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Trends in Patient Procurement of Postoperative Opioids and Route of Hysterectomy in the United States from 2004 to 2014

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Abstract

Background: The opioid epidemic in the United States is a public health emergency. Minimally invasive surgical technology has decreased length of hospital stay, improved postoperative

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While the proportion of minimally invasive routes of hysterectomy have increased over time, the proportion of opioid prescriptions filled have increased between 2004 to 2014.

recovery, and decreased postoperative pain. Hysterectomy is one of the most commonly performed surgeries in the United States. Increasing trends in minimally invasive gynecologic surgery are expected to reduce patients' postoperative pain. It is unclear whether this assumption has resulted in decreasing post-operative opioid prescriptions or patient need for these prescriptions, as prescribing patterns may be contributing to the current opioid public health emergency.

Objectives: To describe opioid prescribing and patient procurement practices for postoperative pain at time of discharge for benign hysterectomy from 2004 to 2014 using the Truven Health Analytics MarketScan® Research Database. The trends of the route of hysterectomy over this time period were concomitantly described to reflect the movement toward more minimally invasive approaches.

Study Design: The Truven Health Analytics MarketScan® Research Database including the Commercial Claims and Encounters Database, and the Medicare Supplemental and Coordination of Benefits Database were utilized. Current Procedural Terminology (CPT4) and International Classification of Diseases 9th revision (ICD-9) codes identified all patients who underwent a hysterectomy for benign indications between 2004 to 2014. Hysterectomy routes were categorized into abdominal, laparoscopic, and, vaginal. The days of opioids supplied at the time of discharge were identified for each encounter. Descriptive statistics were used to summarize data within the entire study period. Although this paper is purely descriptive, further analyses were conducted for exploratory purposes only. ANOVA and chi-squared analyses were used for continuous and categorical variables respectively. Multiple linear regression models were used to describe associations between variables of interest and postoperative opioid prescriptions.

Results: We identified 793,016 patients who underwent a hysterectomy for benign indications between 2004 and 2014. Of these, 96% were identified from the Commercial Claims and Encounters Database. During the study period, the overall route of hysterectomy was categorized into 40.5% abdominal, 42.0% laparoscopic, 17.5% vaginal hysterectomy. The route of hysterectomy changed from 60.2% to 25.6% (a decrease of $\beta=34.58$; 95% C.I. 33.96–35.20) for abdominal, 17.0% to 61.9% (an increase of $\beta=44.83$; 95% C.I. 44.21–45.44) for laparoscopic, and 22.8% to 12.6% (a decrease of $\beta=10.25$; 95% C.I. 9.77–10.73) for vaginal. At discharge, the percentage of patients who were prescribed opioids and filled them increased from 25.6% to 82.1% (an increase of $\beta=56.50$; 95% C.I. 55.88–57.13 with $p < 0.001$) from 2004 to 2014 for all hysterectomy routes. Additionally, the quantity of opioids prescribed also increased.

Conclusion: Opioid prescriptions filled for postoperative pain after hysterectomy substantially increased between 2004 and 2014. Opioid prescription procurement has increased despite a concomitant increase in minimally invasive hysterectomy routes. In light of the current opioid epidemic, physicians must recognize that postoperative prescribing practices may contribute to chronic opioid use. Heightened awareness of opioid prescribing practices following surgery is critically important to decrease risk of development of chronic opioid dependence.

Introduction

The United States is in the midst of an opioid epidemic, now classified as a public health emergency [1]. The evolution of opioid prescribing practices involves a complicated history of the Joint Commission and state medical boards' stance on evaluating and treating pain, pharmaceutical companies' influence without adequate evidence, and a movement towards a

right to pain relief [2–5]. Currently, the United States leads the world in opioid consumption accounting for 80% of all prescriptions, dispensing 650,000 opioid prescriptions each day [6, 7]. As a result, increased non-medical opioid use and abuse have led to a rapid increase in death due to opioid-related overdose. Since the year 2000, deaths from drug overdose have increased 137%, including a 200% increase in the rate of overdose deaths involving opioids—approximately 91 deaths each day [8, 9]. The long-term implications of opioid prescribing practices must be investigated in order to have any possibility of achieving meaningful change.

Prescribing opioids for postoperative pain is a widely accepted practice. Historically, opioid-naïve patients were considered immune to long-term opioid use disorder (OUD) when treated for acute and postoperative pain. However, more evidence suggests that this is not a definite rule [10–12]. In general, characteristics of patients at risk for long-term OUD, after the initial prescription, include older women, a pain diagnosis prior to opioid initiation, and higher first prescription dosages [13]. After major elective surgeries, approximately 50% of patients are prescribed opioids and 3% of those patients continue to use opioids after their postoperative period [11]. Additional risks of prolonged opioid use have included lower socioeconomic status, chronic medical conditions, drug and alcohol abuse, and use of antidepressants and benzodiazepines preoperatively [11, 12]. Postoperative pain management is often a patient's first experience with opioids, so these risk factors for long-term use are critical for providers to understand.

Hysterectomy is one of the most common gynecologic surgeries performed in the United States [14–17]. While trends in gynecologic surgery aim to reduce patients' postoperative pain, it is unclear whether this has translated into decreased opioid use postoperatively. Given the public health emergency in opioid abuse, it is incumbent upon providers to evaluate how opioids are prescribed postoperatively. Therefore, the primary aim of this study was to describe trends in postoperative opioid prescribing practices as well as patient procurement of postoperative opioids after discharge for benign hysterectomy in the United States from 2004 to 2014. Given the background of increases in opioid use and abuse, we decided to explore the possibility that despite minimally invasive routes of hysterectomy have increased over time, the amount of opioids prescribed at the time of discharge have not decreased during the same time period.

Materials and Methods

We analyzed the Truven Health MarketScan® Research Database including the MarketScan Commercial Claims and Encounters Database, and the Medicare Supplemental and Coordination of Benefits Database. The MarketScan Commercial Claims and Encounters Database contains data from active employees, early retirees, Consolidated Omnibus Budget Reconciliation Act (COBRA) continuees, and dependents who are insured by employer-sponsored plans (i.e., persons not eligible for Medicare). The MarketScan® Medicare Database contains the pooled healthcare experience of over nine million Medicare enrollees from multiple states. It includes outpatient and inpatient services and prescription drug claims, as well as information on enrollment, long-term care, and other medical care [18]. This study was determined as Institutional Review Board exempt by the University of New

Mexico Human Research Review Committee (Study ID 17–319), as all information through MarketScan is de-identified.

We used Current Procedural Terminology (CPT4) and International Classification of Diseases 9th revision (ICD-9) codes to identify all patients who underwent a hysterectomy for benign indications between January 1, 2004 to September 30, 2014. The rationale for this timeframe was to include the earliest data available until the implementation of ICD-10 codes. The complete list of CPT4 and ICD-9 codes is included in Appendix I. To identify subjects' preoperative opioid use, utilizing the year before each hysterectomy, the entire study period was shifted to include an extra year covering January 1, 2003 throughout September 30, 2014. We excluded hysterectomies performed for malignancy or associated with an obstetrical delivery by excluding keywords such as *radical hysterectomy*, *cesarean hysterectomy*, and *lymph node dissection*. The postoperative pain management for oncologic patients and procedures coincident with pregnancy and delivery were considered inherently different than routine indications to represent a more homogenous cohort. Furthermore, we assumed that missing values were missing completely at random (MCAR) or missing at random (MAR) and hence we omitted all cases with missing values from the analysis.

Hysterectomy type was categorized into abdominal, laparoscopic, and vaginal. These categories were used to reflect the most invasive approach by incision type. Robotic hysterectomies were categorized as “laparoscopic”. “Other” hysterectomy was excluded from the analysis because this accounted for only 0.5% of the hysterectomy types and no further descriptive details regarding route or concomitant procedures were available for interpretation. If an encounter included more than one hysterectomy code, the most invasive approach was assigned as the category, so each hysterectomy was only accounted for once, to maintain mutually exclusive groups. The investigators assigned the order of invasiveness from least to most invasive as follows; vaginal (least invasive) laparoscopic (intermediately invasive) to abdominal (most invasive). For example, if an encounter included both vaginal and laparoscopic hysterectomy codes, the encounter was categorized as laparoscopic.

Demographics included patient age, year of surgery, insurance type, length of hospital stay (LOS), US region, and preoperative history of opioid use. Patient *age* was categorized into the following groups: 20–40, 41–60, and greater than 61 years old. *Length of hospital stay* was defined with day 0 as the date of hysterectomy until date of discharge. If a patient was discharged home at the same day of surgery, the length of hospital stay was 0. *Insurance* type was described as either Medicare or Commercial Insurance based on the MarketScan database source. *US regions* were divided into northeast, south, midwest, and west as defined by the US census [19]. A *preoperative history of opioid use* was defined as prescriptions for opioids that were given within 12 months prior to time of hysterectomy.

Additionally, the *postoperative period* was defined as 90 days after discharge from the hospital. The opioids quantified in the postoperative period represented outpatient prescriptions filled following discharge. The MarketScan database only captures prescriptions filled at a retail or mail order pharmacy and does not capture prescriptions filled within the inpatient, hospital facility. Inpatient opioid use was not included in the postoperative opioid use. Pharmacy claims data include the fill date, quantity supplied, and

number of days supplied. *Days supplied* was used to reflect the total amount of opioids prescribed and filled by the patient as described in previous studies using the MarketScan database for opioid practice patterns [12, 20, 21]. Mean *days supplied* is used instead of oral morphine equivalents, because of the study design to consolidate the opioid filled by ingredient which did not consider the dosage. Of note, additional prescriptions may have been written by physicians postoperatively, but the database only reflects those that were filled by the patient.

Descriptive statistics were used to summarize demographic data within the entire study period. Preoperative chronic opioid use was a dichotomous variable. Although this paper is purely descriptive, further analyses were conducted for exploratory purposes only. For example, Analysis of Variance (ANOVA) was used to compare the means of three or more groups with respect to continuous variables while chi-squared testing was used to examine associations between categorical variables. Multiple linear regression was used to describe associations between variables of interest and postoperative opioid prescriptions over time. We used the Breusch-Pagan test for heteroscedasticity to validate the constant variance assumption of the linear regression modeling while relaxing the normality assumption. Specifically, due to the large sample size of the used data, we use 100 random subsets of 5000 observations to conduct Breusch-Pagan test in analogous to suggested recommendations for other assumption tests [22–25].

Results

We identified 796,726 patients who underwent a hysterectomy for benign indications between 2004 and 2014. The category “other” hysterectomy was excluded from the analysis which accounted for 3,710 encounters, approximately 0.5% of the hysterectomies. Therefore, 793,016 encounters were included in the analysis and categorized as abdominal, laparoscopic, and vaginal hysterectomies. Table 1 describes the demographic data including age, length of stay, US region, preoperative opioid use, and insurance type. The mean age in this study was 45.3 ± 9.36 (St. Dev.) years for all hysterectomy types. The southern region accounted for 50% of all hysterectomies. Length of stay showed wide variance among all hysterectomy types from 0 to 475 days. Patients discharged home within 21 days accounted for 99.9%. The mean length of stay for those discharged within 21 days was 1.5 days. Thirty-six percent of patients had a history of pre-operative opioid use. The commercial claims and encounters database represented 764,683 (96%) of the hysterectomies. Both mean age and mean LOS significantly differed by specific hysterectomy type according to ANOVA ($p < 0.001$; Table 1). Additionally, region, preoperative opioid use, and insurance were all significantly associated with hysterectomy type according to the chi-square test ($p < 0.001$).

During the study period, the overall route of hysterectomy was broken down into 40.5% abdominal, 42.0% laparoscopic, and 17.5% vaginal. From 2004 to 2014, the trend for route of hysterectomy changed. Abdominal and vaginal approaches decreased while laparoscopic approaches increased. Specifically, the route of hysterectomy changed from 60.2% to 25.6% (a decrease of -34.58 ; 95% C.I. 33.96–35.20) for abdominal, 17.0% to 61.9% (an increase of $+44.83$; 95% C.I. 44.21–45.44) for laparoscopic, and 22.8% to 12.6% (a decrease of

=10.25; 95% C.I. 9.77–10.73) for vaginal (Figure 1). This same trend was observed across all US regions (Figure 2).

The percentage of patients who filled opioids prescribed at the time of discharge for all hysterectomy routes increased from 25.6% in 2004 to 82.1% in 2014 (an increase of =56.50; 95% C.I. 55.88–57.13 with $p<0.001$) (Figure 3). The mean days of opioids supplied increased from 3.0 to 11.5 days among all hysterectomies (an increase of =8.5 95% C.I. 8.4–8.7 with $p<0.001$), when all patients in the database were analyzed including those patients that did not fill any prescription. The increase in mean days of opioid supplied for each route of hysterectomy showed the same trend over time (i.e. the same increase in postoperative days supplied was observed for vaginal, laparoscopic, abdominal hysterectomy) (Figure 4). All US regions showed the same trend for postoperative opioid prescription patterns, however, the Northeast region significantly filled the least opioids over time. The year 2014 represents the greatest regional prescribing differences for mean days supplied among all patients: Northeast 9.8 days (95% CI 9.3–10.2), South 11.7 days (95% CI 11.4–11.9), Midwest 12.1 days (95% CI 11.7–12.0), and West 12.5 days (95% CI 12.1–13.0).

When patients who did not fill prescriptions for opioids were excluded the increase in mean day supply remained significant but with a less dramatic rise, from 11.7 (95%CI 11.4–12.0) to 14.0 days (95%CI 13.9–14.2), an increase of =2.3 days ($p<0.001$). Figure 5 compares the mean days of opioids supplied among each hysterectomy route for only those women prescribed and filled their opioid prescriptions. The mean days of opioids supplied changed from 12.0 days (95% CI 11.6–12.3) to 15.6 days (95% CI 15.2–16.0) for abdominal hysterectomy, from 11.5 days (95% CI 10.9–12.2) to 13.5 days (95% CI 13.3–13.7) for laparoscopic hysterectomy, and from 11.0 days (95% CI 10.4–11.6) to 13.4 days (95% CI 12.9–14.0) for vaginal hysterectomy (all p values <0.05).

Patients with a history of preoperative opioid use were compared to opioid naïve patients. Thirty-six percent of patients had a history of preoperative opioid use. The mean days of opioids supplied postoperatively from 2004 to 2014 increased for both groups over time. The patients with a history of preoperative opioid use consistently filled more opioids during the postoperative period. Patients who were not prescribed and/or did not fill their postoperative opioid prescriptions were then excluded to assess mean days supplied over time. Figure 6 describes patients with a history of preoperative opioid use, opioid naïve patients, and the overall trend of mean days supplied from 2004 to 2014 among all hysterectomy routes for ONLY those women who filled postoperative opioids. The patients with a history of preoperative opioid use still consistently received more opioids from 18.9 days (95% CI 18.1–19.6) to 19.3 days (95% CI 18.9–19.6) compared to opioid naïve patients who were prescribed and filled 8.5 days (95% CI 8.3–8.7) to 8.8 days (95% CI 8.7–9.0) with a p value <0.001 .

Linear regression was used to examine the association between length of hospital stay and postoperative opioid prescriptions filled. For each additional day in the hospital, an additional 0.44 day of opioid supply was prescribed and filled during the postoperative period ($p<0.001$). The constant variance assumption for this model was achieved according

to the Breusch-Pagan test for heteroscedasticity (87 out of 100 samples of the size of 5000 yielded a p-value which is greater than 0.05). Correlation was drawn between mean days supplied and minimally invasive route (vaginal and laparoscopic approaches) over time where mean days supplied was consistently the highest for abdominal hysterectomy. Patients who had abdominal hysterectomies filled prescriptions with significantly more opioids than laparoscopic and vaginal hysterectomy ($p<0.05$). However, no statistical significant difference was appreciated among minimally invasive routes (laparoscopic versus vaginal hysterectomies). When adjusting for year and length of stay, there was no significant association between mean days supplied among minimally invasive and abdominal hysterectomies ($p=0.14$).

Comment

From 2004 to 2014, the route of hysterectomy increased among minimally invasive routes such as laparoscopic and vaginal approaches. Despite this trend toward minimally invasive surgery, postoperative opioid prescriptions filled by patients appears to have increased. Furthermore, associations related to increased opioid prescriptions filled included patient age, length of hospital stay, and opioid use preoperatively. Every US region showed the same trend in change of route of hysterectomy, but the Northeast demonstrated less opioid prescriptions filled postoperatively for all hysterectomy routes. The trend of postoperative opioid prescriptions after hysterectomy reflects the overall increase in opioid prescriptions filled in the United States. However, this increase was most pronounced between the years 2008 and 2011. When patients who were not prescribed and/or filled their opioid prescriptions were excluded, the mean days supplied for all hysterectomy routes increased from 2004 to 2014 and remained statistically significant. In summary, more patients are filling their opioid prescriptions postoperatively along with a slight increase in mean days supplied.

In 2004, approximately 25% of patients filled a prescription for opioids for postoperative pain after hysterectomy. This appears surprisingly low especially since abdominal hysterectomies were more common during that year. Other research in opioid prescribing trends among other surgical specialties show similar trends. Brat et al utilized the Aetna health and pharmacy insurance claims database to describe opioid trends from 2008 to 2016 for general surgery procedures. The percentage of patients filling their opioid prescriptions increased from 47.9% in 2008 to 63.9% in 2013 [26]. Results from other surgical procedures report that in the years later than those included in this study (2012–2017), greater than 2/3 of patients filled their opioid prescriptions after discharge [27, 28]. These results provide external validation to the MarketScan data and highlight the trends in increased patient procurement of opioids over time for postoperative pain.

Research in postoperative opioid use has drastically increased since the medical community and public at large have recognized the severe implications of long-term opioid use and the increase in non-medical abuse. Medical providers are trapped in a unique paradox—providing adequate pain control without excessively prescribing opioids. While guidelines are available for treatment of chronic pain, limited information exists for management of acute postoperative pain. Without guidance for acute postoperative pain prescriptions,

practice patterns vary widely. A retrospective study of common, outpatient general surgery procedures showed 70–100% of patients are prescribed opioids. The number of pills prescribed varied by providers up to 120 pills with variance among individual providers performing the same surgery [29]. Additionally, most patients do not use the entire prescription given [29–31], leaving excess opioid pills unused and increasing the opportunity for non-medical use later. The excessive prescriptions are a problem as most nonmedical users obtain the medications from friends or family for free [9]. Inpatient opioid use may predict postoperative prescription needs. Hill et al., in 2017 described a postoperative prescription guideline based on the opioids used 24 hours prior to discharge. Using their guidelines, postoperative opioid prescriptions decreased by 40% [32]. More surgical subspecialties need to evaluate postoperative prescription patterns to avoid unnecessary opioid exposure contributing to the epidemic.

Hysterectomy is one of the most common surgeries performed in the United States with roughly 600,000 hysterectomies performed annually for benign indications [14–17]. Therefore, women are uniquely at risk for exposure to opioid use and the potential for abuse. Older women have higher rates of long-term opioid use compared to younger women and men of any age [33]. From 1999 to 2010, opioid overdose deaths increased drastically for women by 415% [34]. The opioid epidemic is a national and state-wide concern as well as a women's health issue, and prescribing practices after gynecologic surgery needs a closer look. To improve postoperative pain among other factors, minimally invasive techniques are preferred for the route of hysterectomy. Minimally invasive techniques decrease length of hospital stay, decrease postoperative pain, and offer a faster return to normal activity [35]. Therefore, opioid prescribing practices should reflect the current movement toward minimally invasive surgery.

The route of hysterectomy trends over time confirm previously published results. Wu et al., 2003 reported 538,722 hysterectomies performed in 2003 for benign indications. These were categorized by abdominal (66.1%), laparoscopic (11.8%), and vaginal (21.8%). The hysterectomy rate among US regions showed similar results with the South being the highest [17]. The overall decline of hysterectomies performed in the United States is also consistent with other published data [15]. This trend is most likely due to utilization of uterine-sparing surgical options, such as endometrial ablation, and long-acting hormonal contraceptives [15].

The limitations of this study include the inherent limitations to using an administrative claims database. The information available relies on consistent data input to the MarketScan system. The earlier data from 2004 to 2010 have a lower denominator, which in turn, may skew the results due to variability in the sample size over time. Opioid mean days supplied was used to describe the total amount of opioids instead of oral morphine equivalents used in other studies, however, mean days supplied is a common metric utilized in other MarketScan opioid research [12, 20, 21].

An important limitation is that the days supplied represents *only* prescriptions that were filled at a retail or mail order pharmacy. This may account for the low percentage of opioids prescribed and/or filled in 2004. If patients received opioids from the inpatient or hospital

pharmacies to take home, these prescriptions would not be accounted for in the database. However, data suggest the majority of patients during this time period used non-hospital pharmacies or retail pharmacies to fill their prescriptions. Hospitals offering a discharge prescription service has increased from 11.8% in 2012 to 34.6% in 2016. [36]. During our data reporting period from 2004 to 2014, less than 1/3 of hospitals had a discharge prescription service [36]. If this service was more widely available for patients, we would have expected the number of prescriptions filled overtime to *decrease* as the utilization of inpatient pharmacies *increased*, which was not observed. We also cannot account for prescriptions that may have been written but not filled by the patient. The dramatic increase in the percentage of opioid prescriptions filled may be more of a reflection of patient procurement instead of physician prescribing practices. However, if providers are writing even more opioid prescriptions that are not filled, this would only serve to strengthen the findings of this research.

Another limitation is the lack of more robust demographic data. Data on patient race, ethnicity, socioeconomic status, and education are not captured in the Truven databases, and body mass index measures that would normally be recorded as laboratory tests results were also not available, so these factors could not be included. Also, the link between inpatient opioid use and postoperative complications with discharge opioid use were not analyzed due to the study design. These factors may play important roles in postoperative prescribing practices and offer an opportunity for further research. The strengths of this study include the large numbers, robust dataset with data from a recent time frame available with this database. Additionally, we were able to provide regional prescription pattern information across the United States and to assess different routes of hysterectomy while taking into account the increase in minimally invasive techniques over this time period.

The medical profession has a responsibility to focus efforts in improving opioid prescribing practices. A focus on patient education preoperatively is also necessary to manage expectations, and provide necessary information regarding the implications of opioid use. Patients' acute, postoperative pain must be addressed in a safe, appropriate manner while limiting risk of long-term use. Further research in patient risk factors and guidelines for postoperative prescribing following hysterectomy are necessary to address the opioid public health emergency.

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Appendix I:

List of CPT4 and ICD-9 Codes

Code Type	Code	Description
CPT4	58150	Total abdominal hysterectomy (corpus and cervix), with or without removal of tube(s), with or without removal of ovary(s);
CPT4	58152	Total abdominal hysterectomy (corpus and cervix), with or without removal of tube(s), with or without removal of ovary(s); with colpo-urethrocystopexy (eg, Marshall-MarchettiKrantz, Burch)
CPT4	58180	Supracervical abdominal hysterectomy (subtotal hysterectomy), with or without removal of tube(s), with or without removal of ovary(s)
CPT4	58260	Vaginal hysterectomy, for uterus 250 g or less;
CPT4	58262	Vaginal hysterectomy, for uterus 250 g or less; with removal of tube(s), and/or ovary(s)
CPT4	58263	Vaginal hysterectomy, for uterus 250 g or less; with removal of tube(s), and/or ovary(s), with repair of enterocele
CPT4	58267	Vaginal hysterectomy, for uterus 250 g or less; with colpo-urethrocystopexy (Marshall-MarchettiKrantz type, Pereyra type) with or without endoscopic control
CPT4	58270	Vaginal hysterectomy, for uterus 250 g or less; with repair of enterocele
CPT4	58275	Vaginal hysterectomy, for uterus 250 g or less; with total or partial vaginectomy;
CPT4	58280	Vaginal hysterectomy, for uterus 250 g or less; with total or partial vaginectomy; with repair of enterocele
CPT4	58290	Vaginal hysterectomy, for uterus greater than 250 g;
CPT4	58291	Vaginal hysterectomy, for uterus greater than 250 g; with removal of tube(s) and/or ovary(s)
CPT4	58292	Vaginal hysterectomy, for uterus greater than 250 g; with removal of tube(s) and/or ovary(s), with repair of enterocele
CPT4	58293	Vaginal hysterectomy, for uterus greater than 250 g; with colpo-urethrocystopexy (Marshall-MarchettiKrantz type, Pereyra type) with or without endoscopic control
CPT4	58294	Vaginal hysterectomy, for uterus greater than 250 g; with repair of enterocele
CPT4	58541	Laparoscopic supracervical hysterectomy, for uterus 250 g or less;
CPT4	58542	Laparoscopic supracervical hysterectomy, for uterus 250 g or less; with removal of tube(s) and/or ovary(s)
CPT4	58543	Laparoscopic supracervical hysterectomy, for uterus greater than 250 g;
CPT4	58544	Laparoscopic supracervical hysterectomy, for uterus greater than 250 g; with removal of tube(s) and/or ovary(s)
CPT4	58550	Laparoscopy with vaginal hysterectomy, for uterus 250 g or less;
CPT4	58552	Laparoscopy with vaginal hysterectomy, for uterus 250 g or less; with removal of tube(s) and/or ovary(s)
CPT4	58553	Laparoscopy with vaginal hysterectomy, for uterus greater than 250 g;
CPT4	58554	Laparoscopy with vaginal hysterectomy, for uterus greater than 250 g; with removal of tube(s) and/or ovary(s)
CPT4	58570	Laparoscopic total hysterectomy, for uterus 250 g or less;
CPT4	58571	Laparoscopic total hysterectomy, for uterus 250 g or less; with removal of tube(s) and/or ovary(s)
CPT4	58572	Laparoscopic total hysterectomy, for uterus greater than 250 g;
CPT4	58573	Laparoscopic total hysterectomy, for uterus greater than 250 g; with removal of tube(s) and/or ovary(s)
ICD-9	68.3	Abdominal hysterectomy, subtotal/supracervical
ICD-9	68.31	Laparoscopic Supracervical Hysterectomy
ICD-9	68.39	Other and unspecified subtotal abdominal hysterectomy
ICD-9	68.4	Total Abdominal Hysterectomy

Code Type	Code	Description
ICD-9	68.41	Laparoscopic Total Abdominal Hysterectomy
ICD-9	68.49	Other and unspecified total abdominal hysterectomy
ICD-9	68.5	Vaginal Hysterectomy
ICD-9	68.51	Laparoscopically assisted vaginal hysterectomy
ICD-9	68.59	Other and unspecified vaginal hysterectomy
ICD-9	68.9	Other and unspecified hysterectomy

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Implications and Contributions:

A. To describe opioid prescribing and patient procurement practices for postoperative pain at time of discharge for benign hysterectomy from 2004 to 2014 using the Truven Health Analytics MarketScan® Research Database.

B. While minimally invasive routes of hysterectomy have increased, the percentage of patients filling opioid prescriptions and the mean days supplied increased as well.

C. What this study adds to our knowledge: This study calls attention to gynecologists regarding opioid prescribing practices and patient procurement of opioid prescriptions over time. This adds to the growing literature regarding opioid use to understand our current status as a public health emergency.

Route of Hysterectomy 2004 to 2014

Figure 1.

Trend of Abdominal, Laparoscopic, and Vaginal Hysterectomy Routes. This figure describes the percentage change among different hysterectomy routes between 2004 and 2014.

Figure 2.

Trend of Abdominal, Laparoscopic, and Vaginal Hysterectomy Routes by US Region. This figure describes the percentage change among different hysterectomy routes by specific US region between 2004 and 2014.

Figure 3. Percentage of Patients who Filled Opioid Prescriptions by Specific Route of Hysterectomy from 2004 to 2014. This figure describes the percentage of patients who filled opioid prescriptions by specific hysterectomy route from 2004 to 2014.

Figure 4.
Mean Days of Opioids Supplied Postoperatively by Route of Hysterectomy from 2004 to 2014. This figure describes the mean days of opioids supplied after each route of hysterectomy from 2004 to 2014 *includes all patients in the database which includes patients that did not fill an opioid prescription (mean day supply of 0)

Figure 5.
Mean Days of Opioids Supplied Postoperatively by Route of Hysterectomy from 2004 to 2014 *excluding patients who were not prescribed and/or did not fill their opioid prescriptions.

Figure 6. Mean Days of Opioids Prescribed for Patients Overall, Patients with Preoperative Opioid Use, and Opioid Naïve Patients *excluding patients who were not prescribed and/or did not fill their opioid prescriptions

Table 1:

Aggregated Characteristics of Participants for the Years 2004–2014

	All Hysterectomy Routes ^c	Abdominal	Laparoscopic	Vaginal	P- value ^a
Age (n; Mean; St Dev ^e)	793,016 45.4 (9.4)	321,409 45.4 (8.8)	332,727 44.3 (8.6)	138,880 47.4 (11.6)	<0.001
Region (n; %; 95% CI ^f)	<0.001 ^b				
Northeast	59,644 7.9 (7.9–8.0)	25,747 43.2 (42.8–43.6)	24,342 40.8 (40.4–41.2)	9,555 16.0 (15.7–16.3)	<0.001
South	380,020 50.5 (50.4–50.6)	154,269 40.6 (40.4–40.8)	166,755 43.9 (43.7–44.0)	58,996 15.5 (15.4–15.6)	<0.001
Midwest	181,029 24.1 (24.0–24.2)	72,235 39.9 (39.7–40.1)	72,679 40.1 (39.9–40.4)	36,115 19.9 (19.8–20.1)	<0.001
West	13,426 17.5 (17.4–17.6)	51,722 39.4 (39.1–39.6)	51,444 39.1 (38.9–39.4)	28,260 21.5 (21.3–21.7)	<0.001
Missing Regional Data	40,897	17,436	17,507	5,954	
Length of Stay ^d (n; Mean; St Dev)	792,027 1.5 (1.7)	320,820 2.2 (1.6)	332,439 0.9 (1.7)	138,768 1.2 (1.3)	<0.001
Preoperative Opioid Use (n; %; 95% CI)	284,673 35.9 (35.8–36.0)	101,971 35.8 (35.6–36.0)	141,166 49.6 (49.4–49.8)	41,536 14.6 (14.5–14.7)	<0.001
Insurance Type (n; %; 95% CI)	<0.001 ^b				
Medicare	31,267 3.9 (3.9–4.0)	10,859 34.7 (34.2–35.3)	7,665 24.5 (24.0–25.0)	12,743 40.8 (40.2–41.3)	<0.001
Commercial	761,749 96.1 (96.0–96.1)	310,550 40.8 (40.7–40.9)	325,062 42.7 (42.6–42.8)	126,137 16.6 (16.5–16.6)	<0.001

^a P-values for continuous variables (Age and Length of Stay) correspond to the ANOVA. P-values for categorical variables (region, preop opioid use, and insurance type) correspond to the Chi-squared test.

^b The overall p-value represents the association between all routes of hysterectomy and demographic variables (region, preop opioid use, and insurance type). All other p-values correspond to the demographic variables and specific hysterectomy routes.

^c For this highlighted column % denotes column percentage. All other % denotes row percentage (non-highlighted cells).

^d Length of stay less than or equal to 21 days.

^e St Dev stands for Standard Deviation

^f CI stands for Confidence Interval