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Using Revised Pain Medication Administration Guidelines in Post Anesthesia Care Unit (PACU): A Program Evaluation

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Abstract

Purpose: To determine if implementation of revised pain medication administration guidelines in PACU led to improved patient satisfaction scores, lower pain scores at discharge from PACU, lower pain medication and antiemetic medication costs in PACU, and shorter average PACU length-of-stay (LOS) at the clinical site.

Background and Significance: Negative consequences of poorly managed acute postoperative pain include diminished function and quality of life, compromised surgical recovery, extended use of opioids, development of chronic postoperative pain, and increased morbidity and medical costs (Gan, 2017). There is an impetus to minimize narcotic medications administered after surgery, while still providing adequate pain management in the acute postoperative period.

Intervention and Implementation Plan: The revised pain medication administration guidelines were implemented March 1, 2017. The following data points were compared to evaluate impact: PACU LOS, patient satisfaction scores, PACU discharge pain scores, and costs for antiemetics and oral (PO) and IV pain medications. Pre-implementation data includes a three-month sample from 2016. Post-implementation data includes three-month samples in 2017, 2018, 2019, and 2020. PACU nurses were surveyed in January 2021.

Project Outcomes: Patients who received only PO and/or IV pain medications in PACU had: average LOS decrease 8%, IV narcotic costs decrease 5%, analgesic costs decrease 2%, discharge pain scores increase 12%, and antiemetic costs increase 68%. Nurses' perceptions of the guidelines on their practice and patient outcomes were positive, and patient satisfaction scores were stable.

Keywords: PACU, guidelines, medication costs, pain scores, length-of-stay, satisfaction

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Purpose of the Evaluation

The purpose of this program evaluation is to determine if implementation of revised pain medication administration guidelines in PACU led to improved patient satisfaction scores, lower pain scores at discharge from PACU, lower medication costs, fewer rescue antiemetics being administered, and shorter PACU lengths-of-stay at the clinical site.

Origins and Goals of Effort

A level-one trauma center's surgical services department post-anesthesia care unit (PACU) revised the pain medication administration clinical guidelines in response to Det Norske Veritas Healthcare, Inc. (DNV) findings during a hospital accreditation survey. DNV is an approved Centers for Medicare and Medicaid Services (CMS) accreditor. The hospital was cited for improper ordering of medications leading to medication administration non-conformity in January of 2017. Pain medication orders lacked appropriate pain medication administration guidelines, which resulted in nurses choosing which pain medications to give and at what doses. This was a problem throughout the hospital, so revision of pain medication order sets became part of a hospital-wide initiative. The revision of pain medication administration guidelines for PACU was also necessary because the average PACU length-of-stay (LOS) was consistently longer than the national benchmark of two hours, and this was largely due to pain management issues and overreliance on IV narcotics to treat pain. Extended LOS in PACU negatively affected the operating room (OR) schedule. Monitoring patients in the OR once surgery was completed due to inability to transfer to PACU caused delays for the cases to follow, which resulted in frustrated patients, surgeons, and staff, and increased costs. The PACU nurse manager led the

change to revise the pain medication administration clinical guidelines for immediate postoperative adult patients in PACU, and the chief physician anesthesiologist authored the guideline revisions. The guidelines were revised to clarify which medications were to be given for “acute” pain or for “post-acute” pain while the patient was in PACU. The postoperative pain medication order sets in PACU were altered to include the revised guidelines in March 2017, but only LOS was evaluated, and a comprehensive evaluation was not performed to assess impact of the change. This author conducted a formal program evaluation of the revised pain medication administration clinical guidelines as a DNP project.

Target Population, Activities, and Services

The population for this program evaluation was immediate postoperative adult patients in PACU at one clinical site, an urban level-one trauma center in a city in Hennepin County in the Minneapolis-St. Paul metropolitan area in the state of Minnesota. The county is large, covering approximately 610 square miles. Hennepin County is home to the city of Minneapolis, and forty-four other cities (*Your Government, Overview: Learn About the County*, 2020). Minnesota’s population in 2018 was 5,519,952, and the population of Hennepin County was 1,232,483 (The University of Wisconsin Population Health Institute, 2019). Hennepin County is part of a seven-county metropolitan area (Wright & Roesler, 2019). Detailed demographic information for Hennepin County and the state of Minnesota, adapted from the County Health Rankings and Roadmaps website, can be found in Appendix A.

The PACU at the clinical site recovered 10,302 patients in 2018 and 10,032 patients in 2019. Parties affected by the quality improvement project included postoperative adult patients and the staff who provided direct patient care after surgery. The quality improvement project was implemented March 1 of 2017, and patient involvement started on admission to PACU from the

operating room after surgery and ended on discharge from the PACU. The reason for the quality improvement project was to not only meet DNV accreditation requirements, but also to reduce PACU LOS and provide effective treatment of postoperative pain through utilization of revised pain medication administration guidelines by PACU nursing staff, with the expectation of judicious administration of opioids and minimized reliance on IV opioids for postoperative pain control in the patient population.

Review of Related Research

Opioid Crisis and the Postoperative Pain Connection

The opioid crisis in the United States has been a major focus of the Centers for Medicare and Medicaid Services (CMS), Centers for Disease Control and Prevention (CDC), and state and county health departments in recent years. According to the CDC (2011), 73.8% of deaths caused by prescription medication overdoses involved opioid pain relievers. Sale rates of opioids from 1999 to 2010, and overdose death rates from 1999 to 2008, both quadrupled. The treatment admission rate for substance abuse was almost six times higher in 2009 compared to 1999 (Centers for Disease Control & Prevention, 2011). According to the CDC website, there were over 17,000 opioid overdose deaths resulting from prescription opioids in the United States in 2017. That is approximately 46 deaths per day, and the number is considered undercounted because deaths due to synthetic opioids other than methadone, as well as overdose deaths where the specific drug was not listed on the death certificate, are not included in the count. The reason synthetic opioid prescription pain medications such as fentanyl and tramadol were not counted is because the National Vital Statistics System (NVSS) does not distinguish between deaths caused by pharmaceutical fentanyl vs illegally manufactured fentanyl (IMF) or other synthetic opioids

that are pharmaceutical vs illegally manufactured (*CDC's Response to the Opioid Overdose Epidemic,* 2019).

According to the CMS website and the Hospital Consumer Assessment of Healthcare Providers and Systems (HCAHPS) Fact Sheet, pain management was a measured outcome on HCAHPS surveys from October 2006 to December 2017, and HCAHPS scores were tied to payment from CMS starting in 2012 as part of the "Hospital Value-Based Purchasing program" (Centers for Medicare & Medicaid Services website, n.d.; "HCAHPS Fact Sheet," 2017). Pain management as a measured outcome on HCAHPS surveys followed by CMS payment being impacted by pain management satisfaction scores is thought to be one of the contributors to overprescribing of opioid pain relievers and increase in abuse of these medications. In response to the opioid epidemic, CMS replaced the pain management questions on the HCAHPS survey with questions that focused on communication about pain. This change affected surveys for patients discharged in January 2018 and beyond. Starting in October 2019, all pain communication questions were eliminated from the HCAHPS survey. Removal of these questions was intended to help CMS "comply with the requirements of the Substance Use-Disorder Prevention that Promotes Opioid Recovery and Treatment (SUPPORT) for Patients and Communities Act" ("HCAHPS changes," 2018).

The state of Minnesota is not immune to the opioid epidemic. The Minnesota Department of Health reported that non-fatal opioid overdoses resulted in 2,037 emergency room visits in 2017, and 860 of those did not involve heroin. The number of people in 2014 admitted to the hospital for opioid use disorder was 304.3 per 100,000, and 736.3 per 100,000 were admitted to the hospital for treatment of chronic pain. The number of people admitted to treatment for opioid abuse in 2015 was 10,332 (*Opioid Overdose Prevention*, 2019). According to a report written by

Wright and Roesler (2019), drug overdose rates that involved opioids increased by 7% and overall drug overdose rates increased by 9% in the state of Minnesota from 2016 to 2017. The largest increase was seen in the seven-county Minneapolis-St. Paul metropolitan area, but there was also an increase noted in greater Minnesota. In one year, from 2016 to 2017, the statewide deaths that involved overdose of synthetic opioids such as fentanyl increased by 86%, while the overdoses involving heroin decreased 26%. In the seven-county metropolitan area over the same period, synthetic opioids were involved in 97% of opioid-involved deaths, and heroin overdose deaths decreased by 17%. In the metropolitan area and greater Minnesota in 2017, the age group with the greatest numbers of opioid overdose deaths were people 45-54 years old, and a higher proportion of males than females died from drug overdoses (males 62%, females 38%). Though the overall drug overdose mortality rate for Minnesota is among the lowest in the nation (44 out of 50), there are significant racial disparities. The state was ranked number one when measuring the disparity between African Americans and Caucasian people for overdose deaths. According to the authors of the report, the racial disparities have gotten worse. From 2015 to 2017, statewide drug overdose mortality rates for American Indians went from 47.3 to 76.2 per 100,000 residents, and rates for African Americans increased from 20.8 to 27.6 per 100,000. In contrast, during the same 3 years, statewide drug overdose mortality rates for Caucasians increased from 10.1 to 12.1 per 100,000. The report did not separate prescription vs. illegal opioid overdose deaths (Wright & Roesler, 2019).

Groups who are at greater risk of developing opioid use disorder are men, middle-aged adults, those living in rural areas, and Caucasians, American Indians, and Alaska Natives (Centers for Disease Control and Prevention [CDC], 2011). Opioid abuse can start with legal opioids prescribed for pain, and surgery can be a catalyst for the development of prescription

opioid abuse. A retrospective cohort study by Alam, Gomes, Zheng, Mamdani, Juurlink, and Bell (2012) concluded that older adult patients who were opioid naïve were 44% more likely to use opioids long-term within 1 year of short-stay surgery if they were prescribed an opioid within 7 days of surgery. The study included 391,139 opioid-naïve patients aged 66 or older who had cataract surgery, a laparoscopic cholecystectomy, a transurethral resection of the prostate (TURP), or varicose vein stripping surgery (Alam et al., 2012). According to a retrospective analysis of 641,941 opioid naïve surgical patients by Sun, Darnall, Baker, and Mackey (2016), chronic opioid use in the first year after surgery ranged from 0.119% up to 1.41%. Eleven surgical procedures were included in the study: functional endoscopic sinus surgery (FESS), cataract surgery, TURP, total knee arthroplasty (TKA), total hip arthroplasty (THA), open cholecystectomy, laparoscopic cholecystectomy, open appendectomy, laparoscopic appendectomy, cesarean delivery, and simple mastectomy. The surgery with the highest incidence of chronic opioid use in the first year was total knee arthroplasty. Total hip arthroplasty surgery was also listed as high risk for the development of chronic opioid use in the first year after surgery. The authors identified that those who were most vulnerable to the development of chronic opioid use were men, people older than age 50, and people with a preoperative history of depression, antidepressant use, benzodiazepine use, alcohol abuse, or drug abuse (Sun et al., 2016). All the surgical procedures included in the studies by Sun, Darnall, Baker, & Mackey (2016) and Alam, Gomes, Zheng, Mamdani, Juurlink, and Bell (2012) are performed at the clinical site where this program evaluation took place. Overreliance on opioids in the postoperative period can result in patients experiencing opioid-induced side effects, which require additional medications or interventions and can delay discharge from PACU in the short

term and can have larger implications related to the opioid epidemic, including an increase in abuse of prescription opioids.

Multimodal Analgesia for Pain Management

According to Gan (2017), inadequately managed acute postoperative pain affects a significant segment of postoperative patients. Negative consequences of poorly managed acute postoperative pain include diminished function and quality of life, compromised surgical recovery, extended use of opioids, development of chronic postoperative pain, and increased morbidity and medical costs (Gan, 2017). It is crucial to ensure that pain will be managed effectively in the acute postoperative period. Opioids are commonly administered perioperatively and postoperatively. It may not always be possible to eliminate the administration of opioids, but there is an impetus to give as little narcotic as possible during and after the surgery, while still providing adequate pain management. Non-opioid pain medications are effective in reducing the need for opioid medications. Oral non-steroidal anti-inflammatory drugs (NSAIDS), both selective and non-selective, and oral or intravenous acetaminophen/paracetamol significantly reduced postoperative pain in several studies. The need for additional analgesia was significantly reduced with acetaminophen/paracetamol (Liang et al., 2017; Maund et al., 2011), COX-2 inhibitors (Maund et al., 2011), and ibuprofen plus paracetamol (Derry et al., 2013). Given together, acetaminophen and ibuprofen are more effective in the treatment of pain than when given alone (Derry et al., 2013). Celecoxib 400mg provided longer pain relief than non-selective NSAIDs and was as effective in relieving acute pain as ibuprofen 400mg (Derry & Moore, 2013). Serious adverse events associated with oral analgesics were rare (1 in 3200), and were mainly seen with opioids, opioid combination drugs, and ibuprofen plus caffeine (Moore et al., 2015). The need for rescue opioid pain medications was reduced when NSAIDs, acetaminophen,

or COX-2 inhibitors were used as part of a multimodal pain approach (Liang, et al., 2017; Derry, et al., 2013; Maund, et al., 2011). A literature synthesis table (Appendix B) includes details on each study.

Multimodal analgesia is practiced by using more than one family of analgesic medications to target different receptors in the body, rather than just one type of receptor, to provide more comprehensive pain relief and minimize side effects. Multimodal analgesia also typically involves more than one route of medication administration to treat pain. An example of multimodal analgesia could include patient-controlled epidural analgesia with local anesthetic and opioid, scheduled oral acetaminophen, and IV opioids as needed for breakthrough pain. American Pain Society Guidelines (2016) were compared to UpToDate recommendations (2020), and both guidelines recommended multimodal approaches in the management of acute perioperative pain. These approaches included combinations of analgesic medications like NSAIDs, acetaminophen, COX-2 inhibitors, gabapentinoids, NMDA receptor antagonists, opioids, local anesthetics, as well as medications that are not meant to treat pain but have shown synergistic effects or may potentiate other pain medications. Recommendations for medications and routes of administration varied based on surgery type, length of time postoperative analgesia would be needed, patient history of opioid dependence, and whether the patient was taking buprenorphine or methadone preoperatively (Chou et al., 2016; Mariano et al., 2020). Multimodal analgesia is an effective approach to manage pain in surgical patients and can reduce the need for opioid analgesics.

Overview and Description of the Program Evaluation

The W.K. Kellogg Foundation's (WKKF) Evaluation Guide (2017) steps are applied to this program evaluation project. Stakeholders are involved in all stages of the program evaluation

and are considered an important resource to the evaluator and the evaluation process. The WKKF guide for program evaluation has seven stages: A. preparation, B. determination of stakeholders and stakeholder engagement opportunities, C. identification of assumptions of what the results will be, D. development of a plan for evaluation, E. collection and analysis of data, F. communication of results and interpretation and facilitation of learning, G. use what was learned to determine next steps (W.K. Kellogg Foundation [WKKF], 2017). The overview and description of the program evaluation encompasses WKKF stages A-D. WKKF stage E is represented in the evaluation design, stage F in the evaluation results, and stage G in the summary, conclusion, and recommendations.

Preparation

The most appropriate evaluation type for the improvement project is an outcome evaluation because the project was implemented in 2017 and no changes were made to the guidelines since implementation. The evaluation approach is mainly systems-oriented, as the project was implemented in a complex environment. Preoperative and intraoperative management could affect pain management and antiemetic requirements in PACU, and PACU nurses could choose to ignore the guidelines or make other care decisions unrelated to the project that effect a patient's ability to meet discharge criteria. The methods utilized are primarily quantitative in nature, but some qualitative feedback was obtained from PACU nurses. Data captured during patients' stays in PACU was collected from before the implementation of the guidelines and compared to data after the implementation. The qualitative and quantitative survey data from PACU nurses was obtained in January of 2021 after the guidelines had been implemented and utilized for approximately four calendar years. The DNP student was not an employee of the institution and served as an external evaluator.

Stakeholders

The following stakeholders were identified: patients, PACU nurse manager, anesthesia department, PACU nurses, quality improvement (QI) department, pharmacy department, surgical services administration, financial department, surgeons, and the evaluator (DNP student). The PACU nurse manager and a nurse anesthetist served as clinical site preceptors for the evaluator and were consulted through each stage of the evaluation project and for data collection. Staff from the pharmacy department were consulted for data sources and data collection related to medications. The QI Department director was consulted to clarify the DNV citation specific to PACU and other details relevant to the QI project implementation. PACU nurses were consulted on their perceptions of the implementation, use, and impact of the revised pain medication administration guidelines on their practice and patient outcomes.

Assumptions

The initial theory of change for the project was that revised pain medication administration guidelines would meet DNV accreditation requirements and lead to a reduction of PACU length-of-stay. The expectation was that PACU nurses would have better guidance in determining which pain medications and doses were appropriate to give to patients. Additionally, pain would be managed, and side-effects would be minimized to allow patients to meet discharge criteria sooner. During reconstruction of the logic model with stakeholders after the guidelines had been implemented, it was determined that it may be beneficial to evaluate a broader set of outcomes beyond length-of stay and meeting accreditation requirements for medication orders. The logic model (Appendix C) includes the additional outcomes that were expected.

Evaluation Plan

Three aims were developed for the program evaluation. The first aim was to evaluate the impact of the revised pain medication administration guidelines in PACU to determine if implementation led to improved patient satisfaction scores, lower pain scores at discharge from PACU, lower medication costs, fewer rescue antiemetics being administered, and shorter PACU length-of-stay (LOS). The objective to meet the first aim was to complete an outcome evaluation of the revised pain medication administration guidelines in PACU to determine the impact on patient satisfaction scores, discharge pain scores, medication costs, number of antiemetic doses administered, and LOS. The second aim was to evaluate baseline data on patient satisfaction scores, PACU discharge pain scores, medication costs, number of antiemetic doses administered, and PACU LOS prior to implementation of the revised pain medication administration guidelines. The objective to meet the second aim was to review patient satisfaction data that was obtained prior to implementation; complete a chart audit to determine baseline data on discharge pain scores, medication costs, number of antiemetic doses administered, and LOS prior to implementation of the revised pain medication administration guidelines. The third aim was to determine the perceptions of PACU nurses regarding the utility and impact of the revised pain medication administration guidelines on their practice and patient outcomes. The objective to meet the third aim was to solicit written feedback from PACU nurses regarding their perceptions on the utility and impact of the guidelines on their practice and patient outcomes.

Evaluation questions were identified through discussion with stakeholders and review of the logic model objectives. The impact of the implementation of the revised pain medication administration guidelines in PACU on patients, PACU nurses, and the institution was evaluated by seeking answers for the following questions:

- Did PACU length-of-stay decrease after implementation?
- Did PACU discharge pain scores change, or were they stable?
- Did the cost of antiemetic medications or number of rescue antiemetic medications administered in PACU decrease after implementation?
- Was there a change in overall PACU pain medication costs?
- Was there an increase in oral pain medication costs?
- Was there an increase in IV non-narcotic medication costs?
- Was there a decrease in IV narcotic medication costs?
- Did patient satisfaction survey scores change?
- What were the perceptions of PACU nurses regarding the utility and impact of the guidelines on their practice and on patient outcomes?

Evaluation Design

Data Collection and Analysis

The DNV citation occurred in January of 2017. Baseline aggregate data and patient satisfaction survey scores were acquired from a 3-month sample prior to the DNV site visit, from October 1 to December 31 of 2016. The quality improvement project was implemented March 1 of 2017, and 90.4% of PACU nurses had completed education by April 1 of 2017. Post-implementation data included three-month samples of aggregate data and patient satisfaction survey scores for the following date ranges: April 1 to June 30 of 2017, 2018, and 2019, as well as January 1 to March 31 of 2020. The decision was made to use January 1 to March 31 data for the year 2020 because COVID-19 restrictions, that started in mid to late March of 2020 and changed throughout 2020, affected surgical caseloads.

Quantitative data from patient medical records was obtained by the PACU nurse manager, a nurse anesthetist, and pharmacy staff using pre-existing reports in the electronic medical record system (EPIC). Report data was shared with this program evaluator as encrypted Excel files. The raw data from these reports was filtered to remove duplicate entries, pediatric patients (under age 18 at time of surgery), and patients who did not have a procedure in the OR and a subsequent PACU stay during the specified date ranges. Then each patient was assigned a case number. Duplicate medication administrations and medication administrations outside of each individual patient's PACU stay were removed. Each medication administration was labeled with the proper assigned case number, then any remaining patient identifiers were removed. The removed patient identifiers included name, date of birth, medical record number, hospital account record, and PACU log number. Patients were then separated into three groups for comparison: patients who received only oral analgesics in PACU (PO group), patients who received only IV analgesics in PACU (IV group), and patients who received a combination of oral and IV analgesics in PACU (PO+IV group). Patients who received a combination of medications that included other routes of administration such as intra-muscular injections, epidural, or rectal were not included in the program evaluation. The data points compared were PACU LOS, PACU discharge pain scores, and PACU pain medication and rescue antiemetic medication costs.

Patient satisfaction survey data was obtained by the PACU nurse manager as a Press Ganey report, which was sent to the evaluator in PDF format. The evaluator and stakeholders determined that the most relevant question from the patient satisfaction survey was: "Staff ensure you were comfortable". Scores for that question were extracted from the PDF report for the date ranges included in the program evaluation and entered in an Excel spreadsheet.

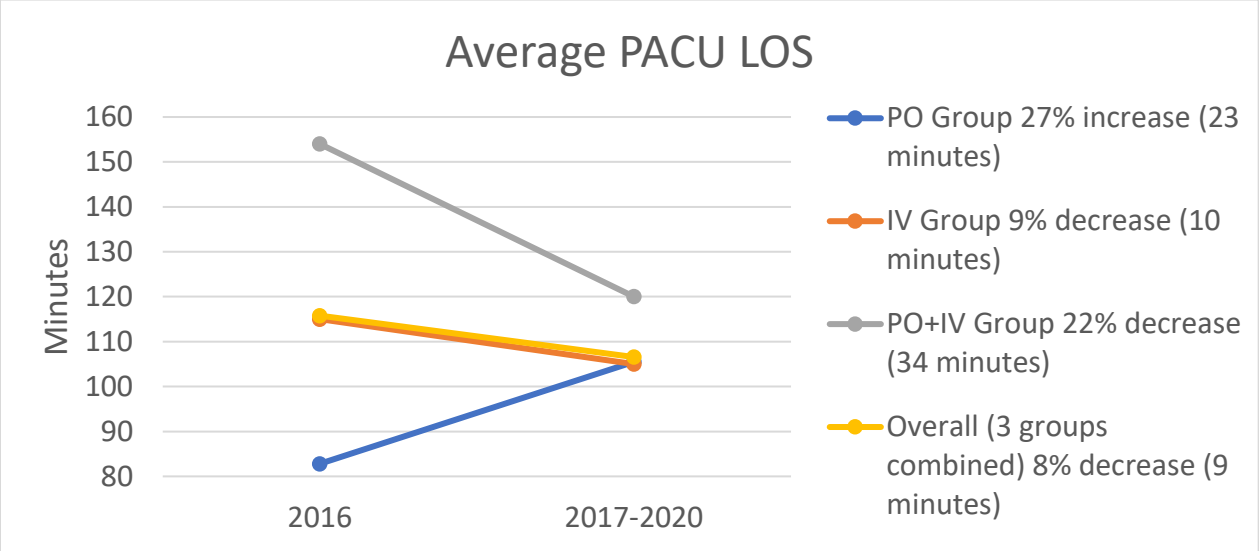
A written survey and letter of introduction (Appendix D) was emailed to a PACU nurse who volunteered to champion the PACU staff survey portion of the program evaluation. The PACU nurse then distributed the survey to the PACU nursing staff and collected the completed surveys in an envelope at the PACU nurses' station. Participation was voluntary. The survey consisted of one yes/no question, fourteen questions on a Likert scale of 1-5, and six open-ended questions. Nurses who were working in PACU at the time of the initial implementation of the revised pain medication guidelines in March of 2017 were asked to complete the entire survey. Nurses who began working in PACU after March 1 of 2017 were asked to complete questions 12-21. The staff was given three weeks in January of 2021 to complete the survey and place it in an envelope at the PACU nurses' station. The program evaluator was then able to pick up the sealed envelope containing the completed surveys at the hospital's front desk.

Evaluation Results

PACU Length-of-Stay

Baseline PACU LOS was determined by calculating the average LOS in minutes over the three-month period of October 1 to December 31, 2016 for each of the three groups. Post-implementation PACU LOS for each of the three groups was determined by calculating the average LOS in minutes of the following date ranges: April 1 to June 30 of 2017, 2018, and 2019; and January 1 to March 31 of 2020. The IV group had a 10-minute decrease, the PO group had a 23-minute increase, the PO+IV group had a 34-minute decrease, and the three groups combined had an overall decrease of 9 minutes in PACU LOS post-implementation (see Figure 1 and Appendix F, Table F1).

Figure 1.

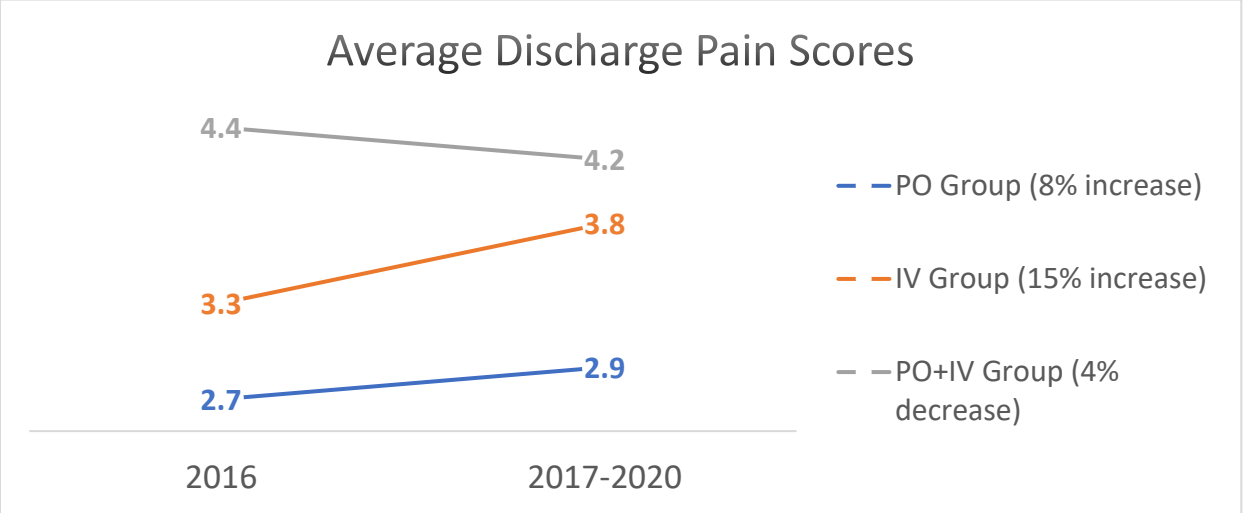


Note. PO group 2016 n=10 and 2017-2020 average n=43; IV group 2016 n=497 and 2017-2020 average n=474; PO+IV group 2016 n=16 and 2017-2020 average n=58

PACU Discharge Pain Scores

Baseline PACU discharge pain scores were determined by calculating the average discharge pain score over the three-month period of October 1 to December 31, 2016 for each of the three groups. Post-implementation PACU discharge pain scores for each of the three groups were determined by calculating the average discharge pain scores of the following date ranges: April 1 to June 30 of 2017, 2018, and 2019; and January 1 to March 31 of 2020. The IV group average discharge pain score increased from 3.3 to 3.8, the PO group increased from 2.7 to 2.9, and the PO+IV group decreased from 4.4 to 4.2 on a 0-10 pain scale post-implementation (see Figure 2 and Appendix F, Table F2).

Figure 2.



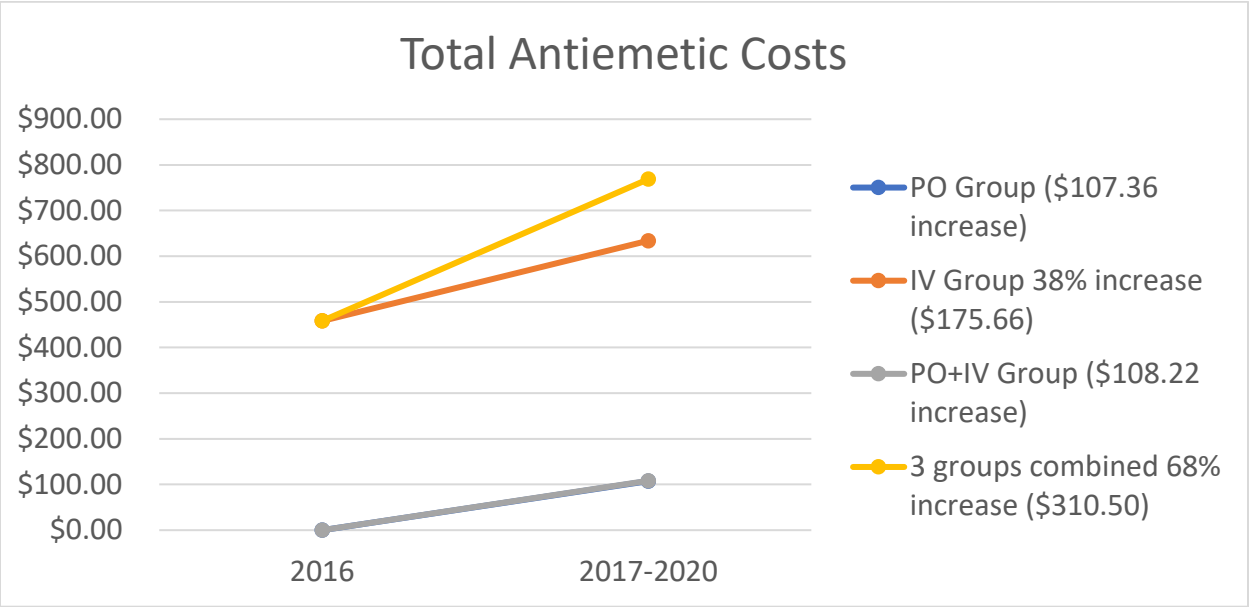
Note. PO group 2016 n=10 and 2017-2020 average n=43; IV group 2016 n=497 and 2017-2020 average n=474; PO+IV group 2016 n=16 and 2017-2020 average n=58

Antiemetic Medication Costs

To calculate antiemetic medication costs, first a single cost per dose was assigned to each antiemetic medication given in PACU. This cost per medication dose was determined by calculating the average cost charged to patients within the evaluation date ranges in 2016-2020 for each antiemetic medication dose given in PACU (Appendix E). Baseline PACU antiemetic medication costs for the program evaluation were determined by calculating the sum of antiemetic medication doses and associated costs over the three-month period of October 1 to December 31, 2016 for each of the three groups. Post-implementation PACU antiemetic medication costs for each of the three groups were determined by calculating the average sum of antiemetic medication doses and associated costs for the following date ranges: April 1 to June 30 of 2017, 2018, and 2019; and January 1 to March 31 of 2020. The IV group average antiemetic medication costs increased by $175.66, the PO group costs increased by $107.36, and

the PO+IV group increased $108.22 post-implementation. The overall antiemetic costs for the three groups combined increased 68% ($310.50) (Figure 3 and Appendix F, Table F3).

Figure 3.



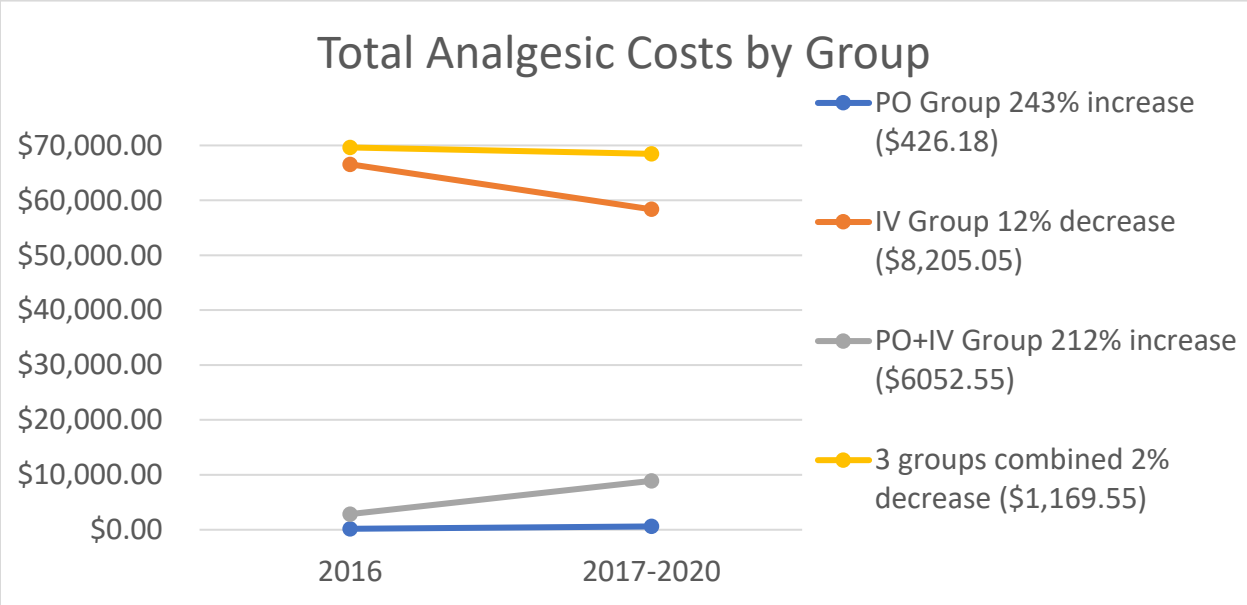
Note. PO group 2016 n=10 and 2017-2020 average n=43; IV group 2016 n=497 and 2017-2020 average n=474; PO+IV group 2016 n=16 and 2017-2020 average n=58

Analgesic Medication Costs

To calculate analgesic medication costs, first a single cost per dose was assigned to each analgesic medication given in PACU. This cost per medication dose was determined by calculating the average cost charged to patients within the evaluation date ranges in 2016-2020 for each analgesic medication dose given in PACU (Appendix E). Baseline PACU analgesic medication costs for the program evaluation were determined by calculating the sum of analgesic medication doses and associated costs over the three-month period of October 1 to December 31, 2016 for each of the three groups. Post-implementation PACU analgesic medication costs for each of the three groups were determined by calculating the average sum of analgesic medication

doses and associated costs for the following date ranges: April 1 to June 30 of 2017, 2018, and 2019; and January 1 to March 31 of 2020. The IV group average analgesic medication costs decreased by $8,205.05 (12%), the PO group costs increased by $426.18 (243%), and the PO+IV group increased by $6,052.55 (212%) post-implementation. The analgesic costs for the three groups combined decreased by $1,169.55 (2%) (see Figure 4 and Appendix F, Table F4).

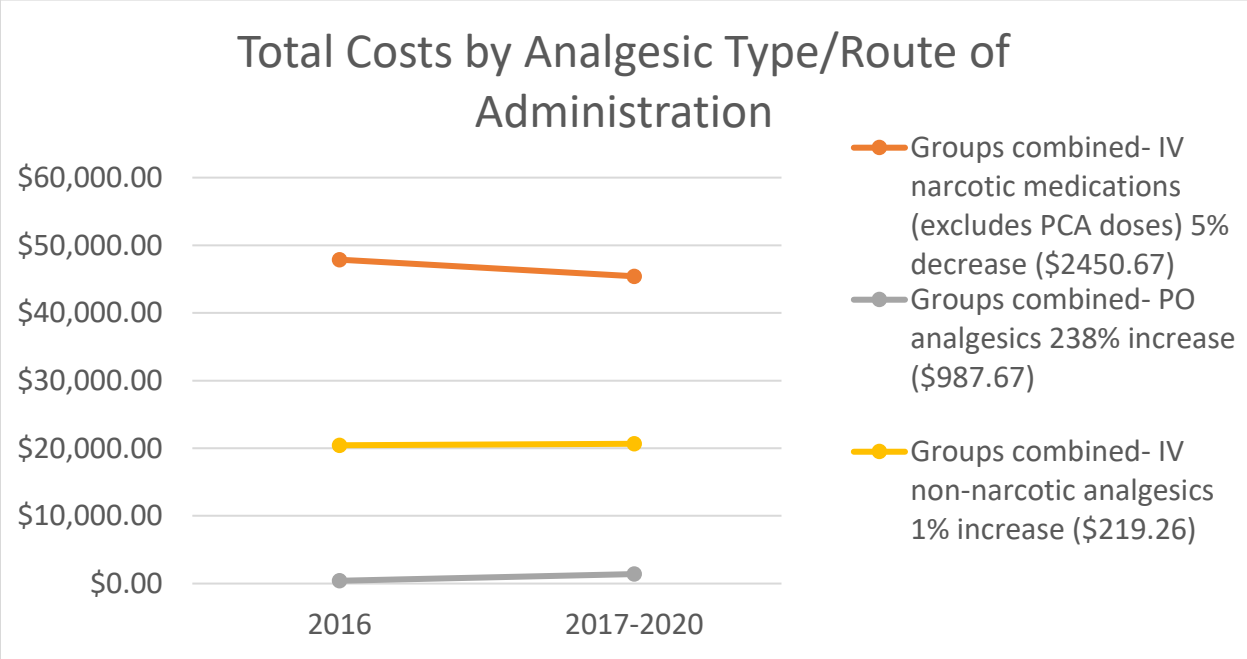
Figure 4.



Note. PO group 2016 n=10 and 2017-2020 average n=43; IV group 2016 n=497 and 2017-2020 average n=474; PO+IV group 2016 n=16 and 2017-2020 average n=58

Comparisons were also made by analgesic type and route of administration for the three groups combined. IV narcotic medication costs, excluding patient-controlled analgesia (PCA) doses, decreased by $2,450.67 (5%). Narcotic and non-narcotic total PO analgesic costs increased $987.67 (238%). IV non-narcotic analgesic costs increased $219.26 (1%) (see Figure 5 and Appendix F, Table F5).

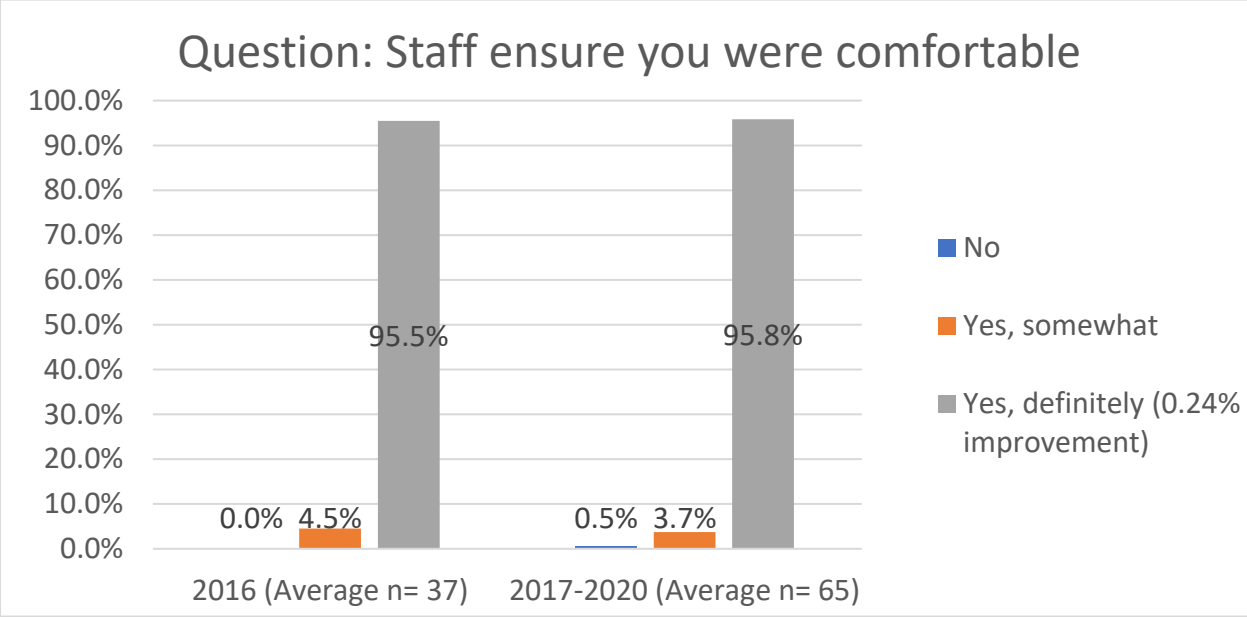
Figure 5.



Patient Satisfaction Survey Scores

Baseline patient satisfaction survey scores for the clinical site were determined by calculating the average percentage of each response for the question "Staff ensure you were comfortable" over the three-month period of October 1 to December 31, 2016. Post-implementation patient satisfaction survey scores for the clinical site were determined by calculating the average percentage of each response for the question "Staff ensure you were comfortable" for the following date ranges: April 1 to June 30 of 2017, 2018, and 2019; and January 1 to March 31 of 2020. The average percentage of patients who answered "Yes, definitely" to the question "Staff ensure you were comfortable" remained stable, with a 0.24% increase from 95.5% to 95.8% post-implementation. (see figure 6).

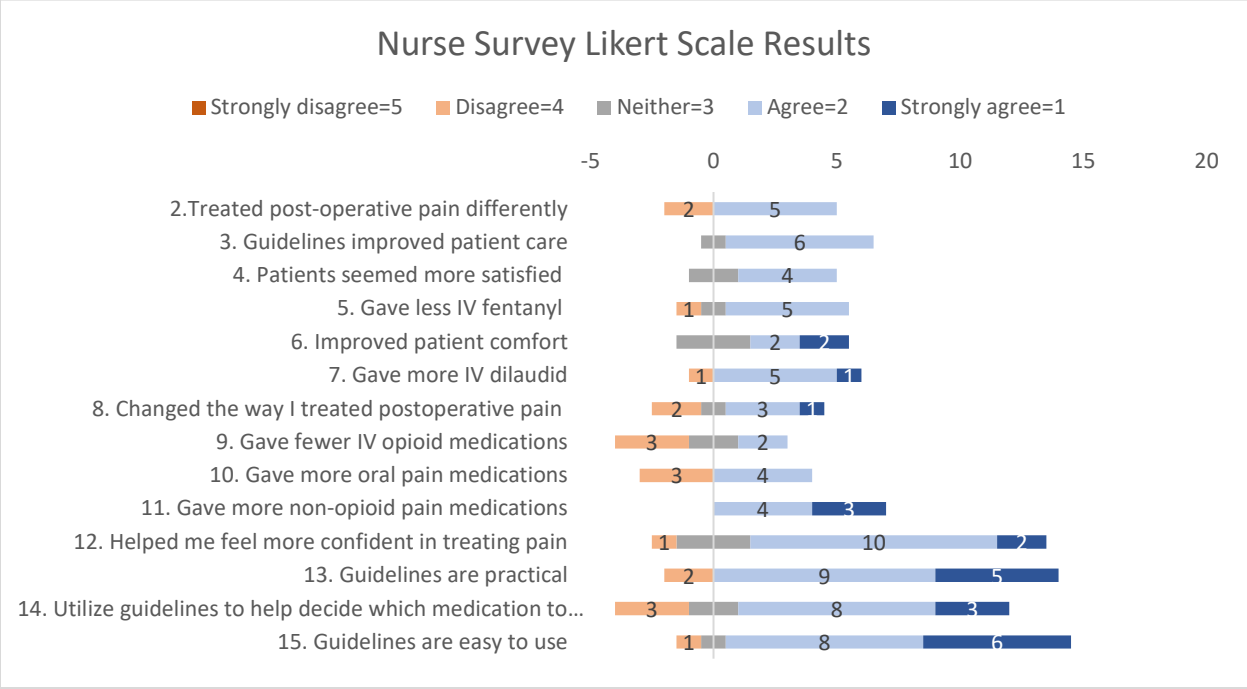
Figure 6.



PACU Nurse Survey

Written feedback was solicited from PACU nurses. Question 1 was a yes/no question asking if the nurse worked in PACU at the clinical site prior to March 1, 2017. Questions 2-15 were answered using a 1-5 Likert scale. Questions 2-11 had fewer responses because the nurses who did not work in PACU until after the change was implemented were not able to answer those questions. Out of 28 total PACU nurses on staff, 16 nurses answered the survey; 7 worked in PACU prior to implementation of the revised pain medication administration guidelines, and 9 started working in PACU after implementation. Most nurses found the guidelines to be practical and easy to use, they utilized them when deciding which medication to administer, and felt more confident in treating pain. Nurses who worked in PACU prior to the change in the guidelines all agreed that they gave more non-opioid medications, and most felt they gave less IV fentanyl and more IV hydromorphone. Most felt they were treating pain differently, patients seemed more satisfied, and the guidelines improved patient care (see Figure 7).

Figure 7.



Out of the 16 completed nurse surveys, 11 nurses included open-ended feedback. Themes that were identified in those open-ended responses included patient outcomes, PACU LOS, PACU standing orders, effect on practice, and quality improvement opportunities. Nurses perceived shorter LOS, improved surgical thruput, improved outcomes, and happier patients with better and quicker pain control. They felt the PACU standing orders need more non-opioid options. PACU nurses also noted that variations in anesthesia providers' intra-operative and post-operative management affects their ability to effectively treat pain with the current options in the standing orders. For the effect on their practice, nurses liked being able to use nursing judgement to treat pain and found the guidelines convenient and helpful in directing pain management. They also identified some opportunities for future quality improvement including a focus on pre-operative medications and the pre-operative patient environment, continuing with Enhanced Recovery After Surgery (ERAS) protocols, and developing more consistency between

anesthesia providers' pain management techniques intra-operatively and post-operatively (see Table 1).

Table 1.

PACU Nurse Survey Qualitative Feedback Summary

Themes	Summary of Answers
Patient outcomes	• Shortened LOS with better/quicker pain control • Improved outcomes • Happier patients with pain managed
PACU LOS	• Improved perception of surgical thruput • Shorter LOS • Decreased PACU recovery time
PACU standing orders	• Need more non-opioid options • Variation in anesthesia providers' intra-operative and post-operative management affects ability to effectively treat pain with current options
Effect on practice	• Use nursing judgement to treat pain • Convenient • Helps direct and manage pain
Quality improvement opportunities	• Pre-operative medications and pre-operative patient management (calming environment) • Continue with enhanced recovery after surgery (ERAS) protocols and non-opioids prior to surgery • More consistency between anesthesia provider pain management techniques intra-operatively and post-operatively

Summary, Conclusion, and Recommendations

Aim #1 was met: Evaluate the impact of the revised pain medication administration guidelines in PACU to determine if implementation led to improved patient satisfaction scores, lower pain scores at discharge from PACU, lower medication costs, fewer rescue antiemetics being administered, and shorter PACU length-of-stay (LOS). Aim #2 was met: Establish baseline data on patient satisfaction scores, PACU discharge pain scores, medication costs, number of antiemetic doses administered, and PACU LOS prior to implementation of the revised pain medication administration guidelines. Overall PACU LOS decreased by 9 minutes (8%) and

discharge pain scores increased 12%, from 3.3 to 3.7 on a 0-10 pain scale. Average IV opioid costs decreased by $2,450.67 (5%), and average oral analgesic costs and IV non-narcotic analgesic costs increased $1,206.94 (6%). Antiemetic doses and the associated costs increased by 68% ($310.50) for the three groups combined. Despite the changes in pain scores and medications being given, patient satisfaction scores were stable, with a 0.24% increase.

The low number of antiemetic doses administered in PACU before and after implementation likely influenced the outcome. In addition to the low overall numbers of antiemetics given, the need for antiemetics may be impacted by multiple factors such as surgical procedure performed, patient age and sex, and anesthetic technique used. The numbers of cases in the PO group (2016 n=10 and 2017-2020 average n=43) and PO+IV group (2016 n=16 and 2017-2020 average n=58) were low. The changes in PACU LOS, PACU discharge pain scores, medication costs, and antiemetic doses administered for the PO group and PO+IV group could be due to the low number of cases in those groups.

Aim #3 was met: Determine the perceptions of PACU nurses regarding the utility and impact of the revised pain medication administration guidelines on their practice and on patient outcomes. Nurses perceived that they gave more IV hydromorphone (Dilaudid), more non-opioid medications, and less IV fentanyl. They also perceived having happier patients, improved outcomes, and quicker, better pain control for patients as well as shorter PACU stays and improved surgical thruput. PACU nurses felt the guidelines were practical, convenient, and easy to use. They also felt more confident in treating pain and liked using nursing judgement to treat pain.

Results of the program evaluation will be shared with clinical site stakeholders and could be used as evidence to accreditors and hospital administration of ongoing evaluation. I

recommend that the clinical site's surgical services department consider implementing an evidence-based multimodal pain management protocol, and that they consider more options for non-narcotic analgesics in PACU. I also recommend they monitor the antiemetic needs and explore possible causes if they continue to increase. The program evaluation could be expanded to include Phase II recovery room and full years instead of 3-month samples for a more complete picture. The evaluation could also be expanded to compare other variables such as service lines or anesthetic given, or to include other analgesic medication routes of administration such as intra-muscular injections, epidural medications, or rectal medications. Other hospital departments could use this program evaluation as a template and modify it as needed.

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Appendix A: Demographics for Hennepin County and the State of Minnesota 2018 & 2019

Demographic information	Hennepin County 2018	Hennepin County 2019	State of MN 2018	State of MN 2019
Population	1,232,483	1,252,024	5,519,952	5,576,606
% below 18 years of age	22%	22%	23%	23.30%
% 65 and older	13.20%	13.60%	15.10%	15.40%
% Non-Hispanic African American	12.70%	13.10%	6.00%	6.30%
% American Indian and Alaskan Native	1.10%	1.10%	1.30%	1.40%
% Asian	7.40%	7.60%	4.90%	5.10%
% Native Hawaiian/Other Pacific Islander	0.10%	0.10%	0.10%	0.10%
% Hispanic	6.90%	7%	5%	5.40%
% Non-Hispanic white	69.60%	68.90%	80.60%	79.90%
% not proficient in English	4%	3%	2%	2%
% Females	50.60%	50.50%	50.20%	50.20%
% Rural	2.20%	2.20%	26.70%	26.70%

Note. From *County Health Rankings and Roadmaps*, by The University of Wisconsin Population Health Institute, 2019 (http://www.countyhealthrankings.org/explore-health-rankings). Copyright 2019 by County Health Rankings. Reprinted with permission.

Appendix B: Literature Synthesis

Author and Date	Evidence Type	Sample, Sample Size, Setting	Observable Measures	Findings	Limitations	Evidence Level, Quality
Maund, 2011	Quantitative; Systematic review with meta-analysis	Adult patients requiring pain relief immediately after major surgery; 60 trials ranging from n=20 to 514	24-hour morphine consumption when paracetamol, NSAID, or COX-2 inhibitors are given in addition to morphine PCA	Decrease in 24 h morphine consumption when paracetamol, NSAID, or COX-2 inhibitors are given in addition to PCA morphine after surgery, with no clear difference between them. When paracetamol, NSAIDs, or COX-2 inhibitors were added to patient-controlled analgesia (PCA) morphine, there was a statistically significant reduction in morphine consumption.	Did not account for any synergistic effects between the non-opioid analgesics and morphine. Did not take into consideration any effect differences between the 3 non-opioids at different levels of morphine consumption.	1A
Mariano, 2018	Non-research; Clinical practice guidelines	N/A	N/A	Multimodal perioperative protocol and postoperative protocol for painful surgeries where regional anesthesia is not utilized.	Some of the recommendations made were based on lower quality studies and were presented as something to consider in patient care rather than a practice standard to follow.	4A
Liang, 2017	Research, Systematic review with meta-analysis	Four studies included 534 adult patients in the acetaminophen groups and 331 adult patients in the control groups.	Opioid consumption, post-operative pain scores, gastrointestinal events (nausea, vomiting).	Intravenous acetaminophen was efficacious for reducing postoperative pain and opioid consumption than the placebo following total joint arthroplasty.	A limited number of studies were available, and they were of moderate to low quality. More RCTs are needed.	1B
Derry, 2013	Research; Systematic review with meta-analysis	Ten studies (n=1785 participants); Adults (>15 years) prescribed any dose of celecoxib or placebo for acute postoperative pain.	Primary outcome: number of participants achieving at least 50% pain relief for the treatment groups (200mg celecoxib, 400mg celecoxib, and placebo). Secondary outcomes: Use of rescue medications within 24 hours of surgery, median time to rescue medications, adverse events, withdrawals from study	Celecoxib at its recommended dosage of 400 mg for acute pain is an effective analgesic, equivalent to ibuprofen 400 mg, but providing a longer duration of pain relief than many traditional NSAIDs.	The studies mainly involved dental surgery patients, or dental and orthopedic surgery patients.	1A

Author and Date	Evidence Type	Sample, Sample Size, Setting	Observable Measures	Findings	Limitations	Evidence Level, Quality
Derry, 2013	Research; Systematic review with meta-analysis	Three studies (n=1647 participants); adult participants (> 15 years) with established postoperative pain of moderate to severe intensity following day surgery or in-patient surgery.	Primary outcome: Participants achieving at least 50% of maximum pain relief over four to six hours for the treatment groups (placebo, ibuprofen, or ibuprofen + paracetamol). Secondary outcomes: Median (or mean) time to use of rescue medication; Number of participants using rescue medication; Number of participants with: any adverse event; any serious adverse event (as reported in the study); withdrawal due to an adverse event; Other withdrawals: withdrawals for reasons other than lack of efficacy (participants using rescue medication.)	Fewer participants required rescue medication with the ibuprofen + paracetamol combination than with placebo or ibuprofen alone. Ibuprofen plus paracetamol combinations provided better analgesia than either drug alone (at the same dose), with a smaller chance of needing additional analgesia over about eight hours, and with a smaller chance of experiencing an adverse event.	The studies used involved dental surgery patients. There were only 3 studies included in the review.	1A
Derry, 2009	Research; Systematic review with meta-analysis	Seventy-two studies compared ibuprofen and placebo (9186 participants)	Primary outcome: Number of participants achieving at least 50% pain relief over 4 to 6 hours. Secondary outcomes: Numbers of participants using rescue medication over specified time periods, time to use of rescue medication, adverse events, and withdrawal from studies.	A single dose of ibuprofen 400mg is an effective analgesic, providing at least 50% pain relief to over half of the treated patients with acute, moderate to severe, postoperative pain.	The study is older (2009). Only one treatment arm utilized doses of 800mg ibuprofen. Most of the studies were on dental surgery patients.	1A

Author and Date	Evidence Type	Sample, Sample Size, Setting	Observable Measures	Findings	Limitations	Evidence Level, Quality
McNicol, 2016	Research; Systematic review with meta-analysis	Seventy-five studies (7200 participants); children or adults with postoperative pain following any kind of surgery, including dental, who were able to self-report pain intensity or pain relief.	Primary outcomes 1. Pain relief: number of participants experiencing at least 50% of maximum pain relief over four or six hours postintervention. 2. Pain intensity: mean pain intensity over both the four- and six-hour postintervention periods in each treatment arm and their corresponding standard deviations (SD), and in turn calculated the mean pain difference between groups. Secondary outcomes Time to achieve 50% pain relief, number of participants requiring rescue medication during the four to six hours after administration of the study drugs, mean time to requiring rescue medication, opioid consumption, patient satisfaction, adverse events, withdrawals.	IV paracetamol and IV propacetamol are statistically superior to placebo for the outcome of the proportion of participants achieving at least 50% pain relief over four or six hours. Neither IV paracetamol nor IV propacetamol were clinically superior for any efficacy outcome versus other analgesic agents, such as nonsteroidal anti-inflammatory drugs (NSAIDs) or opioids. Both offer an advantage over oral paracetamol due to their faster onset of action and in that many patients are unable to tolerate oral medication post-surgically.	Only one of the 75 studies had at least 200 participants in each study arm. Some non-blinded studies were used.	1B
Moore, 2015	Non-research; Literature review	Thirty-nine Cochrane Reviews (approximately 350 studies and 35,000 participants); Adults with acute postoperative pain taking oral analgesics.	The overall objective was to provide an overview of adverse event rates associated with single dose oral analgesics, compared with placebo, for acute postoperative pain in adults. Adverse events, serious adverse events (including death), and specific adverse events for the drugs being compared (NSAIDs, NSAIDs given in combination with non-opioid drugs, paracetamol, opioids or opioid combination drugs).	Serious adverse events were rare, occurring a rate of about 1 in 3200 participants. For several opioids and opioid combinations, the event rate with active drug was significantly higher than with placebo. For most comparisons, there was no statistically significant difference between NSAID and placebo. For ibuprofen200mgplusparacetamol500mgandforibuprofen 400 mg plus paracetamol 1000 mg, the adverse event rate with the combination was lower than with placebo. For ibuprofen 200 mg plus caffeine 100 mg, the adverse event rate with the combination was statistically higher than with placebo. There was no statistically significant difference between paracetamol and placebo for any comparison. There was no difference between gabapentin and placebo.	Most participants were younger adults who had dental surgery (molar extraction).	5A

Author and Date	Evidence Type	Sample, Sample Size, Setting	Observable Measures	Findings	Limitations	Evidence Level, Quality
Moore, 2015	Non-research; Literature review	Thirty-nine Cochrane Reviews (approximately 460 studies and 50,000 participants); single dose oral analgesics for acute postoperative pain in adults (aged 15 years or greater).	The overall objective was to summarize the efficacy of pharmaceutical interventions for acute pain in adults with at least moderate pain following surgery who have been given a single dose of oral analgesic. Drugs for which Cochrane reviews found no information, drugs for which Cochrane reviews found inadequate information (fewer than 200 participants in comparisons in two studies), drugs for which Cochrane reviews found no evidence of effect or evidence of no effect, pairs of drug and dose for which Cochrane reviews found evidence of effect, but where results were potentially subject to publication bias, pairs of drug and dose for which Cochrane reviews found evidence of effect, where results were reliable and not subject to potential publication bias, percentage of participants achieving target of at least 50% maximum pain relief, time to re-medication, percentage re-medicating.	Long duration of action (eight hours or greater) was found for etoricoxib 120 mg, diflunisal 500 mg, paracetamol 650 mg plus oxycodone 10 mg, naproxen 500/550 mg, celecoxib 400 mg, and ibuprofen 400 mg plus paracetamol 1000 mg. Fast acting formulations and fixed dose combinations of analgesics can produce good and often long-lasting analgesia at relatively low doses.	Most of the studies involved dental surgery patients.	5A

Author and Date	Evidence Type	Sample, Sample Size, Setting	Observable Measures	Findings	Limitations	Evidence Level, Quality
Chou, et al, 2016	Non-research; Clinical practice guidelines	N/A		Multimodal pain management protocol.	Some of the recommendations made were based on lower quality studies and were presented as something to consider in patient care rather than a practice standard to follow.	4A

Note: Adapted from "Lessons from Practice: Using the JHNEBP Tools" by D. Dang & S.L. Dearholt, *Johns Hopkins Nursing Evidence-Based Practice: Model and Guidelines* (3rd ed., p.253), 2018, Sigma Theta Tau International. Copyright 2018 by Sigma Theta Tau International.

Appendix C: Revised Pain Medication Administration Guidelines Logic Model

Inputs	Activities	Outputs	Outcomes		
			Short-term	Intermediate	Long-term
• Meeting time with quality improvement (QI) department and information technology (IT) department • Interdisciplinary team-independent review of materials and meeting time for planning • Medication administration-medications, pharmacy costs, lab work, staff, IV tubing and other equipment	• Assemble an interdisciplinary team to determine details of action plan • Secure IT staff to build data collection reports and make changes to the electronic medical record (change order sets, set up alerts) • Secure QI staff to assist with planning for the project, data collection, and analysis • Communicate the change to staff • Implement revised pain medication administration guidelines in PACU	• PACU patients whose pain was treated utilizing the revised pain medication administration guidelines • Nurses who utilized the revised pain medication administration guidelines to treat postoperative pain	• Meet DNV accreditation requirement • Reduced variability in treatment of postoperative pain due to revised pain medication administration guidelines	• Stable or improved average pain scores • PACU LOS average will be less than 2 hours • Patient satisfaction scores on HCAHPS survey questions related to pain will be stable or improve • Fewer antiemetic medications will be given to treat nausea and vomiting	• Administration of IV narcotics will decrease • Administration of oral analgesics or non-narcotic IV pain medications will increase

Appendix D: Letter of Introduction and PACU Nurse Survey

Dear fellow nurses,

I am a doctoral nursing student completing my Doctor of Nursing Practice degree through Duquesne University School of Nursing in Pittsburgh (online program). I am working with your PACU manager, Chris Kraulik, on a project to complete my doctoral requirements.

The PACU order sets were changed in March of 2017 to include more clear guidance for pain medication administration. I am evaluating patient satisfaction scores and data on length-of-stay, admission and discharge pain scores, pain medications and antiemetic medications given in PACU and their costs, and PACU holds before the change (April, May, June 2016 and October, November, December 2016) and after the change (April, May, June of 2017, 2018, & 2019; January, February, March of 2020).

In addition to evaluating data from around 15,000 cases, I need your input regarding your perceptions of the utility and impact of the guidelines on your practice and on patient outcomes. I created a survey with some Likert scale questions for you to answer, as well as a few open-ended questions. Your survey answers and input, along with the data from EPIC, will allow for a comprehensive evaluation of the change and may lead to the discovery of other quality improvement opportunities in PACU. Your participation and opinions are important for the success of the project, so please complete the survey. Your co-worker, Luanna Flaaen, has graciously offered to help me distribute the survey to you all. I live in Minneapolis, but because of the pandemic, I am not allowed to come to North Memorial myself. With your help, I will be able to complete my degree by the end of spring semester 2021. Thank you in advance for completing the survey and being candid in your responses.

Sincerely,

Elizabeth (Liz) Gerber
DNP student, CRNA, RN

March 1, 2017 the pain medication order sets were updated for PACU. A significant focus of that update included revising the guidelines for IV pain medication administration to the following:

Fentanyl 25-50mcg IV every 5 minutes as needed for acute surgical pain up to 200mcg while in recovery area

Dilaudid 1mg/1mL syringe 0.2-0.4mg IV every 5 minutes as needed for 5 doses for post-acute pain management while in recovery area.

In this survey, the terms "guidelines", "revised pain medication guidelines", "revised guidelines", and "pain medication guidelines" refer to the pain medication order sets used from March 1, 2017 to present.

1. I worked as a PACU nurse at North Memorial before March 1, 2017.	**Circle one answer:** **Yes** **No (If no, skip to question #12)**				
2. I treated post-operative pain differently after the revised pain medication guidelines were implemented.	(1) **Strongly Agree**	(2) **Agree**	(3) **Neither**	(4) **Disagree**	(5) **Strongly Disagree**
3. Using the guidelines improved patient care.	(1) **Strongly Agree**	(2) **Agree**	(3) **Neither**	(4) **Disagree**	(5) **Strongly Disagree**
4. Patients seemed more satisfied when I treated their pain using the guidelines.	(1) **Strongly Agree**	(2) **Agree**	(3) **Neither**	(4) **Disagree**	(5) **Strongly Disagree**
5. I gave less IV fentanyl to patients after the guidelines were implemented.	(1) **Strongly Agree**	(2) **Agree**	(3) **Neither**	(4) **Disagree**	(5) **Strongly Disagree**
6. Using the guidelines improved patient comfort.	(1) **Strongly Agree**	(2) **Agree**	(3) **Neither**	(4) **Disagree**	(5) **Strongly Disagree**
7. I gave more IV dilaudid to patients after the guidelines were implemented.	(1) **Strongly Agree**	(2) **Agree**	(3) **Neither**	(4) **Disagree**	(5) **Strongly Disagree**
8. I changed the way I treated postoperative pain because of the revised pain medication guidelines.	(1) **Strongly Agree**	(2) **Agree**	(3) **Neither**	(4) **Disagree**	(5) **Strongly Disagree**

9. I gave fewer IV opioid medications to patients after the guidelines were implemented.	(1) Strongly Agree	(2) Agree	(3) Neither	(4) Disagree	(5) Strongly Disagree
10. I gave more oral pain medications in PACU after the guidelines were implemented.	(1) Strongly Agree	(2) Agree	(3) Neither	(4) Disagree	(5) Strongly Disagree
11. I gave more non-opioid pain medications in PACU after the guidelines were implemented.	(1) Strongly Agree	(2) Agree	(3) Neither	(4) Disagree	(5) Strongly Disagree
12. Using the guidelines helped me feel more confident in treating pain.	(1) Strongly Agree	(2) Agree	(3) Neither	(4) Disagree	(5) Strongly Disagree
13. The pain medication guidelines are practical.	(1) Strongly Agree	(2) Agree	(3) Neither	(4) Disagree	(5) Strongly Disagree
14. I utilize the pain medication guidelines to help me decide which medication to administer.	(1) Strongly Agree	(2) Agree	(3) Neither	(4) Disagree	(5) Strongly Disagree
15. The pain medication guidelines are easy to use.	(1) Strongly Agree	(2) Agree	(3) Neither	(4) Disagree	(5) Strongly Disagree
16. How did the guidelines affect your practice?					
17. How did the guidelines affect patient outcomes?					
18. How did the guidelines affect PACU length-of-stay?					
19. What was your perception of the project to change the pain medication guidelines?					
20. Please write anything else you would like to share about your experiences related to the change itself (project, process, roll-out, staff education, communication, etc.) and your experiences using the pain medication guidelines in patient care.					
21. Please share any current opportunities for quality improvement in PACU.					

Appendix E: Average Charge Per Medication Dose

Medication	Average Charge
ACETAMINOPHEN 1,000 MG/100 ML (10 MG/ML) INTRAVENOUS SOLUTION	$99.40
ACETAMINOPHEN 10 MG/ML BOLUS (NEONATE) (PEDS)	$105.08
ACETAMINOPHEN 325 MG TABLET	$4.22
ACETAMINOPHEN 325 MG/10.15 ML ORAL SUSPENSION	$0.24
ACETAMINOPHEN 500 MG TABLET	$9.49
ASPIRIN 325 MG TABLET	$0.25
BUTALBITAL-ASPIRIN-CAFFEINE 50 MG-325 MG-40 MG CAPSULE	$2.84
FENTANYL (PF) 100 MCG/2 ML (50 MCG/ML) INTRAVENOUS SYRINGE	$86.04
FENTANYL (PF) 50 MCG/ML INJECTION SOLUTION	$40.49
HYDROCODONE 5 MG-ACETAMINOPHEN 325 MG TABLET	$21.05
HYDROMORPHONE (PF) 2 MG/ML INJECTION SYRINGE WRAPPER	$40.40
HYDROMORPHONE 0.5 MG/0.5 ML INJECTION SYRINGE	$40.35
HYDROMORPHONE 0.5 MG/0.5 ML INJECTION SYRINGE WRAPPER	$42.91
HYDROMORPHONE 1 MG / 1 ML ORAL SYRINGE	$25.11
HYDROMORPHONE 1 MG/1 ML INJECTION SYRINGE WRAPPER	$41.56
HYDROMORPHONE 1 MG/ML INJECTION SYRINGE	$41.25
HYDROMORPHONE 2 MG TABLET	$15.39
HYDROMORPHONE 2 MG/ML INJECTION SYRINGE	$39.16
HYDROMORPHONE 4 MG TABLET	$21.11
KETOROLAC 30 MG/ML (1 ML) INJECTION SOLUTION	$43.29
MEPERIDINE (PF) 25 MG/ML INJECTION	$42.30
MEPERIDINE (PF) 25 MG/ML INJECTION SYRINGE	$44.02
METHADONE 10 MG TABLET	$21.07
METHADONE 10 MG/ML ORAL CONCENTRATE	$2.11
MORPHINE 1-4 MG IV SOLUTION	$32.05
MORPHINE 2 MG/ML INJECTION WRAPPER	$44.13
MORPHINE 2-4 MG IV SOLUTION	$44.08
MORPHINE ER 30 MG TABLET,EXTENDED RELEASE	$20.30
MORPHINE ER 60 MG TABLET,EXTENDED RELEASE	$28.12
NALBUPHINE 20 MG/ML INJECTION SOLUTION	$49.53
ONDANSETRON 4 MG DISINTEGRATING TABLET	$20.92
ONDANSETRON HCL (PF) 4 MG/2 ML INJECTION SOLUTION	$40.58
OXYCODONE 5 MG TABLET	$8.75
OXYCODONE 5 MG/5 ML ORAL SOLUTION	$17.96
OXYCODONE ER 20 MG TABLET,CRUSH RESISTANT,EXTENDED RELEASE 12 HR	$25.99
OXYCODONE-ACETAMINOPHEN 5 MG-325 MG TABLET	$20.45
PROCHLORPERAZINE EDISYLATE 10 MG/2 ML (5 MG/ML) INJECTION SOLUTION	$49.68
SCOPOLAMINE 1 MG OVER 3 DAYS TRANSDERMAL PATCH	$52.40

Appendix F: Supplemental Details for Figures

Table F1.

Average PACU LOS in Minutes

Year(s)	PO Group 27% increase (23 minutes)	IV Group 9% decrease (10 minutes)	PO+IV Group 22% decrease (34 minutes)	Overall (3 groups combined) 8% decrease (9 minutes)
2016	83	115	154	116
2017-2020	105	105	120	107

Note. PO group 2016 n=10 and 2017-2020 average n=43; IV group 2016 n=497 and 2017-2020 average n=474; PO+IV group 2016 n=16 and 2017-2020 average n=58

Table F2.

Average PACU Discharge Pain Scores

Year (s)	PO Group (8% increase)	IV Group (15% increase)	PO+IV Group (4% decrease)	Three groups combined (12% increase)
2016	2.7	3.3	4.4	3.3
2017-2020	2.9	3.8	4.2	3.7

Note. PO group 2016 n=10 and 2017-2020 average n=43; IV group 2016 n=497 and 2017-2020 average n=474; PO+IV group 2016 n=16 and 2017-2020 average n=58. Scores are on a 0-10 pain scale.

Table F3.

Total Antiemetic Medication Costs Per Group

	PO Group ($107.36 increase)	IV Group 38% increase ($175.66)	PO+IV Group ($108.22 increase)	3 groups combined 68% increase ($310.50)
2016	$0.00	$458.22	$0.00	$458.22
2017-2020	$107.36	$633.87	$108.22	$768.72

Note. PO group 2016 n=10 and 2017-2020 average n=43; IV group 2016 n=497 and 2017-2020 average n=474; PO+IV group 2016 n=16 and 2017-2020 average n=58

Table F4.

Total Analgesic Medication Costs Per Group

Year(s)	PO Group 243% increase ($426.18)	IV Group 12% decrease ($8,205.05)	PO+IV Group 212% increase ($6052.55)	3 groups combined 2% decrease ($1,169.55)
2016	$175.22	$66,563.67	$2,851.79	$69,635.14
2017-2020	$601.39	$58,358.62	$8,904.35	$68,465.59

Note. PO group 2016 n=10 and 2017-2020 average n=43; IV group 2016 n=497 and 2017-2020 average n=474; PO+IV group 2016 n=16 and 2017-2020 average n=58

Table F5.

Costs by Analgesic Type and Route of Administration

Year(s)	Groups combined all analgesics 2% decrease ($1,169.55)	Groups combined- IV narcotic medications (excludes PCA doses) 5% decrease ($2450.67)	Groups combined- PO analgesics 238% increase ($987.67)	Groups combined- IV non-narcotic analgesics 1% increase ($219.26)
2016	$69,635.14	$47,871.45	$415.64	$20,443.69
2017-2020	$68,465.59	$45,420.78	$1,403.31	$20,662.95

Appendix G: PO+IV Group Total Analgesic and Antiemetic Costs

Date	Count	Medication	Average Charge	Total cost per med	Total cost per year
2016	1	ACETAMINOPHEN 500 MG TABLET	$9.49	$9.49	$2,851.79
2016	1	ASPIRIN 325 MG TABLET	$0.25	$0.25	
2016	1	HYDROMORPHONE 4 MG TABLET	$21.11	$21.11	
2016	2	HYDROCODONE 5 MG-ACETAMINOPHEN 325 MG TABLET	$21.05	$42.09	
2016	3	ACETAMINOPHEN 1,000 MG/100 ML (10 MG/ML) INTRAVENOUS SOLUTION	$99.40	$298.21	
2016	3	KETOROLAC 30 MG/ML (1 ML) INJECTION SOLUTION	$43.29	$129.87	
2016	4	MEPERIDINE (PF) 25 MG/ML INJECTION SYRINGE	$44.02	$176.07	
2016	5	OXYCODONE-ACETAMINOPHEN 5 MG-325 MG TABLET	$20.45	$102.24	
2016	7	OXYCODONE 5 MG TABLET	$8.75	$61.27	
2016	13	FENTANYL (PF) 50 MCG/ML INJECTION SOLUTION	$40.49	$526.33	
2016	36	HYDROMORPHONE 1 MG/ML INJECTION SYRINGE	$41.25	$1,484.86	
2017	3	ACETAMINOPHEN 1,000 MG/100 ML (10 MG/ML) INTRAVENOUS SOLUTION	$99.40	$298.21	$5,004.15
2017	3	ACETAMINOPHEN 325 MG TABLET	$4.22	$12.65	
2017	4	ACETAMINOPHEN 500 MG TABLET	$9.49	$37.95	
2017	4	HYDROCODONE 5 MG-ACETAMINOPHEN 325 MG TABLET	$21.05	$84.19	
2017	4	MEPERIDINE (PF) 25 MG/ML INJECTION SYRINGE	$44.02	$176.07	
2017	5	KETOROLAC 30 MG/ML (1 ML) INJECTION SOLUTION	$43.29	$216.45	
2017	6	OXYCODONE-ACETAMINOPHEN 5 MG-325 MG TABLET	$20.45	$122.69	
2017	13	OXYCODONE 5 MG TABLET	$8.75	$113.79	
2017	23	FENTANYL (PF) 50 MCG/ML INJECTION SOLUTION	$40.49	$931.19	
2017	73	HYDROMORPHONE 1 MG/ML INJECTION SYRINGE	$41.25	$3,010.97	
2018	1	ACETAMINOPHEN 325 MG TABLET	$4.22	$4.22	$3,116.86
2018	1	HYDROMORPHONE 2 MG TABLET	$15.39	$15.39	
2018	1	ONDANSETRON HCL (PF) 4 MG/2 ML INJECTION SOLUTION	$40.58	$40.58	
2018	2	ACETAMINOPHEN 500 MG TABLET	$9.49	$18.98	
2018	4	ACETAMINOPHEN 1,000 MG/100 ML (10 MG/ML) INTRAVENOUS SOLUTION	$99.40	$397.62	
2018	4	KETOROLAC 30 MG/ML (1 ML) INJECTION SOLUTION	$43.29	$173.16	
2018	5	HYDROCODONE 5 MG-ACETAMINOPHEN 325 MG TABLET	$21.05	$105.24	
2018	6	HYDROMORPHONE 2 MG/ML INJECTION SYRINGE	$39.16	$234.94	

Date	Count	Medication	Average Charge	Total cost per med	Total cost per year
2018	7	OXYCODONE 5 MG TABLET	$8.75	$61.27	
2018	10	HYDROMORPHONE 0.5 MG/0.5 ML INJECTION SYRINGE	$40.35	$403.49	
2018	10	OXYCODONE-ACETAMINOPHEN 5 MG-325 MG TABLET	$20.45	$204.48	
2018	36	FENTANYL (PF) 50 MCG/ML INJECTION SOLUTION	$40.49	$1,457.52	
2019	1	HYDROMORPHONE 2 MG TABLET	$15.39	$15.39	$15,071.95
2019	1	METHADONE 10 MG TABLET	$21.07	$21.07	
2019	2	MORPHINE 2 MG/ML INJECTION WRAPPER	$44.13	$88.25	
2019	5	ACETAMINOPHEN 325 MG TABLET	$4.22	$21.08	
2019	5	ONDANSETRON HCL (PF) 4 MG/2 ML INJECTION SOLUTION	$40.58	$202.91	
2019	6	ACETAMINOPHEN 500 MG TABLET	$9.49	$56.93	
2019	8	KETOROLAC 30 MG/ML (1 ML) INJECTION SOLUTION	$43.29	$346.33	
2019	14	HYDROCODONE 5 MG-ACETAMINOPHEN 325 MG TABLET	$21.05	$294.66	
2019	19	ACETAMINOPHEN 1,000 MG/100 ML (10 MG/ML) INTRAVENOUS SOLUTION	$99.40	$1,888.68	
2019	28	OXYCODONE-ACETAMINOPHEN 5 MG-325 MG TABLET	$20.45	$572.53	
2019	42	HYDROMORPHONE 2 MG/ML INJECTION SYRINGE	$39.16	$1,644.55	
2019	44	HYDROMORPHONE 0.5 MG/0.5 ML INJECTION SYRINGE WRAPPER	$42.91	$1,887.97	
2019	48	OXYCODONE 5 MG TABLET	$8.75	$420.14	
2019	188	FENTANYL (PF) 50 MCG/ML INJECTION SOLUTION	$40.49	$7,611.48	
2020	1	HYDROMORPHONE 1 MG / 1 ML ORAL SYRINGE	$25.11	$25.11	$12,749.09
2020	2	MORPHINE 2 MG/ML INJECTION WRAPPER	$44.13	$88.25	
2020	2	ONDANSETRON HCL (PF) 4 MG/2 ML INJECTION SOLUTION	$40.58	$81.16	
2020	3	MEPERIDINE (PF) 25 MG/ML INJECTION	$42.30	$126.90	
2020	5	HYDROCODONE 5 MG-ACETAMINOPHEN 325 MG TABLET	$21.05	$105.24	
2020	8	KETOROLAC 30 MG/ML (1 ML) INJECTION SOLUTION	$43.29	$346.33	
2020	11	ACETAMINOPHEN 500 MG TABLET	$9.49	$104.36	
2020	12	OXYCODONE-ACETAMINOPHEN 5 MG-325 MG TABLET	$20.45	$245.37	
2020	13	ACETAMINOPHEN 325 MG TABLET	$4.22	$54.81	
2020	16	ACETAMINOPHEN 1,000 MG/100 ML (10 MG/ML) INTRAVENOUS SOLUTION	$99.40	$1,590.46	
2020	22	HYDROMORPHONE (PF) 2 MG/ML INJECTION SYRINGE WRAPPER	$40.40	$888.77	
2020	56	OXYCODONE 5 MG TABLET	$8.75	$490.16	
2020	58	HYDROMORPHONE 0.5 MG/0.5 ML INJECTION SYRINGE WRAPPER	$42.91	$2,488.69	
2020	151	FENTANYL (PF) 50 MCG/ML INJECTION SOLUTION	$40.49	$6,113.47	

Appendix H: IV Group Total Analgesic and Antiemetic Costs

Date	Count	Medication	Average Charge	Total cost per med	Total cost per year
2016	1	SCOPOLAMINE 1 MG OVER 3 DAYS TRANSDERMAL PATCH	$52.40	$52.40	$67,021.89
2016	10	ONDANSETRON HCL (PF) 4 MG/2 ML INJECTION SOLUTION	$40.58	$405.81	
2016	13	HYDROMORPHONE 10 MG/50 ML PCA IV INFUSION (PREMIX)	$69.57	$904.36	
2016	40	MEPERIDINE (PF) 25 MG/ML INJECTION SYRINGE	$44.02	$1,760.73	
2016	72	KETOROLAC 30 MG/ML (1 ML) INJECTION SOLUTION	$43.29	$3,116.93	
2016	170	ACETAMINOPHEN 1,000 MG/100 ML (10 MG/ML) INTRAVENOUS SOLUTION	$99.40	$16,898.67	
2016	221	FENTANYL (PF) 50 MCG/ML INJECTION SOLUTION	$40.49	$8,947.54	
2016	847	HYDROMORPHONE 1 MG/ML INJECTION SYRINGE	$41.25	$34,935.44	
2017	1	MORPHINE 50 MG/50 ML PCA IN 0.9 % SODIUM CHLORIDE IV (PREMIX)	$71.00	$71.00	$72,854.47
2017	1	SCOPOLAMINE 1 MG OVER 3 DAYS TRANSDERMAL PATCH	$52.40	$52.40	
2017	2	NALBUPHINE 20 MG/ML INJECTION SOLUTION	$49.53	$99.07	
2017	3	MORPHINE 2-4 MG IV SOLUTION	$44.08	$132.23	
2017	5	HYDROMORPHONE 10 MG/50 ML PCA IV INFUSION (PREMIX)	$69.57	$347.83	
2017	15	ONDANSETRON HCL (PF) 4 MG/2 ML INJECTION SOLUTION	$40.58	$608.72	
2017	39	MEPERIDINE (PF) 25 MG/ML INJECTION SYRINGE	$44.02	$1,716.71	
2017	78	KETOROLAC 30 MG/ML (1 ML) INJECTION SOLUTION	$43.29	$3,376.67	
2017	187	ACETAMINOPHEN 1,000 MG/100 ML (10 MG/ML) INTRAVENOUS SOLUTION	$99.40	$18,588.54	
2017	305	FENTANYL (PF) 50 MCG/ML INJECTION SOLUTION	$40.49	$12,348.41	
2017	861	HYDROMORPHONE 1 MG/ML INJECTION SYRINGE	$41.25	$35,512.89	
2018	1	ACETAMINOPHEN 10 MG/ML BOLUS (NEONATE) (PEDS)	$105.08	$105.08	$48,449.84
2018	1	FENTANYL (PF) 2,500 MCG/50 ML PCA IV (PREMIX)	$173.26	$173.26	
2018	1	ONDANSETRON 4 MG DISINTEGRATING TABLET	$20.92	$20.92	
2018	2	MORPHINE 50 MG/50 ML PCA IN 0.9 % SODIUM CHLORIDE IV (PREMIX)	$71.00	$142.00	
2018	2	PROCHLORPERAZINE EDISYLATE 10 MG/2 ML (5 MG/ML) INJECTION SOLUTION	$49.68	$99.36	
2018	6	HYDROMORPHONE 10 MG/50 ML PCA IV INFUSION (PREMIX)	$69.57	$417.40	
2018	13	ONDANSETRON HCL (PF) 4 MG/2 ML INJECTION SOLUTION	$40.58	$527.56	
2018	15	HYDROMORPHONE 10 MG/50 ML PCA IV INFUSION (MIXTURE)	$142.35	$2,135.19	
2018	26	MEPERIDINE (PF) 25 MG/ML INJECTION	$42.30	$1,099.76	
2018	38	HYDROMORPHONE 2 MG/ML INJECTION SYRINGE	$39.16	$1,487.93	
2018	187	ACETAMINOPHEN 1,000 MG/100 ML (10 MG/ML) INTRAVENOUS SOLUTION	$99.40	$18,588.54	

Date	Count	Medication	Average Charge	Total cost per med	Total cost per year
2018	231	HYDROMORPHONE 0.5 MG/0.5 ML INJECTION SYRINGE	$40.35	$9,320.59	
2018	354	FENTANYL (PF) 50 MCG/ML INJECTION SOLUTION	$40.49	$14,332.25	
2019	1	ACETAMINOPHEN 10 MG/ML BOLUS (NEONATE) (PEDS)	$105.08	$105.08	$67,985.45
2019	1	MORPHINE 50 MG/50 ML PCA IN 0.9 % SODIUM CHLORIDE IV (PREMIX)	$71.00	$71.00	
2019	1	NALBUPHINE 20 MG/ML INJECTION SOLUTION	$49.53	$49.53	
2019	1	PROCHLORPERAZINE EDISYLATE 10 MG/2 ML (5 MG/ML) INJECTION SOLUTION	$49.68	$49.68	
2019	2	MORPHINE 2 MG/ML INJECTION WRAPPER	$44.13	$88.25	
2019	4	HYDROMORPHONE 10 MG/50 ML PCA IV INFUSION (PREMIX)	$69.57	$278.27	
2019	23	MEPERIDINE (PF) 25 MG/ML INJECTION	$42.30	$972.87	
2019	26	ONDANSETRON HCL (PF) 4 MG/2 ML INJECTION SOLUTION	$40.58	$1,055.11	
2019	28	HYDROMORPHONE (PF) 2 MG/ML INJECTION SYRINGE WRAPPER	$40.40	$1,131.17	
2019	60	KETOROLAC 30 MG/ML (1 ML) INJECTION SOLUTION	$43.29	$2,597.44	
2019	142	HYDROMORPHONE 2 MG/ML INJECTION SYRINGE	$39.16	$5,560.15	
2019	177	ACETAMINOPHEN 1,000 MG/100 ML (10 MG/ML) INTRAVENOUS SOLUTION	$99.40	$17,594.50	
2019	205	HYDROMORPHONE 0.5 MG/0.5 ML INJECTION SYRINGE WRAPPER	$42.91	$8,796.22	
2019	732	FENTANYL (PF) 50 MCG/ML INJECTION SOLUTION	$40.49	$29,636.18	
2020	2	MORPHINE 2 MG/ML INJECTION WRAPPER	$44.13	$88.25	$46,680.21
2020	3	ONDANSETRON HCL (PF) 4 MG/2 ML INJECTION SOLUTION	$40.58	$121.74	
2020	4	HYDROMORPHONE 10 MG/50 ML PCA IV INFUSION (PREMIX)	$69.57	$278.27	
2020	5	HYDROMORPHONE 1 MG/1 ML INJECTION SYRINGE WRAPPER	$41.56	$207.78	
2020	22	MEPERIDINE (PF) 25 MG/ML INJECTION	$42.30	$930.57	
2020	30	HYDROMORPHONE (PF) 2 MG/ML INJECTION SYRINGE WRAPPER	$40.40	$1,211.96	
2020	33	KETOROLAC 30 MG/ML (1 ML) INJECTION SOLUTION	$43.29	$1,428.59	
2020	124	ACETAMINOPHEN 1,000 MG/100 ML (10 MG/ML) INTRAVENOUS SOLUTION	$99.40	$12,326.09	
2020	253	HYDROMORPHONE 0.5 MG/0.5 ML INJECTION SYRINGE WRAPPER	$42.91	$10,855.82	
2020	475	FENTANYL (PF) 50 MCG/ML INJECTION SOLUTION	$40.49	$19,231.13	

Appendix I: PO Group Total Analgesic and Antiemetic Costs

Date	Count	Medication	Average Charge	Total cost per med	Total cost per year
2016	1	ACETAMINOPHEN 325 MG TABLET	$4.22	$4.22	$175.22
2016	1	ACETAMINOPHEN 500 MG TABLET	$9.49	$9.49	
2016	1	HYDROMORPHONE 2 MG TABLET	$15.39	$15.39	
2016	2	OXYCODONE-ACETAMINOPHEN 5 MG-325 MG TABLET	$20.45	$40.90	
2016	5	HYDROCODONE 5 MG-ACETAMINOPHEN 325 MG TABLET	$21.05	$105.24	
2017	4	ACETAMINOPHEN 325 MG TABLET	$4.22	$16.87	$363.85
2017	4	ACETAMINOPHEN 500 MG TABLET	$9.49	$37.95	
2017	4	HYDROCODONE 5 MG-ACETAMINOPHEN 325 MG TABLET	$21.05	$84.19	
2017	7	OXYCODONE 5 MG TABLET	$8.75	$61.27	
2017	8	OXYCODONE-ACETAMINOPHEN 5 MG-325 MG TABLET	$20.45	$163.58	
2018	1	ASPIRIN 325 MG TABLET	$0.25	$0.25	$538.29
2018	3	ACETAMINOPHEN 325 MG TABLET	$4.22	$12.65	
2018	6	ACETAMINOPHEN 500 MG TABLET	$9.49	$56.93	
2018	7	HYDROCODONE 5 MG-ACETAMINOPHEN 325 MG TABLET	$21.05	$147.33	
2018	8	OXYCODONE-ACETAMINOPHEN 5 MG-325 MG TABLET	$20.45	$163.58	
2018	18	OXYCODONE 5 MG TABLET	$8.75	$157.55	
2019	1	ACETAMINOPHEN 325 MG/10.15 ML ORAL SUSPENSION	$0.24	$0.24	$722.31
2019	1	BUTALBITAL-ASPIRIN-CAFFEINE 50 MG-325 MG-40 MG CAPSULE	$2.84	$2.84	
2019	1	ONDANSETRON HCL (PF) 4 MG/2 ML INJECTION SOLUTION	$40.58	$40.58	
2019	1	SCOPOLAMINE 1 MG OVER 3 DAYS TRANSDERMAL PATCH	$52.40	$52.40	
2019	5	ACETAMINOPHEN 325 MG TABLET	$4.22	$21.08	
2019	5	HYDROCODONE 5 MG-ACETAMINOPHEN 325 MG TABLET	$21.05	$105.24	
2019	9	OXYCODONE-ACETAMINOPHEN 5 MG-325 MG TABLET	$20.45	$184.03	
2019	13	ACETAMINOPHEN 500 MG TABLET	$9.49	$123.34	
2019	22	OXYCODONE 5 MG TABLET	$8.75	$192.56	
2020	1	ACETAMINOPHEN 325 MG/10.15 ML ORAL SUSPENSION	$0.24	$0.24	$995.86
2020	1	ASPIRIN 325 MG TABLET	$0.25	$0.25	
2020	1	HYDROMORPHONE 2 MG TABLET	$15.39	$15.39	
2020	1	METHADONE 10 MG TABLET	$21.07	$21.07	
2020	1	MORPHINE ER 60 MG TABLET,EXTENDED RELEASE	$28.12	$28.12	

Date	Count	Medication	Average Charge	Total cost per med	Total cost per year
2020	1	OXYCODONE 5 MG/5 ML ORAL SOLUTION	$17.96	$17.96	
2020	3	ONDANSETRON HCL (PF) 4 MG/2 ML INJECTION SOLUTION	$40.58	$121.74	
2020	6	ACETAMINOPHEN 325 MG TABLET	$4.22	$25.30	
2020	11	HYDROCODONE 5 MG-ACETAMINOPHEN 325 MG TABLET	$21.05	$231.52	
2020	11	OXYCODONE-ACETAMINOPHEN 5 MG-325 MG TABLET	$20.45	$224.92	
2020	16	ACETAMINOPHEN 500 MG TABLET	$9.49	$151.80	
2020	18	OXYCODONE 5 MG TABLET	$8.75	$157.55	

Appendix J: All Groups IV Narcotic Costs Per Year

All Groups IV Narcotics (excludes PCA doses)- Sum of Total cost per year per medication	2016	2017	2018	2019	2020
FENTANYL (PF) 50 MCG/ML INJECTION SOLUTION	$9,514.35	$14,372.74	$15,789.77	$37,247.66	$25,344.60
HYDROMORPHONE (PF) 2 MG/ML INJECTION SYRINGE WRAPPER				$1,131.17	$2,036.11
HYDROMORPHONE 0.5 MG/0.5 ML INJECTION SYRINGE			$9,724.08		
HYDROMORPHONE 0.5 MG/0.5 ML INJECTION SYRINGE WRAPPER				$10,046.87	$12,548.50
HYDROMORPHONE 1 MG/1 ML INJECTION SYRINGE WRAPPER					$206.23
HYDROMORPHONE 1 MG/ML INJECTION SYRINGE	$36,420.30	$38,523.85			
HYDROMORPHONE 2 MG/ML INJECTION SYRINGE			$1,722.86	$7,204.70	
MEPERIDINE (PF) 25 MG/ML INJECTION			$1,144.47	$1,012.42	$1,100.46
MEPERIDINE (PF) 25 MG/ML INJECTION SYRINGE	$1,936.80	$1,892.78			
MORPHINE 2 MG/ML INJECTION WRAPPER				$176.50	$176.50
MORPHINE 2-4 MG IV SOLUTION		$132.23			
NALBUPHINE 20 MG/ML INJECTION SOLUTION		$99.07		$49.53	
Grand Total	$47,871.45	$55,020.67	$28,381.19	$56,868.85	$41,412.40

Appendix K: Permission to Reprint Table

[External] RE: Permission requested

County Health Rankings & Roadmaps <website@chrr.wisc.edu>
Wed 4/28/2021 4:49 PM
To: Elizabeth Gerber <gerbere@duq.edu>; info@countyhealthrankings.org <info@countyhealthrankings.org>

Hello Elizabeth,

Thank you for reaching out to County Health Rankings & Roadmaps, for your interest in our data, and your thoughtful review of our terms of use.

Yes, you may use our data in your dissertation. You can find our preferred citation below:

The University of Wisconsin Population Health Institute. County Health Rankings & Roadmaps, 2021.
www.countyhealthrankings.org

Please let me know if you have any additional questions!

Best Regards,

Colleen M. Wick *(She/Her)*
Communications Associate
County Health Rankings & Roadmaps
@CHRankings| www.countyhealthrankings.org | (608) 265-3045
The University of Wisconsin Population Health Institute

From: Elizabeth Gerber <gerbere@duq.edu>
Sent: Monday, April 26, 2021 9:03 PM
To: info@countyhealthrankings.org
Subject: Permission requested

Dear Sir or Madam,

I am hoping to include some report information from your website in my doctoral project manuscript. The report information I would like to use in the manuscript includes the following demographic information for Hennepin County and the state of MN (2018 & 2019):

- Population
- % below 18 years of age
- % 65 and older
- % Non-Hispanic African American
- % American Indian and Alaskan Native
- % Asian
- % Native Hawaiian/Other Pacific Islander
- % Hispanic
- % Non-Hispanic white
- % not proficient in English
- % Females
- % Rural

I read through the Terms of Use page on https://www.countyhealthrankings.org, but I want to be certain that I am allowed to adapt the information listed above from the website into a table with the demographic information for my manuscript. If given permission, I will credit the original source. Please let me know if I am allowed to adapt this information from the website into a table for my manuscript.

Sincerely,
Elizabeth Gerber