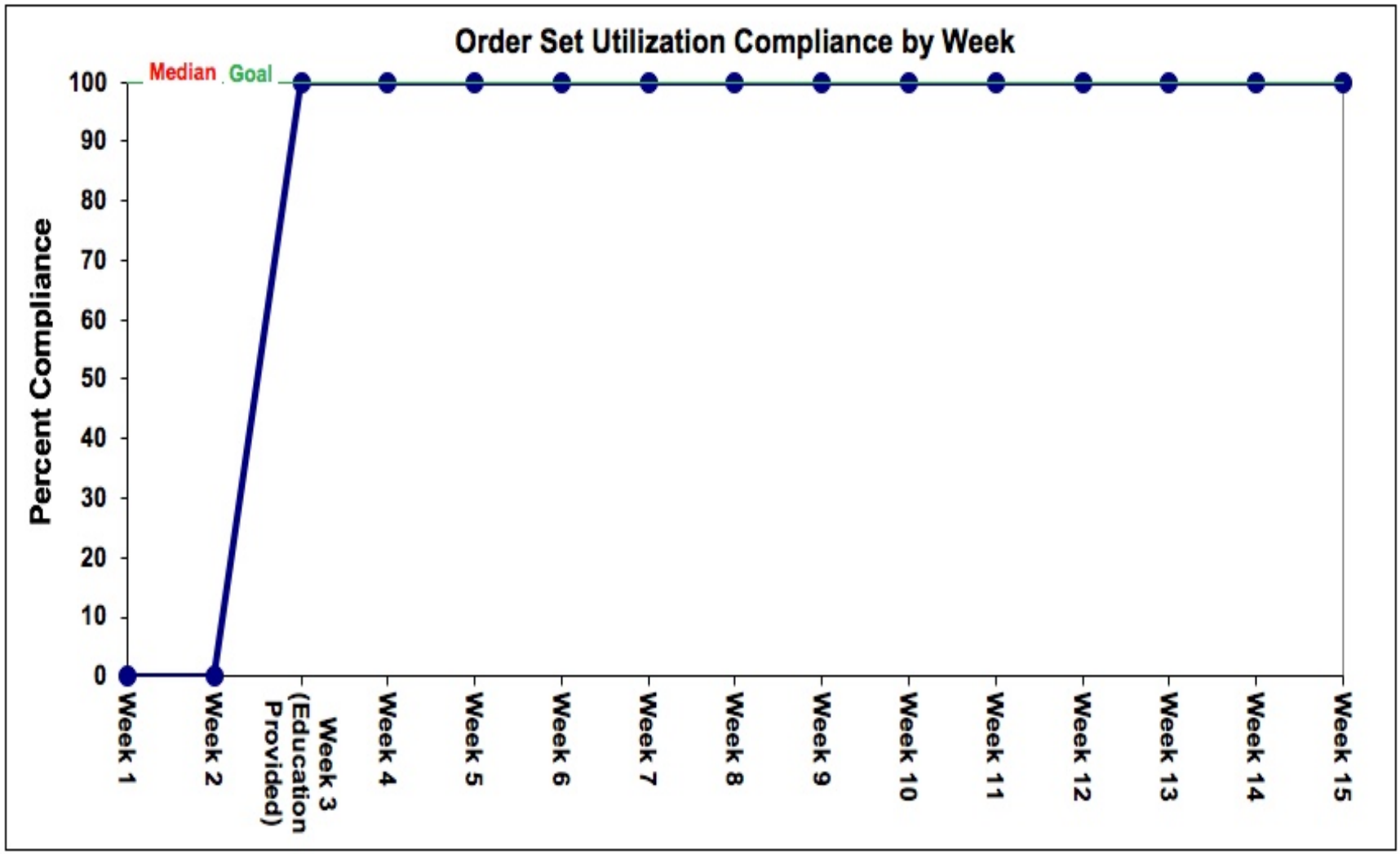


Key:

Oval—Start or end of the process | Rectangle—Step in the process

Figure 5

Run Chart



Appendix A

Evidence Review and Synthesis (adapted from Dang et al., 2022)

Citation: Bornstein, E., Husk, G., Lenchner, E., Grunebaum, A., Gadomski, T., Zottola, C., Werner, S., Hirsch, J. S., & Chervenak, F. A. (2020). Implementation of a Standardized Post-Cesarean Delivery Order Set with Multimodal Combination Analgesia Reduces Inpatient Opioid Usage. *Journal of Clinical Medicine*, *10*(1), 7. https://doi.org/10.3390/jcm10010007					**Level and Quality:** IIB
Purpose/ Hypothesis	**Type of Research Design**	**Sample – Population, Size, Setting**	**Intervention/Procedures**	**Primary Outcome/Measures**	**Results/ Conclusions**
"To evaluate the potential impact of adopting a standardized order set based on multimodal combination analgesic therapy on both opioid usage as well as quality of pain control in the immediate post cesarean delivery period in a large healthcare system with multiple	Research; Retrospective analysis of two non-randomized cohorts	Sampling Technique: Sequential/consecutive (all) from 1/2018 to 12/2019 # eligible: 13,233 # accepted: 12,898 # in control: 8,696 # in intervention: 4,202 Power analysis: "sufficient power to demonstrate the benefit of the multimodal therapy in decreasing both the exposure to opioids as well as the opioid dosage across several 24 h time periods tested during the patients' postoperative course ($p <$ 0.0001)" Group Homogeneity: "There was a statistically significant difference in the distribution of the specific weight categories between the two groups, although the mean BMI was similar. There were	Control: "The 'old' post cesarean pain management order set…included a pre-selected standing treatment with ibuprofen 600 mg every 6 h. Oxycodone 5 mg/acetaminophen 325 mg every 3 h for moderate pain (defined as pain score of 4–6), and oxycodone 10 mg/ acetaminophen 650 mg every 6 h for severe pain (defined as pain score 7–10) were pre-selected as PRN…did not include a standing order for acetaminophen" Intervention: "The new…order set…included pre-selected standing orders for...acetaminophen 975 mg and ibuprofen 600 mg every 6h, alternating…so that patients would receive an analgesic every 3 h…it pre-selected oxycodone immediate release (IR) 5 mg every 3 h for moderate to severe pain (pain score 4–10), and an additional oxycodone IR 5 mg… 1 h later if the first dose was ineffective" Intervention Fidelity: "able to demonstrate immediate adherence to the new, multimodal, order set following the "go live" date, which resulted in an abrupt change in opioid use." The new protocol was the default in the EHR. While it is possible that individual providers could have modified it, it is unlikely based on	DV: "overall incidence of inpatient opioid use, defined as opioid intake by the patient." State the instrument, reliability, and measurement procedure: The measurement was conducted by review of the MAR for total milligrams of oxycodone administered. This is an objective measure; no reliability data is provided. Assumptions include: 1. all administered doses of narcotics were documented, and 2., all documented doses of narcotics were administered. While there is always the possibility that these assumptions may have been violated, it is unlikely due to regulations regarding	Statistical Results: "average opioid dose decreased by 27% (36.6 mg to 26.7 mg, respectively, $p < 0.0001$)." Conclusions: "a standardized post-cesarean order set based on multimodal therapy resulted in substantially decreased exposure to opioids while simultaneously improving pain scores."

obstetrical units."		no significant differences… between the two groups."	the abrupt changes that correlate with the go-live date. No discussion of specific monitoring of provider adherence.	narcotics/controlled substances.	

Citation: Ganer Herman, H., Ben Zvi, M., Tairy, D., Kleiner, I., Gonen, N., Kuper Sason, L., Bar, J., & Kovo, M. (2020). Enhancing patient mobility following cesarean-delivery – the efficacy of an improved postpartum protocol assessed with pedometers. *BMC Pregnancy and Childbirth*, *20*, 353. https://doi.org/10.1186/s12884-020-03046-z					**Level and Quality:** IIB
Purpose/ Hypothesis	**Type of Research Design**	**Sample – Population, Size, Setting**	**Intervention/Procedures**	**Primary Outcome/ Measures**	**Results/ Conclusions**
"to investigate the efficacy of an improved post-partum protocol for the enhancement of patient mobility following CD" The researchers wanted to know if patient education, earlier ambulation/ foley removal, and increased duration of scheduled acetaminophen would improve mobility after CD, with the overarching concern of reducing VTE.	Research: Prospective Interventional Study	Sampling Technique: Convenience between June 2017-July 2018 # eligible: 309 # accepted: 201 # in control: 101 # in intervention: 100 Power analysis: Minimum of 100 subjects required in each group. Enrollments were continued until 100 subjects successfully completed the study in each group. Adequate power. Group Homogeneity: No statistically significant differences in age, BMI, gravidity, parity, number of prior CDs, smoking status, rate of multiple gestation, preeclampsia, or diabetes mellitus. There were no significant differences in intra- or post-partum complications between groups. The post-intervention group did have slightly longer surgical times (~5min), which was statistically significant.	Control: pedometer, no education, catheter removal/ambulation 6hrs post-op, scheduled acetaminophen x 24hrs Intervention: pedometer, education on importance of ambulation, catheter removal/ambulation 4hrs post-op, scheduled acetaminophen x 48hrs Intervention Fidelity: From February 2018 to July 2018, assessed the effect of new protocol (patients' education, nurses' tutoring on the importance of early ambulation. Nurses were briefed on the changes in protocol and current statistics regarding thromboembolic complications and incidence. They were asked to incorporate this information while briefing patients on admission. All participants were also briefed (verbally and in writing) by research staff regarding the study objective and the importance of ambulation.	DV: Number of steps taken State the instrument, reliability, and measurement procedure: Pedometers were used to measure step count in the post-op period. No data for reliability of the pedometer was presented. No operation of the pedometer was required by patients, and staff assessed whether patients had worn them continuously for the duration of the study period before including them in the results.	Statistical Results "A higher number of steps was taken in the post-protocol group as compared to the pre-protocol group (4394 ± 2985 vs.3551 ± 2931, respectively $p = 0.04$)" Conclusions The researchers felt that the entire bundle contributed to the increased number of steps taken in the post-protocol group. Education and facilitation (earlier catheter removal, improved pain control) were all felt to be important contributors to improved mobility. The post-protocol group required fewer additional analgesics than the pre-protocol group, in addition.

Citation: Holland, E., Bateman, B. T., Cole, N., Taggart, A., Robinson, L. A., Sugrue, R., Xu, X., & Robinson, J. N. (2019). Evaluation of a Quality Improvement Intervention That Eliminated Routine Use of Opioids After Cesarean Delivery. *Obstetrics & Gynecology*, *133*(1), 91–97. https://doi.org/10.1097/AOG.0000000000003010					**Level and Quality:** IIB
Purpose/ Hypothesis	**Type of Research Design**	**Sample – Population, Size, Setting**	**Intervention/Procedures**	**Primary Outcome/ Measures**	**Results/Conclusions**
"To evaluate the effects of eliminating the routine use of oral opioids for post cesarean delivery analgesia on post cesarean opioid consumption."	Research: retrospective, non-random, experimental	Sampling Technique: Sequential/ consecutive # eligible: 372 # accepted: 372 # in control: 191 # in intervention: 181 Power analysis: Sufficient to determine lower utilization of opioids; possibly underpowered to determine whether satisfaction scores were unchanged. Only 24% completed the satisfaction survey. Group Homogeneity: No statistically significant differences between groups	Control: standard orders included: 1) acetaminophen: 975 mg orally every 6 hours standing for 72 hours; 2) 30 mg ketorolac intravenously every 6 hours standing for 24 hours followed by 600 mg ibuprofen orally every 6 hours standing for 48 hours followed by 600 mg ibuprofen orally every 6 hours as needed; and 3) oxycodone: 5–10 mg orally every 4 hours as needed for pain. Intervention: clinicians were asked not to order opioids, to continue the established acetaminophen and NSAID regimens, and to counsel patients that opioids were available if needed by asking their nurse to page the responding clinician. Clinicians were also instructed to order no more than 5 mg oxycodone every 6 hours for six doses if a patient requested opioids postdelivery and to repeat this order if the same patient requested additional opioids. Clinicians were asked to use their clinical judgment when responding to nursing pages about pain control and to use their communication with nursing in addition to patient vital signs to inform whether a patient needed to be evaluated in person before ordering opioids. Nurses were asked to offer opioids if a patient's pain was not well controlled as assessed by the nurse or the patient Intervention fidelity: 12 weeks of preintervention data were collected from October 16, 2017, to January 8, 2018, followed by 3 "washout" weeks during which no data were collected. From January 29, 2018, to April 23, 2018, the quality improvement intervention was implemented. Education for physicians, and postpartum nurses accompanied the practice change, and project staff rounded regularly to reinforce/answer questions. Compliance by ordering physicians was tracked on a weekly basis.	DV: percentage of women who used any opioids postoperatively in-hospital. State the instrument, reliability, and measurement procedure: chart review of patient data and a survey of patients in the 12 weeks before and 12 weeks after the intervention	Statistical Results 45% of patients used systemic opioids after the intervention, compared with 68% before (P<.001). There were no significant changes in pain scores or satisfaction. Conclusions "Eliminating routine ordering of oral opioids after cesarean delivery is associated with a significant decrease in opioid consumption while maintaining the same levels of pain control and patient satisfaction. Oral opioids are not needed by a large proportion of women after cesarean delivery" In the presence of standing orders for multimodal analgesia, pain scores and satisfaction did not change despite a decrease in opioid use.

Citation: Kleiman, A. M., Chisholm, C. A., Dixon, A. J., Sariosek, B. M., Thiele, R. H., Hedrick, T. L., Carvalho, B., & Tiouririne, M. (2020). Evaluation of the impact of enhanced recovery after surgery protocol implementation on maternal outcomes following elective cesarean delivery. *International Journal of Obstetric Anesthesia*, *43*, 39–46. https://doi.org/10.1016/j.ijoa.2019.08.004					**Level and Quality:** IIB
Purpose/ Hypothesis	**Type of Research Design**	**Sample – Population, Size, Setting**	**Intervention/ Procedures**	**Primary Outcome/ Measures**	**Results/Conclusions**
"to evaluate the impact of ERAS protocol implementation on maternal outcomes following scheduled elective CD"	Research-retrospective before/after	Sampling Technique: Consecutive # eligible: 368 # accepted: 357 # in control: 197 # in intervention: 171 Power analysis: "sample size calculation was based on institutional data on postoperative MMEQ consumption following CD. Pre-ERAS average postoperative MMEQ consumption was 44.7 ± 35.4 mg. For the purposes of powering our analysis, we assumed that 33% reduction in postoperative MMEQ consumption would be a clinically significant difference that is within the goals of the ERAS program for reducing opioid consumption. A minimum sample size of 248 patients was calculated (124 per group) using a two-tailed t-test, an alpha error of 0.05 and a power of 90%." Group Homogeneity: some differences between initial groups, but final results were based on propensity-matched groups. Both raw groupings and propensity matched groupings demonstrated the same percentage reduction in opioid consumption.	Control (pre-eras) Inpatient Postpartum Pain Management: Oxycodone 5-10mg, Hydromorphone 0.2-0.4mg IV, Naproxen 500mg PO BID, Intervention (post-eras) Inpatient Postpartum Pain Management: Scheduled Acetaminophen + ketorolac x 24hrs w/ 5mg oxycodone for breakthrough, followed by 24hrs of scheduled acetaminophen + naproxen w/ oxycodone as above Intervention fidelity: assembly of multidisciplinary team, construction of protocol, development of patient education resources, post-intervention data collected 6 months after go-live.	DV: amount of opioid required from surgery end until hospital discharge. Opioid consumption was determined as mg morphine equivalents (MMEQ), with the following conversion ratios utilized: oxycodone: morphine [1:1.5] and hydromorphone: morphine [1:4] State the instrument, reliability, and measurement procedure: the CDC MMEQ is considered reliable/valid. Measurement came from chart review.	Statistical Results The implementation of ERAS resulted in a 38% reduction in total postoperative opioid consumption Conclusions This team implemented an entire ERAS bundle, which had pre, intra, and post-op components, making it impossible to say if any one intervention was more responsible for the results than the others. Nonetheless, scheduled non-narcotic analgesia was part of the protocol, and the results indicated that opioid consumption as decreased by over a third, with no increase in pain scores.

Citation: Llarena, N. C., Krivanek, K., Yao, M., Kim, D. D., Devarajan, J., Ayad, S., & Chiang, E. (2022). A multimodal approach to reducing post-caesarean opioid use: A quality improvement initiative. *BJOG: An International Journal of Obstetrics & Gynecology*, *n/a*(n/a), 1–8. https://doi.org/10.1111/1471-0528.17094					**Level and Quality:** IIB
Purpose/ Hypothesis	**Type of Research Design**	**Sample – Population, Size, Setting**	**Intervention/Procedures**	**Primary Outcome/ Measures**	**Results/ Conclusions**
"To evaluate the impact of a QI initiative to reduce post-caesarean opioid use."	Research: retrospective cohort	Sampling Technique: consecutive/ sequential # eligible: 1350 # accepted: 1350 # in control: 682 # in intervention: 668 Power analysis: sufficient Group Homogeneity: no statistically significant differences between groups.	Control: pre-intervention. Management at provider's discretion. Combo oxycodone-acetaminophen was the most commonly used analgesic. Intervention: consisted of four parts: an order set in the EMR maximizing non-opioid analgesics, nursing education, data-driven nursing feedback and physician education. Intervention Fidelity: "Following implementation of the ROOT protocol, oxycodone-acetaminophen was removed from the post-partum order set. The intervention order set consisted of scheduled oral acetaminophen (1000 mg q6h) and IV ketorolac (15 mg q6h), alternating every 3 hours, for the first 24 hours postpartum. Oxycodone (5 mg q4h) was ordered only for severe breakthrough pain (pain score 7–10 on an 11-point numeric rating scale). After the first 24 hours, scheduled oral acetaminophen was continued, and scheduled oral ibuprofen (600 mg q6h) was substituted for ketorolac. Oxycodone was continued as needed for breakthrough pain. To minimize ordering variability among a large number of obstetric providers, postpartum analgesic orders were placed exclusively by anesthesia providers and the remainder of the orders were placed by the obstetrics team."	DV: total morphine milligram equivalents (MME) consumed during the postpartum admission State the instrument, reliability, and measurement procedure: the CDC MMEQ is considered reliable/valid. Measurement came from chart review	Statistical Results median inpatient opioid use decreased by more than 60%, from 75 to 30 MME per admission ($P < 0.001$) Conclusions Reduction in opioid consumption was not associated with increased pain scores.

Category (Level Type)	Total Number of Sources	Overall Quality Rating	Synthesis of Findings
Level 1 - Experimental study · Randomized Controlled Trial (RCT) · Systematic review of RCTs with or without meta-analysis			
Level II · Quasi-experimental studies · Systematic review of a combination of RCTs and quasi-experimental studies, or quasi-experimental studies only, with or without meta-analysis	5	B	All studies found benefits associated with increasing (frequency, duration, or dose) scheduled non-narcotic pain medication. Several studies implemented this measure as part of a bundle, and there was some variation among the aims of the studies. All of the studies had aims of improving some aspect of quality or safety of care. Protocols typically included maximal dosing of PO acetaminophen (4g/24hours), and some studies also included additional scheduled NSAIDS with rescue opioids available as needed.
Level III · Non-experimental study · Systematic review of a combination of RCTs, quasi-experimental, and non-experimental studies, or non-experimental studies only, with or without meta-analysis · Qualitative study or systematic review of qualitative studies with or without meta-synthesis			
Level IV · Opinion of respected authorities and/or reports of nationally recognized expert committees/consensus panels based on scientific evidence			
Level V · Evidence obtained from literature reviews, quality improvement, program evaluation, financial evaluation, or case reports · Opinion of nationally recognized expert(s) based on experiential evidence			
Recommendations Based on Evidence Synthesis Strong, compelling evidence with consistent results. Recommend practice change to standard order set with scheduled non-narcotic analgesia for post-cesarean delivery patients.			

Appendix

Appendix B

Order Set

- Intermittent Pneumatic Compression Devices: routine, continuous, must be worn 17hrs/day, may be removed for skin assessment, bathing, or ambulating
- IV Access: routine, continuous, saline lock
- Lactated Ringers: continuous IV infusion @ 125ml/hr until pt able to tolerate 600ml PO fluids or regular diet
- Maintain Urinary Catheter: per nursing removal protocol
- Notify Provider: routine, continuous for vital signs outside of normal limits
- Vital signs: q15min x 8, then q1hr x 4, then q 4hrs until discharge
- Nurse Assessment: Routine, q4 hours w/ VS, pulse oximetry, pain, and intake/output
- Oxycodone IR 5mg: oral, 1x PRN for breakthrough pain, do not administer within first 18hrs after spinal duramorph
- Shower: Routine, PRN, pt may shower
- Early and Aggressive Ambulation: routine, continuous
- Postpartum assessment, including perineal, fundal, and lochia assessment: q15 min x 4, then q30 min x 2, then q1 hour x 4, then q shift
- Perineal care: Routine, PRN
- PEG 17g: 1x day, oral
- Senna tablet 17.2mg: nightly, prn
- Naloxone 0.1mg injection: Q15min prn, IV, administer over 30 seconds for opioid reversal, nausea, vomiting, or itching

- Respiratory and Sedation assessment: with VS
- Acetaminophen tablet 1000mg: q6hrs, oral (maximum dose is 4000g/24hrs from all sources)
- Simethicone chewable 80mg tablet: q6 hr prn
- Sugar free chewing gum: routine, continuous, TID one piece, chew for 5 minutes, begin in recovery room.
- Assess Patient's Ability to Bear Weight: routine, continuous, prior to attempting ambulation
- Breast Care and Cold Therapy: Routine, continuous, prn
- Docusate Sodium 100mg: oral, 2xdaily
- Gabapentin 300mg: q8 hours, oral
- Ibuprofen 800mg: q8 hours, oral, take with food
- Incentive Spirometry: 10x hour while awake
- Apply Abdominal binder: routine