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Decreasing Opioid Overprescription Following Outpatient Gynecology Surgery

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DECREASING OPIOID OVERPRESCRIPTION FOLLOWING OUTPATIENT GYNECOLOGY SURGERY

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Abstract

Problem: Opioid abuse may be a result of overprescribing opioids. There are no opioid prescribing recommendations for minor gynecologic surgery. As a result, there is a wide variation in prescribing practices at a privately-owned surgery center where excessive opioid prescription occurs.

Methods: A quality improvement initiative with a descriptive, cohort design. A retrospective review of medical records and telephone surveys over three months resulted in the development of a series of posters describing prescription data for three procedures: hysteroscopy dilation and curettage (HDC), uterine ablation (UA), and laparoscopy (LAP). The trends and changes in opioid prescription practices were displayed throughout the surgery center every month.

Results: A total on 526 medical records were reviewed (N=526) with HDC (n=358); UA (n=95); and LAP (n=73), and 45 telephone surveys were completed (N=45) with HDC (n=18); UA (n=9); and LAP (n=18). The number of patients receiving a prescription for opioids following HDC decreased from 23.3% to 16.4% (p = .001). When opioids were prescribed following HDC, UA, and LAP the mean milligrams of morphine equivalents (MMEs) prescribed decreased 34%, 19%, and 14%, respectively. Results were significant at the $p < .05$ level for all groups (HDC: p=.001; UA: p=.034; LAP: p= .039).

Implications for practice: Opioid prescribing following monthly publications of prescribing practice and self-reported patient usage decreased the number of opioids prescribed. Monitoring prescribing practices and regular patient surveys may assist in changing prescription practices and may be a reasonable option to decrease excessive opioid prescription at specialty surgery centers.

Decreasing Opioid Over-Prescription Following Outpatient Gynecologic Surgery

Opioid misuse and overdose continue to be a pervasive problem in the United States. In 2016, more than 11.5 million people reported misusing a prescription opioid (Centers for Disease Control [CDC], 2018) and there were more than 17,000 deaths involving a pharmaceutically manufactured opioid (Seth, Rudd, Noonan, & Haegerich, 2018). Moreover, most heroin users report first misusing prescription painkillers (Muhuri, Gfroerer, & Davies, 2013). On October 26, 2017, the opioid crisis was declared a public health emergency by the U.S. Department of Health and Human Services (HHS) (HHS, 2017).

Opioids are an important modality for treating pain in the surgical patient, but are often overprescribed following surgery (Feinberg, Chesney, Srikandarajah, Acuna, & McLeod, 2017). Excessive prescription can lead to abuse and diversion. Opioid prescribing recommendations for common surgical procedures have been suggested by groups such as the Michigan Surgical Quality Collaborative (Michigan Surgical Quality Collaborative, 2018) and the Center for Opioid Research and Education (Center for Opioid Research and Education, 2018). However, these recommendations are conflicting and do not include outpatient gynecologic procedures.

The aims of this project were to establish baseline data on opioid prescription and consumption; disseminate the data to surgeons and nurses; and decrease opioid over-prescription following outpatient gynecology surgery. This project was guided by the following study questions:

For women undergoing outpatient gynecological procedures at a Midwest Multispecialty Surgery Center, aged 18 and older:

1. What percentage of patients received a prescription for an opioid at discharge from July 1st – September 30th following hysteroscopy dilation and curettage (HDC)?
2. When opioids were prescribed, what was the median milligram of morphine equivalents (MME) prescribed from July 1st – September 30th for HDC, uterine ablation (UA), and laparoscopy (LAP), respectively?
3. For those prescribed opioids, what was the self-reported MME consumed July 1st – September 30th?

Data from the three months prior to the intervention was compared with data from the three months following the intervention (February 1st – April 30th) for study questions 1 and 2. Results were stratified by procedure type and answered the following study questions:

With dissemination of information on opioid consumption was there:

4. a decrease in the percentage of patients who received a prescription for opioids following HDC?
5. a decrease in the mean MME prescribed, when opioids were prescribed, following HDC, UA, and LAP, respectively?

Literature Review

A literature search was performed of MEDLINE, Cochrane, and CINAHL databases using Ebscohost. The databases were searched using the terms: "opioid" and "postoperative", not "chronic", with truncation from August 31, 2013 to August 31, 2018. The database search identified 4,603 articles. After title review, 71 articles were selected for abstract review based on relevance to current prescribing trends after

outpatient surgery, historical perspective of the opioid crisis, and interventions to decrease inappropriate opioid prescription after surgery. Nine study abstracts and two systematic review abstracts were initially found examining opioid medication use following discharge. Two studies were excluded that included only pediatric populations, and another two were excluded that reported only on inpatient surgeries. One study was excluded because full text was not available through interlibrary loan.

The percentage of opioids used after surgery ranged from 5.6% to 58% of the total amount prescribed for adult populations (Feinberg, et. al., 2018; Bicket, Long, Provonost, Alexander, & Wu, 2017; Tan et al., 2018; Theils et al., 2018; Fujii et al., 2018; Hill, McMahon, Stucke, & Barth, 2017). All studies of adult patients reported patients were using significantly fewer opioids than prescribed. However, one study of pediatric patients, included in the Feinberg et al. (2018) systematic review, found pediatric spinal fusion patients consumed 90.1% of the opioids prescribed.

All studies in the review included patients from more than one type of surgery and found that median opioid consumption varied by procedure. Most studies reported doses of opioid prescription in MMEs (appendix A) (Feinberg, et. al., 2018; 2018; Fujii et al., 2018; Tan et al., 2018; Thiels et al., 2018). In general, people undergoing orthopedic surgery used a greater number of MMEs than those undergoing other types of surgeries (Hill et al., 2017; Thiels et al., 2018). Only one study included median MME prescribed after hysteroscopy, but it did not include data on consumption for any gynecology procedures due to resource limitations (Fujii et al., 2018).

Consistently, less than 10% of patients surveyed reported disposing of excess pills in a manner approved of by the U.S. Food and Drug Administration (FDA) (Bicket et al,

2017; Hill et al., 2017; Thiels et al., 2018). FDA-approved disposal methods include: returning the medication to a drug take-back location, mixing with an inedible substance and disposing of in the household trash, or, when other options are not available, flushing down the toilet (U.S. Food and Drug Administration, 2018).

Excess opioid prescription after surgery poses two risks: misuse and diversion. The risk of developing an opioid misuse disorder after surgery is low (0.2%), but the risk of developing new, persistent use is appreciable and is not significantly different between major and minor surgeries (5.9%-6.5%) (Brat et al., 2018; Brummett et al., 2017). Diversion is common, 40.8% of the 11.5 million adults in the U.S. who are misusing prescription opioids obtained the medication for free from friends or family, primarily by theft (Han et al., 2017). Additionally, initiation of heroin use is 19 times more likely in people who have misused prescription pain medications (Muhuri, Gfroerer, & Davies, 2013).

The opioid crisis has resulted from a complex interplay of social and political factors and has claimed more lives than the HIV epidemic of the 1980s (Theisen, Jacobs, Macleod, & Davies, 2018). In 1990s, the American Pain Society proposed pain as the "fifth vital sign." Their aim was to make invisible suffering visible and provide a standardized pain rating scale (Baker, 2017). Not long after, the Joint Commission, in conjunction with the National Pharmaceutical Council, released guidelines on assessing, reporting, and treating pain (National Pharmaceutical Council, 2001). Five years later, the Centers for Medicare and Medicaid Services (CMS) implemented Hospital Consumer Assessment of Healthcare Providers and Systems (HCAHPS) surveys to assess healthcare experience from the patient's perspective. Three questions on the survey related to pain

management and control (CMS, 2018). The next year, hospital reimbursement from CMS was related to HCAHPS scores (Theisen et al., 2018).

At the same time regulations were incentivizing pain treatment, pharmaceutical companies were aggressively marketing drugs like OxyContin directly to consumers (Haffajee & Mello, 2017). From 1999 to 2015, the amount of opioid prescribed by physicians tripled (Guy et al., 2017). Since 2004, Purdue Pharma, Cardinal Health, Insys Therapeutics, McKesson, and Mallincrodt have settled seven state/local lawsuits and four federal suits for misbranding, false-advertising, and kickbacks to prescribers (Haffajee & Mello, 2017). Paradoxically, restrictions on scheduled medication prescribing may have contributed to overprescribing. Until 2015, the only way to give a patient a prescription for an opioid in a Midwestern state was with a hand-written prescription. Surgeons likely provided written prescriptions for opioids after surgery "just in case" since the logistics of obtaining a prescription after discharge would be difficult for both patient and provider.

Since the release of the CDC's Opioid Prescribing Guidelines for Chronic Pain in 2016, rate of high dose prescription (> 90 MMEs per day), concurrent benzodiazepine prescription, and overall rate of opioid prescription has fallen in the U.S. (Bohnert, Guy, & Losby, 2018). However, the CDC guidelines do not address opioid prescribing after surgery. Guidelines for surgical procedures have been proposed by groups such as the Michigan Surgical Quality Collaborative (Michigan Surgical Quality Collaborative, 2018) and the Center for Opioid Research and Education (Center for Opioid Research and Education, 2018). These guidelines made recommendations for common surgical

procedures, but do not include any gynecologic procedures commonly performed on an outpatient basis.

At the institutional level, several quality improvement initiatives have successfully resulted in decreased initial opioid prescription. Hill, Stucke, Mcmahon, Beeman, and Barth (2018), presented institution-specific data gathered in a previous study on opioid prescription variability and over prescription following surgery to their surgeons during grand rounds. In their educational intervention, they encouraged prescribers to recommend acetaminophen and NSAIDs first, and only use opioids for breakthrough pain. After the intervention, opioid prescription fell 53%, and the number of refills requested by patients did not increase (Hill, Stucke, McMahon, Beeman, & Barth, 2018). Another study found implementing evidence-based opioid prescription guidelines for one surgery had unintended effects on prescription practices following other types of surgeries, and decreased prescription in four other procedures without significantly increasing requests for refills (Howard, et al., 2018).

Chiu, Jean, Hoag, Freedman-Weiss, Healy, and Pei examined the effects of lowering the default number of opioid pills in the electronic medical record (EMR) when prescribing discharge analgesics (Chiu et al., 2018). In this study, the autopopulated number of pills in the EMR was decreased from 30 to 12, forcing prescribers to manually enter a number greater than 12, if additional pills were required. After the EMR change, the median number of opioid pills prescribed fell from 30 to 20, without a statistically significant change in refill requests (Chiu et al., 2018).

One theme emerged from the literature review regarding a lack of patient education on appropriate disposal of unused opioids. Since pain tolerance varies from

person to person, it is impossible to predict the exact number of opioids required for each person. Even if initial opioid prescription was decreased, some patients would still have excess pills. A quality improvement initiative at Washington University in St. Louis sought to address this problem with a low cost, easily implementable intervention (Hasak, et al., 2017). The intervention included dissemination of an opioid-disposal brochure to patient at the time surgery was scheduled and again at the time of discharge (Hasak et al., 2017). After the intervention, the number of patients who reported disposing of their unused medications appropriately doubled (Hasak et al., 2017).

This project used a Plan-Do-Study-Act framework for implementing change. This four-step cycle emphasizes continuous improvement of a product, process, or service. During the first step, plan, goals and success metrics are identified. During the second step, do, the plan is implemented. During the third step, study, outcomes are measured and successes and failures are identified. During the last step, act, the intervention is scaled-up or the goals and methods are adjusted and the cycle begins again (Deming Institute, 2018).

Method

Design

This quality improvement project utilized a descriptive cohort design for the survey portion and an uncontrolled before-and-after intervention study design for tracking prescribing changes. A retrospective medical record review of all eligible charts from July 1- September 30, 2018 was completed. Two attempts were made to contact all patients identified by the review as having met the inclusion criteria and having been prescribed opioids at discharge by phone. The results of the phone survey were used to

develop educational posters for prescribers. After the posters were displayed, another retrospective medical record review was completed to examine changes in prescribing patterns. The post-intervention data was collected from February 1- April 30, 2019.

Setting

The setting for this project was a privately-owned ambulatory surgery center (ASC) in a Midwestern, suburban area. The center was originally founded as a gynecology-only facility, and, despite expanding to include other specialties, maintains a large percentage of gynecology cases, approximately 1200 cases per year. The facility is part of a larger network of ASCs and is not part of an academic medical center.

Sample

A convenience sample of female patients from July 1, 2018 through September 30, 2018, who were 18-years of age and older, who underwent HDC, UA, or LAP, and whose procedure was performed by an obstetrician/gynecologist at the surgery center. Exclusionary criteria included self-report of opioid use as a home medication on the admission record, other gynecological surgeries, or age less than 18-years. For the survey phone call, convenience sampling was also used. Two attempts were made to contact all patients identified in the chart review as having received an opioid prescription at discharge. Exclusionary criteria for the phone survey included: non-English speaking or no working phone number listed in the chart.

Procedures

A team was assembled including nurses, physicians, and the board of directors at the Midwestern surgical center. The proposal was first submitted for feedback on

feasibility and appropriateness to the board in September, 2018. Feedback was incorporated into the project proposal.

Prior to disseminating data, a medical record review and telephone survey compared opioid prescription with opioid consumption. All patients logged received a random and unique identifier (1-1100) using randomizer.org. Since it was necessary to link patients who received an opioid to the information collected from their medical record, a hand-written key was created listing each participant's identifier, name, and phone number. The key was kept in a locked box within a locked cabinet in the medical records storage room. Only the coordinator of the project had access to this box. The key will be destroyed by shredding in 2022, per recommendation of the institutional review board (IRB). Data extracted from the medical record included: demographics data (age, race, date of surgery, procedure type, physician), type of opioid prescribed, dosage, and number of pills.

After the chart review was completed, up to three attempts were made to contact eligible participants (those that received an opioid and did not meet any exclusionary criteria) by phone. If contact was made, and patients verbally agreed to participate in the survey over the phone, three questions were asked and recorded. Questions included: did they fill their prescription; how many pills were left over after their surgical pain resolved; and did they receive disposal instructions?

After all information was collected from the medical records and patient surveys, the amount of opioid prescribed and consumed was converted to MMEs. For those prescribed opioids, the median number of MMEs prescribed was compared the median

number of MMEs consumed. All data collected was stored on a password-protected computer.

Once the data was collected and analyzed it was disseminated to OB/GYNs and nurses along with information on the consequences of over prescription through handouts, and via signage in the locker rooms and break room at the project site. Dissemination of information took place in January 2019, and continued throughout the duration of the study. Signage was updated monthly.

To determine if dissemination of this information resulted in any practice change, opioid prescribing was tracked for three months after the education was provided: February 1 through April 30, 2019. The following variables were compared pre- and post-intervention:

1. Percentage of patients receiving opioid prescription following HDC
2. MMEs prescribed, when opioids were prescribed, following HDC, UA, and LAP

Data from the chart reviews was compared pre/post intervention using chi squared and t-tests.

Approval Process

This project was approved by the board of directors and compliance department at the project site on September 17, 2018, and by the University IRB in December, 2019. During the board meeting, one consideration of concern was that patients receiving the phone survey may believe their personal phone numbers had been "sold" to an outside company. To mitigate this risk, the person conducting the phone calls identified herself as an employee of the surgery center since this was a fact. Another risk was the potential for breach of confidentiality. To prevent this, all personal identifiers were removed from

the data collected. The projected benefits of this project were numerous and included: increased awareness of the consequences of over-prescription; development of gynecology specific recommendations for postoperative opioid prescription; a decrease in over prescription; and fewer unused pills resulting in less potential for misuse and diversion.

Results

A total of 526 medical records were reviewed (*N*=526). There were 203 patients identified for the pre-intervention HDC group. Ten medical records were not available leaving 193 medical records reviewed for the pre-intervention HDC cohort (*n*=193). There were 179 identified for the post-intervention HDC group. Eleven medical records were not available, and three patients were excluded for opioid use on admission, leaving 165 medical records for the post-intervention HDC cohort (*n*=165). For those receiving a UA, 47 patients were initially identified for the pre-intervention group. One medical record was unavailable and one patient was excluded for opioid use on admission, resulting in 45 medical records for the pre-intervention UA cohort (*n*=45). For the postintervention group, 50 medical records were identified, and all met the inclusion criteria for the post-intervention UA cohort (*n*=50). For LAP, 40 medical records were identified for the pre-intervention cohort (*n*=40) and 33 medical records were identified for the post-intervention LAP cohort (*n*=33). Finally, 45 patients consented to, and participated in the post-surgical telephone survey (*N*=45).

There were no statistically significant differences between the pre-intervention cohorts and the post-intervention cohorts in race or age. Most patients were Caucasian (*n*= 475, 84.8% – 93.3%), followed by Black (*n*= 27, 0% - 7.3%), then Asian (*n*= 12, 0%

- 7.5%), and Hispanic (*n*=7, 0% - 4.4% (appendix B). All patients were female. The range of ages was 20 to 87 years. The mean age for HDC was 50.8 years (*SD*=11.4) and 49.2 years (*SD*=11.4) in the pre- and post- intervention cohorts respectively. For the UA cohort, the mean age for the pre-intervention cohort was 43.6 years (*SD*=6) and post-intervention was 42.4 years (*SD*=5.7). Finally, the average age for the pre-intervention LAP cohort was 38.3 years (*SD*=10.3) and post-intervention was 37.4 years (*SD*=9.0) (appendix B).

In the pre-intervention cohorts, there were no reports of unrelieved pain on postoperative day one for any patient who underwent HDC (*n*= 193) regardless of receipt of opioid prescription at discharge. Of the HDC patients, 45 received a prescription for opioids (23.3%). When opioids were prescribed, the median amount of MMEs prescribed was 75 (*M*=85.6; *SD*=47.1). Of those 45 patients, 18 (40%) consented to and completed the telephone survey. The median number of MMEs reported to be consumed by the surveyed group was zero. For those who underwent a UA, 36 (80%) patients received a prescription for opioids following the procedure. For those patients the median amount of MMEs prescribed was 112.5 (*M*=119.2; *SD*=53.4). Of the 36 patients, nine consented to and completed the telephone survey (25%). The median MMEs reported to be consumed by those surveyed was 60 (*M*=68.5; *SD*=60.4). Most patients (85%) who underwent a UA reported taking 100 MMEs or fewer. Finally, 38 (95%) patients received a prescription for opioids following LAP. For those patients, the median MMEs prescribed was 150 (*M*=142.2; *SD*=49.3). Of those patients, 18 (47%) consented to the telephone survey. The median MMEs consumed by those surveyed was reported to be 33.7 (*M*=43.4; *SD*=42.7) (appendix C). Most patients (90%) took fewer than 90 MMEs following LAP.

Chi-squared analysis was used to compare the percentage of patients who received an opioid at discharge following HDC before and after the intervention and to compare patient report of uncontrolled pain on post-operative day one or two follow up call before and after the intervention. The percentage of patients who received an opioid at discharge following HDC decreased from 23.3% to 16.4% (p = .001). Most of the decreased prescription for HDC was seen in the final month of the chart review (appendix D). In fact, there was only one prescription for opioids following HDC in April. There was no statistically significant difference in patient report of uncontrolled pain on post-operative day one or two follow-up call before and after the intervention (p = .2974) (appendix F).

To compare the mean MME prescribed pre- and post-intervention, an unpaired-samples *t* test was performed for each of the three procedures. The mean MME prescribed for HDC decreased 34% from 85.6 (*SD*=47.1) in the pre-intervention cohort to 56.4 (*SD*=31.9) in the post-intervention cohort. The difference between the two means was statistically significant at the .05 level (*t*=3.131, *df*=68.8717, *p*=.001). For the UA cohorts, the mean MME prescribed decreased 19% from 119.2 (*SD*=53.4) pre-intervention to 96.6 (*SD*=43.6) post-intervention. The difference between the two means was statistically significant at the .05 level (*t*=2.008, *df*=67.7.7202, *p*=.034). Last, in the LAP cohort, the mean MME prescribed decreased 14% from 142.4 (*SD*=49.3) pre-intervention to 121.7 (*SD*=46.4) post-intervention. The difference between these two means was also statistically significant at the .05 level (*t*=1.746, *df*=67.128, *p*=.039) (appendix E).

Discussion

Providing monthly data to the outpatient surgical group appeared to be effective in changing prescribing opioid habits for HDC, UA, and LAP patients. Based on the results of this study, the recommended number of MMEs to be prescribed following outpatient gynecologic surgery is: Zero for HDC procedures, 100 (or 13 Percocet, 5 mg equivalents) for UA procedures, and 90 (or 12 Percocet, 5 mg equivalents) for LAP procedures. After posters of patient survey data were placed throughout the surgical center and distributed to physicians and nurses, the amount of opioids prescribed fell significantly for all three procedures. For HDC, the number of patients who received an opioid at discharge decreased 6.9% (p = .001). When opioids were prescribed after UA and LAP the mean MME prescribed decreased 19% and 14% (p=.034; LAP: p= .039), respectively. Interestingly, the longer the posters were displayed, the greater decrease in opioid prescription. In fact, for HDC, there was no significant decrease in the percentage of patients who received a prescription until the third and final month of the study when only one patient received a prescription for opioids. The results of this project were consistent with opioid quality initiatives attempted at other institutions.

One common apprehension voiced by prescribers was concern about the risk of under prescribing and uncontrolled pain. Despite the reductions in opioid prescriptions seen in this project, there was no increase in reports of uncontrolled pain or requests for additional medications. This is consistent with previous studies. While pain, especially post-surgical pain is of concern, dispelling the myth that all post-surgical patients need an opioid is recommended.

Several practice guidelines for postsurgical opioid prescription have been released and revised in the last few years, however, these large-scale studies did not include specialty surgical procedures performed on an outpatient basis. A goal for future practice should include the development of practice guidelines for surgical specialty procedures, such as gynecological procedures, based on evidence. Often specialty procedures are performed in outpatient surgical centers not affiliated with academic hospitals, making research support difficult. Recommendations for further study include larger scale studies for specialty-specific surgeries and postoperative pain prescribing habits for minor to major procedures and in different types of surgical settings. Further study is also needed in patient disposal of unused opioids since the overall aim is to decrease the number of opioids available for public consumption.

Conclusion

This outpatient women's surgical center established an opioid prescription practice for postsurgical HDC, UA, and LAP pain control. While postoperative surgical pain is of concern, there are procedures performed with little resulting pain. Improved knowledge regarding the types of procedures not needing an opioid or needing only a few opioids may decrease the number of opioids prescribed. Prescribing healthcare providers can play a vital role in decreasing the number of available opioids to the general public.

References

Baker, D.W. (2017). The Joint Commission's pain standards: Origins and evolution. *The Joint Commission.* Retrieved from https://www.jointcommission.org/assets/1/6/Pain_Std_History_Web_Version_05122017.pdf

Bicket, M. C., Long, J. J., Pronovost, P. J., Alexander, G. C., & Wu, C. L. (2017). Prescription opioid analgesics commonly unused after surgery. *JAMA Surgery, 152*(11), 1066. doi:10.1001/jamasurg.2017.0831

Bohnert, A. S., Guy, G. P., & Losby, J. L. (2018). Opioid prescribing in the United States before and after the Centers for Disease Control and Preventions 2016 Opioid Guideline. *Annals of Internal Medicine*. doi:10.7326/m18-1243

Brat, G. A., Agniel, D., Beam, A., Yorkgitis, B., Bicket, M., Homer, M., . . . Kohane, I. (2018). Postsurgical prescriptions for opioid naive patients and association with overdose and misuse: Retrospective cohort study. *BMJ*. doi:10.1136/bmj.j5790

Brummett, C. M., Waljee, J. F., Goesling, J., Moser, S., Lin, P., Englesbe, M. J., . . . Nallamothu, B. K. (2017). New persistent opioid use after minor and major surgical procedures in US adults. *JAMA Surgery, 152*(6). doi:10.1001/jamasurg.2017.0504

Center for Opioid Research and Education. (2018). *Surgical opioid guidelines.* Retrieved from https://www.solvethecrisis.org/best-practices

Centers for Disease Control and Prevention, National Center for Injury Prevention and Control. (2018). *2018 Annual Surveillance Report of Drug Related Risks and Outcomes.* Retrieved from https://www.cdc.gov/drugoverdose/pdf/pubs/2018-cdc-drug-surveillance-report.pdf

Centers for Medicare and Medicaid Services. (2018). *Hospital Consumer Assessment of Healthcare Providers and Services.* Retrieved from https://www.hcahpsonline.org/

Chiu, A. S., Jean, R. A., Hoag, J. R., Freedman-Weiss, M., Healy, J. M., & Pei, K. Y. (2018). Association of lowering default pill counts in electronic medical record systems with postoperative opioid prescribing. *JAMA Surgery*. doi:10.1001/jamasurg.2018.2083

Deming Institute. (2018). *PDSA cycle*. Retrieved from https://deming.org/explore/p-d-s-a

Feinberg, A. E., Chesney, T. R., Srikandarajah, S., Acuna, S. A., & Mcleod, R. S. (2018). Opioid use after discharge in postoperative patients. *Annals of Surgery, 267*(6), 1056-1062. doi:10.1097/sla.0000000000002591

Fujii, M. H., Hodges, A. C., Russell, R. L., Roensch, K., Beynnon, B., Ahern, T. P., . . . Maclean, C. D. (2018). Post-discharge opioid prescribing and use after common surgical procedure. *Journal of the American College of Surgeons, 226*(6), 1004-1012. doi:10.1016/j.jamcollsurg.2018.01.058

Guy, G. P., Zhang, K., Bohm, M. K., Losby, J., Lewis, B., Young, R., . . . Dowell, D. (2017). Vital signs: Changes in opioid prescribing in the United States, 2006–2015. *MMWR. Morbidity and Mortality Weekly Report, 66*(26), 697-704. doi:10.15585/mmwr.mm6626a4

Haffajee, R. L., & Mello, M. M. (2017). Drug companies' liability for the opioid epidemic. *New England Journal of Medicine, 377*(24), 2301-2305. doi:10.1056/nejmp1710756

Han, B., Compton, W. M., Blanco, C., Crane, E., Lee, J., & Jones, C. M. (2017). Prescription opioid use, misuse, and use disorders in U.S. adults: 2015 national survey on drug use and health. *Annals of Internal Medicine, 167*(5), 293. doi:10.7326/m17-0865

Hasak, J. M., Bettlach, C. L., Santosa, K. B., Larson, E. L., Stroud, J., & Mackinnon, S. E. (2018). Empowering post-surgical patients to improve opioid disposal: A before and after quality improvement study. *Journal of the American College of Surgeons, 226*(3). doi:10.1016/j.jamcollsurg.2017.11.023

Hill, M. V., McMahon, M. L., Stucke, R. S., & Barth, R. J. (2017). Wide variation and excessive dosage of opioid prescriptions for common general surgical procedures. *Annals of Surgery,265*(4), 709-714. doi:10.1097/sla.0000000000001993

Hill, M. V., Stucke, R. S., Mcmahon, M. L., Beeman, J. L., & Barth, R. J. (2018). An educational intervention decreases opioid prescribing after general surgical operations. *Annals of Surgery,267*(3), 468-472. doi:10.1097/sla.0000000000002198

Howard, R., Alameddine, M., Klueh, M., Englesbe, M., Brummett, C., Waljee, J., & Lee, J. (2018). Spillover effect of evidence-based postoperative opioid prescribing. *Journal of the American College of Surgeons, 227*(3), 374-381. doi:10.1016/j.jamcollsurg.2018.06.007

Michigan Surgical Quality Collaborative, Opioid Prescribing Engagement Network. (2018). *Opioid prescribing recommendations for surgery.* Retrieved from https://opioidprescribing.info/

Muhuri, P.K., Groefrer, J.C.,& Davies, M.C. (2013). Associations of nonmedical pain reliever use and initiation of heroin use in the United States. *CBHSQ Data Review.* Retrieved from https://www.samhsa.gov/data/sites/default/files/DR006/DR006/nonmedical-pain-reliever-use-2013.htm

National Pharmaceutical Council, Inc. & Joint Commission. (2001). *Pain: Current understanding of assessment, management, and treatment.* Retrieved from https://www.npcnow.org/system/files/research/download/Pain-Current-Understanding-of-Assessment-Management-and-Treatments.pdf

Seth, P., Rudd, R. A., Noonan, R. K., & Haegerich, T. M. (2018). Quantifying the epidemic of prescription opioid overdose deaths. *American Journal of Public Health, 108*(4), 500-502. doi:10.2105/ajph.2017.304265

Tan, W. H., Yu, J., Feaman, S., Mcallister, J., Kahan, L. G., Quasebarth, M., . . . Brunt, M. (2017). Opioid medication use in the surgical patient: An assessment of prescribing patterns and utilization. *Journal of the American College of Surgeons, 225*(4). doi:10.1016/j.jamcollsurg.2017.07.771

Theisen, K., Jacobs, B., Macleod, L., & Davies, B. (2018). The United States opioid epidemic: A review of the surgeon's contribution to it and health policy initiatives. *BJU International*. doi:10.1111/bju.14446

Thiels, C. A., Ubl, D. S., Yost, K. J., Dowdy, S. C., Mabry, T. M., Gazelka, H. M., . . . Habermann, E. B. (2018). Results of a prospective, multicenter initiative aimed at developing opioid-prescribing guidelines after surgery. *Annals of Surgery, 268*(3), 457-468. doi:10.1097/sla.0000000000002919

United States Department of Health and Human Services. (2017). *Determination that a public health emergency exists.* Retrieved from https://www.hhs.gov/sites/default/files/opioid%20PHE%20Declaration-no-sig.pdf

Appendix A

Milligrams Morphine Equivalent (MME) Conversion Chart for Selected Opioids

Type of Opioid (unit of measurement)	**MME Conversion Factor**
Codeine (mg)	0.15
Hydrocodone (mg)	1
Morphine (mg)	1
Oxycodone (mg)	1.5
Tramadol (mg)	0.1

Reference

Centers for Medicare and Medicaid Services. (2016). *Opioid oral morphine milligram equivalent (MME) conversion factors.* Retrieved from https://www.cms.gov/Medicare/Prescription-DrugCoverage/PrescriptionDrugCovContra/Downloads/Opioid-Morphine-EQ-Conversion-Factors-Aug-2017.pdf

Appendix B

Table 1.
Patient Characteristics Before and After Intervention

	Pre -Intervention			*Post-Intervention*		
	HDC (*n=193*)	UA *(n = 45)*	LAP *(n = 40)*	HDC *(n = 165)*	UA *(n = 50)*	LAP *(n = 33)*
Mean Age (*SD*)	50.8 (11.4)	43.6 (6.0)	38.3 (10.3)	49.2 (11.4)	42.4 (5.7)	37.4 (9.0)
p value				.1864	.3202	.6954
Race						
American Indian/ Alaska Native	0; 0%	0; 0%	0; 0%	0; 0%	0; 0%	0; 0%
p value				1.0	1.0	1.0
Asian	2; 1.0%	0; 0%	3; 7.5%	6; 3.6%	0; 0%	1; 3.0%
p value				.0949	1.0	.4301
Black or African American	9; 4.7%	1; 2.2%	2; 5%	12; 7.3%	0; 0%	3; 9.1%
p value				.3543	.2943	.5025
Hispanic or Latino	2; 1.0%	2; 4.4%	0; 0%	3; 1.8%	0; 0%	0; 0%
p value				.5167	.1360	1.0
Native Hawaiian or Pacific Islander	0; 0%	0; 0%	0; 0%	0; 0%	0; 0%	0; 0%
p value				1.0	1.0	1.0
White	177; 91.7%	42; 93.3%	35; 87.5%	143; 86.7%	50	28; 84.8%
p value				.1261	.0643	.7403
Not Recorded	3; 1.6%	0; 0%	0; 0%	1; 0.6%	0; 0%	1; 3%
p value				.3748	1.0	.2734

Appendix C

Table 2.
Third Quarter 2018 Survey of Patients Prescribed Opioids

	HDC (n = 45)	UA (n = 36)	LAP (n = 38)
Number of patients contacted n (%)	18 (40%)	9 (25%)	18 (47%)
Prescription vs Consumption			
Prescribed MME			
Mean (SD)	85.6 (47.1)	119.2 (53.4)	142.4 (49.3)
Median	75	112.5	150
Consumed MME			
Mean (SD)	24.3 (54.3)	68.5 (60.4)	43.4 (42.7)
MME	0	60	33.75
MMEs consumed by 85th percentile and below		100	90

Note. Two surveyed patients in the UA group could not remember how many opioid pain pills were taken after discharge following their procedure.

Appendix D

Table 3.1.

Percentage of Patients Receiving an Opioid at Discharge Pre/Post-intervention Following HDC, by Month

	Preintervention n = 193	Feb n = 54	March n = 49	April n = 62	Postintervention Feb – March Combined
N	45	13	13	1	27
%	23.3	24.1	26.5	1.6	16.4
p value		.6272	.6400	.0001	0.001

Appendix E

Table 3.2
Mean MME when Opioids were Prescribed, Pre/Post-intervention

	Preintervention	Postintervention	Decrease	p value
HDC				
n	45	27		
mean	85.6	56.4	29.2	.001
standard deviation	47.1	31.9		
UA				
n	36	40		
mean	119.2	96.6	22.6	.034
standard deviation	53.4	43.6		
LAP				
n	38	32		
mean	142.4	121.7	19.7	.039
standard deviation	49.3	46.4		

Note. The mean MME prescribed for HDC decreased from 85.6 (*SD*=47.1) in the pre-intervention cohort to 56.4 (*SD*=31.9) in the post-intervention cohort. The difference between the two means was statistically significant at the .05 level (t=3.131, df=68.8717, p=.001). For the UA cohorts, the mean MME prescribed decreased from 119.2 (*SD*=53.4) pre-intervention to 96.6 (*SD*=43.6) post-intervention. The difference between the two means was statistically significant at the .05 level (t=2.008, df=67.7.7202, p=.034). Last, in the LAP cohort, the mean MME prescribed pre-intervention was 142.4 (*SD*=49.3) and compared to the mean in the post-intervention cohort of 121.7 (*SD*=46.4). The difference between these two means was also statistically significant at the .05 level (t=1.746, df=67.128, p=.039).

Appendix F

Table 3.3.
Pain Controlled on Postoperative Day One: All Patients

	Preintervention n = 278	Postintervention n = 248
No report of uncontrolled pain		
n	277	245
%	99.6	98.8
Reported uncontrolled Pain		
n	1	3
%	0.4%	1.2%
p value		.2974

Note. *No report of uncontrolled pain* included all patients marked on the day one or two postoperative call as "pain unrelieved with medications." Everyone else, including those who were not available by phone were included in the "No report of uncontrolled pain."

Appendix G

Figure 1.

Number of Opioid Pain Pills Prescribed Before and After Intervention

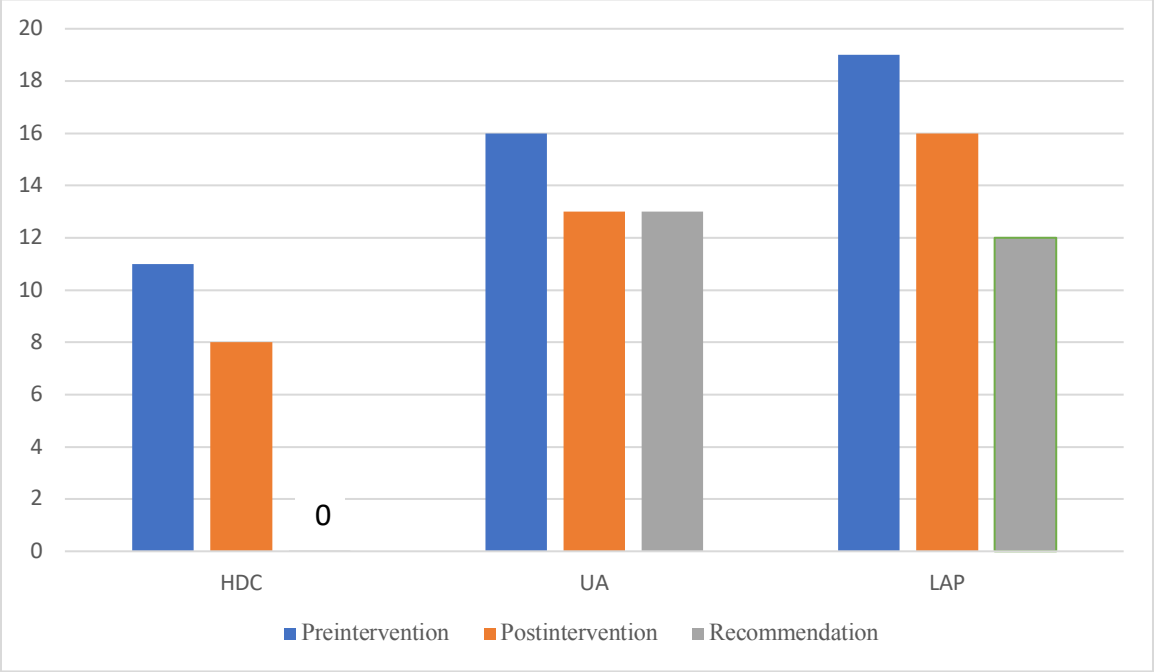

Figure 4. This is a chart of the MMEs converted into their Percocet 5mg equivalents using the "MME Equivalency Chart" provided by the Centers for Medicare and Medicaid Services. (2016). *Opioid oral morphine milligram equivalent (MME) conversion factors.* Retrieved from https://www.cms.gov/Medicare/Prescription-DrugCoverage/PrescriptionDrugCovContra/Downloads/Opioid-Morphine-EQ-Conversion-Factors-