

Outpatient Hysterectomy Volume in the United States

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OBJECTIVE: To estimate the number of outpatient hysterectomies being performed annually in the United States in an effort to offer more correct estimates of hysterectomy use in light of reported decreasing inpatient case volume.

METHODS: This is a cross-sectional analysis of State Ambulatory Surgery and Services Databases from 16 states with complete information for year 2011. Adult women undergoing hysterectomy were included. Procedure volume, route, and associated patient and surgical characteristics were calculated.

RESULTS: There were 64,612 ambulatory hysterectomies reported; 81.5% of surgeries were performed laparoscopically and 16% vaginally. If these numbers are extrapolated to national estimates, this represents 100,000–200,000 outpatient hysterectomies per year. The strongest driver of the laparoscopic, compared with vaginal, route of hysterectomy in this data set was presence of cancer (odds ratio 4.01 [3.19–5.05], $P < .001$). In addition to indication for surgery, patient characteristics such as age, race, income, location, and primary payer were associated with mode of hysterectomy. The laparoscopic surgeries were associated with shorter length of stay (mean stay 0.65 days, [99% confidence interval 0.65–0.66] compared with 0.79 days [0.78–0.81], adjusted incidence rate ratio 0.89 [0.86–0.92], $P < .001$) and higher mean charges (\$24,227 [\$24,053–24,402]

versus \$14,068 [\$13,811–14,330], $P < .001$) compared with vaginal surgeries.

CONCLUSION: The perceived decline that has been reported in national hysterectomy volume may represent lack of reporting of surgeries performed in ambulatory settings. This information has considerable implications for business, public health interventions, and insurance carriers among other key stakeholders in women's health care delivery.

(*Obstet Gynecol* 2017;130:130–7)

DOI: 10.1097/AOG.0000000000002103

Hysterectomy is one of the most commonly performed gynecologic surgeries with an estimated one in nine women in the United States undergoing the procedure in their lifetime.¹ According to data from the Nationwide Inpatient Sample databases, the number of inpatient hysterectomies in the United States decreased from 681,000 in 2002 to 433,000 in 2010, representing a 36% decline.² Explanations for this reduction in surgical volume include use of pharmacologic therapies and uterine-sparing procedures for gynecologic conditions and an increase in the number of minimally invasive hysterectomies being performed as outpatient procedures.^{2,3} As of 2010, 40% of inpatient hysterectomies were performed laparoscopically, and 46% of patients undergoing laparoscopic hysterectomies were discharged on the same day.^{4,5} Several observational studies have demonstrated that same-day discharge after laparoscopic and vaginal hysterectomy is safe with lower costs and comparable readmission rates to inpatient hysterectomy.^{6–8} Importantly, previous estimates of national hysterectomy volume only represent surgeries performed in inpatient facilities and do not account for ambulatory surgical centers.

Given advances in the setting and surgical approach to hysterectomy, defining outpatient hysterectomy volume is critical when evaluating current hysterectomy trends. The objective of this population-

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Financial Disclosure

The authors did not report any potential conflicts of interest.

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ISSN: 0029-7844/17



based study was to define the number of outpatient hysterectomies being performed annually in the United States in an effort to offer more correct estimates of hysterectomy use. We also assessed the proportion of laparoscopic and vaginal hysterectomies performed as an outpatient and the associated patient and procedure characteristics.

MATERIALS AND METHODS

This cross-sectional study was deemed exempt by the Partners Human Research Committee because it did not involve direct interaction with patients or make use of identifiable private information. The U.S. Healthcare Cost and Utilization Project State Ambulatory Surgery and Services Databases (SASD) contain uniform encounter-level data regarding outpatient procedures from both hospital-owned and, in some states, nonhospital-owned facilities. Details about the database can be found at <https://www.hcup-us.ahrq.gov/sasdooverview.jsp>; Healthcare Cost and Utilization Project administrators confirmed with the authors that the data represented in the SASD do not overlap with any inpatient databases. Thirty-five of the 50 states contribute data to the SASD, with varying data elements reported by state and year. For the research question at hand, there were 16 states (California, Colorado, Florida, Iowa, Kentucky, Maine, Maryland, Michigan, Nebraska, Nevada, New Jersey, New York, Oregon, South Carolina, Utah, Vermont) reporting all key variables in year 2011, which was the most recent year with data available at the onset of this research.

The 2011 SASD for the previously mentioned 16 states were queried to identify patients who underwent hysterectomy in an ambulatory facility using International Classification of Diseases, 9th Revision, Clinical Modification procedure codes and Current Procedural Terminology codes; seven states used procedure codes, and all others used Current Procedural Terminology codes (codes listed in Box 1). Robotic surgeries were coded for the states where procedure codes were used; however, only four of these states reliably coded for this variable. Additional variables that were abstracted from the databases included: age; race; median household income in both state and national quartiles; urban–rural location; primary payer; indication for surgery; number of chronic conditions; total charges as reported by the surgical facility; and length of stay.

These states were further grouped by region (Northeast, Midwest, South, and West) as defined by

Box 1. Current Procedural Terminology and Procedure Codes for Hysterectomy

- Abdominal hysterectomies—CPT codes: 58180, 58150, 58152, 58200, 58210, 58951, 58953, 58954 and procedure codes: 6839, 6849, and 6869
- Vaginal hysterectomies—CPT codes: 58260, 58262, 58263, 58267, 58270, 58275, 58280, 58290, 58291, 58292, 58293, 58294, and 58285 and procedure codes: 6859 and 6879
- Laparoscopic hysterectomies—CPT codes: 58541, 58542, 58543, 58544, 58570, 58571, 58572, 58573, 58550, 58552, 58553, 58554 and procedure codes: 6831, 6841, 6851, 6861, and 6871
- Robotic surgeries—procedure codes 1741, 1742, 1743, 1744, and 1779

the U.S. Census for descriptive data presentation. We calculated crude and adjusted odds ratios (ORs) and 99% confidence intervals (CIs) using logistic regression to estimate the associations between patient characteristics and risk of laparoscopic hysterectomy compared with vaginal hysterectomy. The multivariable models included all predictor variables. To prevent variables with missing values from being dropped from analyses, the missing indicator method was used, and these indicators were included in the regression models. Additionally, we examined the association between type of surgery and the outcomes total charges and length of stay. We used logistic regression to calculate the OR for receiving any postoperative observation. For continuous outcomes and total charges, we first log-transformed to create normal distributions and linear regression was used to calculate multivariable adjusted means with 99% CI for these continuous outcomes. Multivariable-adjusted Poisson regression was used to examine the relationship between type of surgery and patient length of stay with results expressed as adjusted incidence rate ratios with 99% CI. These models were adjusted a priori for age, race, median household income state quartile for patient zip code, patient location, primary payer, number of chronic conditions, any gynecologic cancer, endometriosis, leiomyomas, prolapse, and menstrual disorder. As a result of the large number of comparisons, only associations with P values $<.01$ were considered significant. SAS 9.4 was used for the analyses.

Based on the observed numbers of hysterectomies in the 16 states, extrapolations were calculated for a national rate of outpatient hysterectomies using the most recent U.S. Census data from 2010.^{9,10} Sensitivity analysis was performed on these projections using select individual state and regional



hysterectomy rates to determine a plausible true national range.

RESULTS

Demographic characteristics of hysterectomy patients by region are summarized in Table 1. Patients were in general in their mid- to late 40s and predominantly white with private insurance. There was a range of incomes and geographic classifications represented. The surgical characteristics of hysterectomy patients grouped by region are presented in Table 2. There were 64,612 ambulatory hysterectomies reported from 16 states in 2011; 81.5% of surgeries were performed laparoscopically and 16% vaginally. The most common indications for surgery (not mutually exclusive) were leiomyomas, menstrual disorder, and endometriosis. Four states (Colorado, Florida, Michigan, and New Jersey) used robotic codes in addition to another assigned mode of hysterectomy; 110 of 413 (26.6%) abdominal hysterectomies in these states were also coded as robotic procedures—possibly representing conversions compared with misclassification—and 9,992 of 22,969 (43.5%) laparoscopic hysterectomies were also coded as robotic (data not shown).

Although the data set was drawn from only 16 of 50 states, these represented 41% (47,834,549/116,470,126) of U.S. women aged 18 years or older according to 2010 Census data. A total of 64,612 outpatient hysterectomies were reported in these 16 states, giving a rate of 0.14% (135/100,000 adult women). The highest rate was in Maine at 0.46% (464/100,000 adult women), and the lowest rate was in California at 0.06% (61/100,000 adult women). Using the four regions recognized by the U.S. Census Bureau (Northeast, Midwest, South, and West), the highest rate was in the South at 0.20% (196/100,000 adult women), and the lowest rate was in the West at 0.10% (97/100,000 adult women).

With an average rate of 0.14% in the 16 states, extrapolation to the older than 18 years female population would yield 163,058 ambulatory hysterectomies performed in the United States in 2011. Using the highest (Maine—0.46%) and lowest (California—0.06%) state rates to determine a potential range, it is estimated that 69,882–535,763 ambulatory hysterectomies were performed in the United States in 2011. Alternatively, using the highest (South—0.20%) and lowest (West—0.10%) regional rates, the estimated range of ambulatory hysterectomies performed in the United States was between 116,470 and 232,940.

Because the vast majority of surgeries were approached in a minimally invasive fashion, the abdominal route was not considered for further

analysis. Table 3 depicts the likelihood of undergoing a laparoscopic compared with vaginal hysterectomy in an ambulatory facility controlling for baseline characteristics. The oldest patients and those with pelvic organ prolapse or menstrual disorders were more likely to undergo a vaginal approach to hysterectomy as were patients from smaller geographic regions and those with a primary payer other than private insurance. Black patients were more likely to have a laparoscopic approach to hysterectomy, even when accounting for the indication of leiomyomas. Patients with higher income and those with cancer, leiomyomas, or endometriosis were also more likely to undergo a laparoscopic route of hysterectomy.

Length of stay and total charges by mode of hysterectomy are shown in Table 4. After controlling for baseline characteristics, the length of stay was shorter in the laparoscopic group. Total charges, which generally do not include professional fees or noncovered charges, were on average \$10,000 greater for the laparoscopic hysterectomies.

DISCUSSION

With this analysis of state-maintained data on ambulatory surgical volume in 2011, we describe characteristics of more than 64,000 hysterectomies performed in an outpatient setting. Greater than 80% of surgeries were laparoscopic with the remainder being predominantly a vaginal mode of access. If the observed outpatient hysterectomy rates from the 16 states included in this analysis are extrapolated to a national scale, there may be an additional 100,000–200,000 hysterectomies being performed in the United States each year, which are not reported in traditional summary statistics.

In contrast to prior literature suggestion down-trending hysterectomy rates, we argue that the perceived decrease in case volume may actually reflect lack of accounting for outpatient surgery centers. This may result in not only the underestimation of overall hysterectomy volume, but specifically the relative number that is performed in a minimally invasive fashion. Previous publications that have reported national estimates for hysterectomy numbers have traditionally relied on the Nationwide Inpatient Sample, a federal database that is also maintained by the Healthcare Cost and Utilization Project.^{2,3,11,12} The Nationwide Inpatient Sample includes a sample of discharges from all non-federal, short-term hospitals in the United States and is the largest national all-payer database of hospital discharges. Surgeries that are performed in a hospital setting as same-day procedures would be represented in the Nationwide Inpatient Sample; however,



Table 1. Patient Characteristics by Region

Characteristic	Northeast (Maine, New Jersey, New York, Vermont) (n=11,592)	Midwest (Iowa, Michigan, Nebraska) (n=9,764)	South (Florida, Kentucky, Maryland, South Carolina) (n=26,180)	West (California, Colorado, Nevada, Oregon, Utah) (n=17,076)
Age at admission (y)	48.60±10.79; 47.0 (22–95)	44.97±10.18; 44.0 (18–101)	47.02±11.09; 45.0 (19–96)	46.17±10.11; 45.0 (19–88)
Missing	2,528	0	4,044	0
Age category (y)				
Younger than 30	248 (2.1)	399 (4.1)	816 (3.1)	531 (3.1)
30–39	1,956 (16.9)	2,478 (25.4)	5,680 (21.7)	3,516 (20.6)
40–49	5,064 (43.7)	4,340 (44.4)	11,652 (44.5)	7,969 (46.7)
50–59	2,433 (21.0)	1,697 (17.4)	4,590 (17.5)	3,283 (19.2)
60–69	1,273 (11.0)	569 (5.8)	2,314 (8.8)	1,252 (7.3)
70 or older	618 (5.3)	281 (2.9)	1,128 (4.3)	525 (3.1)
Missing	0	0	0	0
Race (uniform)				
White	8,630 (74.4)	6,087 (62.3)	18,540 (70.8)	10,238 (60.0)
Black	824 (7.1)	641 (6.6)	4,350 (16.6)	941 (5.5)
Hispanic	633 (5.5)	77 (0.8)	2,360 (9.0)	2,589 (15.2)
Asian or Pacific Islander	175 (1.5)	41 (0.4)	258 (1.0)	625 (3.7)
Native American	37 (0.3)	18 (0.2)	25 (0.1)	54 (0.3)
Other	287 (2.5)	155 (1.6)	470 (1.8)	272 (1.6)
Missing	1,006 (8.7)	2,745 (28.1)	177 (0.7)	2,357 (13.8)
Median household income				
State quartile for patient zip code				
1st	2,330 (20.1)	2,072 (21.2)	5,264 (20.1)	3,020 (17.7)
2nd	3,368 (29.1)	2,360 (24.2)	6,047 (23.1)	4,177 (24.5)
3rd	3,166 (27.3)	2,652 (27.2)	6,978 (26.7)	4,529 (26.5)
4th	2,519 (21.7)	2,603 (26.7)	7,461 (28.5)	5,032 (29.5)
Missing	209 (1.8)	77 (0.8)	430 (1.6)	318 (1.9)
National quartile for patient zip code				
1: \$1–38,999	2,006 (17.3)	1,647 (16.9)	6,659 (25.4)	911 (5.3)
2: \$39,000–47,999	2,833 (24.4)	3,326 (34.1)	6,865 (26.2)	2,026 (11.9)
3: \$48,000–63,999	3,014 (26.0)	3,263 (33.4)	7,397 (28.3)	3,264 (19.1)
4: \$64,000 or more	3,530 (30.5)	1,451 (14.9)	4,829 (18.4)	2,856 (16.7)
9: Missing	0	0	0	0
Missing	209 (1.8)	77 (0.8)	430 (1.6)	8,019 (47.0)
Patient location				
Central large metropolitan	1,172 (10.1)	704 (7.2)	5,586 (21.3)	6,199 (36.3)
Fringe large metropolitan	3,159 (27.3)	1,338 (13.7)	7,415 (28.3)	3,950 (23.1)
Medium metropolitan	3,524 (30.4)	3,317 (34.0)	6,978 (26.7)	3,977 (23.3)
Smaller metropolitan	1,352 (11.7)	1,499 (15.4)	2,365 (9.0)	1,579 (9.2)
Micropolitan counties	1,236 (10.7)	1,455 (14.9)	2,185 (8.3)	839 (4.9)
Not metropolitan or micropolitan	1,097 (9.5)	1,445 (14.8)	1,581 (6.0)	519 (3.0)
Missing	52 (0.4)	6 (0.1)	70 (0.3)	13 (0.1)
Primary expected payer				
Medicare	1,412 (12.2)	726 (7.4)	2,796 (10.7)	1,182 (6.9)
Medicaid	1,525 (13.2)	1,337 (13.7)	2,158 (8.2)	1,177 (6.9)
Private insurance	8,197 (70.7)	7,437 (76.2)	19,680 (75.2)	14,053 (82.3)
Self-pay	233 (2.0)	118 (1.2)	493 (1.9)	269 (1.6)
No charge	17 (0.1)	6 (0.1)	203 (0.8)	56 (0.3)
Other	208 (1.8)	138 (1.4)	842 (3.2)	328 (1.9)
Missing	0	2 (0.0)	8 (0.0)	11 (0.1)

Data are mean±standard deviation, median (minimum–maximum), n, or n (%).



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Table 2. Surgical Characteristics by Region

Characteristic	Northeast (Maine, New Jersey, New York, Vermont) (n=11,592)	Midwest (Iowa, Michigan, Nebraska) (n=9,764)	South (Florida, Kentucky, Maryland, South Carolina) (n=26,180)	West (California, Colorado, Nevada, Oregon, Utah) (n=17,076)
Mode of hysterectomy				
Abdominal	629 (5.4)	88 (0.9)	454 (1.7)	290 (1.7)
Laparoscopic	9,493 (81.9)	8,072 (82.7)	22,520 (86.0)	13,969 (81.8)
Vaginal	1,466 (12.6)	1,604 (16.4)	3,204 (12.2)	2,816 (16.5)
Other	4 (0)	0	2 (0)	1 (0)
Missing	0	0	0	0
Indication				
Any gynecologic cancer				
No	10,288 (88.8)	9,394 (96.2)	24,500 (93.6)	16,223 (95.0)
Yes	1,304 (11.2)	370 (3.8)	1,680 (6.4)	853 (5.0)
Missing	0	0	0	0
Leiomyomas				
No	5,495 (47.4)	5,003 (51.2)	12,370 (47.2)	7,820 (45.8)
Yes	6,097 (52.6)	4,761 (48.8)	13,810 (52.8)	9,256 (54.2)
Missing	0	0	0	0
Endometriosis				
No	7,414 (64.0)	6,190 (63.4)	16,799 (64.2)	11,627 (68.1)
Yes	4,178 (36.0)	3,574 (36.6)	9,381 (35.8)	5,449 (31.9)
Missing	0	0	0	0
Prolapse				
No	9,817 (84.7)	8,498 (87.0)	22,650 (86.5)	14,521 (85.0)
Yes	1,775 (15.3)	1,266 (13.0)	3,530 (13.5)	2,555 (15.0)
Missing	0	0	0	0
Menstrual disorder				
No	6,809 (58.7)	3,902 (40.0)	12,770 (48.8)	8,197 (48.0)
Yes	4,783 (41.3)	5,862 (60.0)	13,410 (51.2)	8,879 (52.0)
Missing	0	0	0	0
Length of stay (d)				
0	1 (0–3)	1 (0–3)	1 (0–3)	0 (0–3)
1	5,372 (47.4)	2,851 (29.3)	5,926 (27.2)	9,531 (56.7)
2 or more	5,676 (50.0)	6,244 (63.9)	14,133 (54.0)	6,439 (37.7)
Missing	297 (2.6)	640 (6.6)	1,761 (8.1)	838 (5.0)
Total charges				
Geometric mean	17,738 (387–265,956)	17,935 (224–247,501)	27,500 (163–170,575)	24,829 (239–155,750)
(99% CI)	17,905 (17,631–18,182)	17,836 (17,631–18,044)	25,392 (25,104–25,684)	23,654 (23,292–24,021)
IQR	11,992–25,621	13,797–23,337	16,739–44,031	15,565–36,268
Missing	2,528	1,123	0	7,833

CI, confidence interval; IQR, interquartile range.
Data are n (%), n, or median (minimum–maximum) unless otherwise specified.

surgeries performed in ambulatory surgical centers are not accounted for. The SASD is the only nationally maintained database of ambulatory surgery and, unlike the Nationwide Inpatient Sample, is reported on a state-by-state basis. Importantly, the data represented by the SASD and Nationwide Inpatient Sample are mutually exclusive. The SASD have previously been used to analyze risk of readmission after robotic compared with nonrobotically assisted hysterectomy as well as the effect of endometrial ablation on hysterectomy use.^{13,14} Given the increas-

ing performance of hysterectomy as an outpatient procedure, it is critical to take into account both inpatient and ambulatory facilities to have a true accounting of national hysterectomy volume.

Regarding the mode of access of hysterectomy in ambulatory surgical facilities, it is not surprising that the vast majority are laparoscopic with a smaller percentage being approached vaginally. Clinically relevant patient factors were associated with a laparoscopic compared with a vaginal approach to surgery, although surgeon-level factors were not able to be



Table 3. Associations Between Patient Characteristics and Laparoscopic Hysterectomy

Characteristic	Vaginal (n=9,090)	Laparoscopic (n=54,054)	Crude		Adjusted*	
			OR (99% CI)	P	OR (99% CI)	P
Age at admission (y)						
Younger than 30	333 (3.7)	1,623 (3.0)	0.66 (0.56–0.78)	<.001	0.98 (0.82–1.17)	.74
30–39	1,990 (21.9)	11,416 (21.1)	0.78 (0.72–0.84)	<.001	0.93 (0.86–1.02)	.04
40–49	3,391 (37.3)	24,986 (46.2)	1.00 (referent)		1.00 (referent)	
50–59	1,514 (16.7)	10,165 (18.8)	0.91 (0.84–0.99)	.005	1.07 (0.97–1.18)	.06
60–69	1,133 (12.5)	4,117 (7.6)	0.49 (0.45–0.54)	<.001	0.84 (0.74–0.97)	.001
70 or older	729 (8.0)	1,747 (3.2)	0.33 (0.29–0.37)	<.001	0.67 (0.55–0.81)	<.001
Race (uniform)						
White	6,302 (80.3)	36,458 (73.8)	1.00 (referent)		1.00 (referent)	
Black	580 (7.4)	6,015 (12.2)	1.79 (1.59–2.02)	<.001	1.26 (1.10–1.43)	<.001
Hispanic	672 (8.6)	4,861 (9.8)	1.25 (1.12–1.40)	<.001	1.08 (0.95–1.23)	.11
Asian or Pacific Islander	109 (1.4)	952 (1.9)	1.51 (1.16–1.96)	<.001	1.02 (0.77–1.36)	.86
Native American	21 (0.3)	110 (0.2)	0.91 (0.49–1.67)	.68	0.75 (0.39–1.44)	.26
Other	163 (2.1)	1,005 (2.0)	1.07 (0.86–1.33)	.46	0.86 (0.68–1.10)	.12
Missing	1,243	4,653				
Median household income						
State quartile for patient zip code						
1st	2,093 (23.4)	10,272 (19.3)	1.00 (referent)		1.00 (referent)	
2nd	2,409 (26.9)	13,121 (24.7)	1.11 (1.02–1.21)	.001	1.07 (0.98–1.18)	.05
3rd	2,326 (26.0)	14,608 (27.5)	1.28 (1.18–1.39)	<.001	1.17 (1.06–1.29)	<.001
4th	2,135 (23.8)	15,168 (28.5)	1.45 (1.33–1.58)	<.001	1.17 (1.05–1.30)	<.001
Missing	127	885				
National quartile for patient zip code						
1: \$1–38,999	1,882 (23.2)	9,004 (19.4)	1.00 (referent)		1.00 (referent)	
2: \$39,000–47,999	2,230 (27.5)	12,438 (26.7)	1.17 (1.07–1.27)	<.001	1.21 (1.10–1.34)	<.001
3: \$48,000–63,999	2,432 (30.0)	14,151 (30.4)	1.22 (1.12–1.33)	<.001	1.13 (1.02–1.25)	.003
4: \$64,000 or more	1,556 (19.2)	10,931 (23.5)	1.47 (1.33–1.62)	<.001	1.16 (1.03–1.31)	.002
Missing	990	7,530				
Patient location: NCHS urban–rural code						
Central large metropolitan	1,418 (15.6)	11,952 (22.2)	1.00 (referent)		1.00 (referent)	
Fringe large metropolitan	1,946 (21.4)	13,629 (25.3)	0.83 (0.76–0.91)	<.001	0.85 (0.76–0.94)	<.001
Medium metropolitan	2,572 (28.3)	14,835 (27.5)	0.68 (0.62–0.75)	<.001	0.82 (0.74–0.90)	<.001
Smaller metropolitan	1,203 (13.2)	5,412 (10.0)	0.53 (0.48–0.60)	<.001	0.72 (0.64–0.82)	<.001
Micropolitan counties	969 (10.7)	4,602 (8.5)	0.56 (0.50–0.63)	<.001	0.69 (0.60–0.79)	<.001
Not metropolitan or micropolitan	977 (10.8)	3,494 (6.5)	0.42 (0.38–0.48)	<.001	0.57 (0.50–0.65)	<.001
Missing	5	130				
Primary expected payer						
Medicare	1,382 (15.2)	4,526 (8.4)	0.47 (0.43–0.52)	<.001	0.82 (0.71–0.93)	<.001
Medicaid	1,146 (12.6)	4,882 (9.0)	0.62 (0.56–0.68)	<.001	0.65 (0.59–0.73)	<.001
Private insurance	6,120 (67.3)	42,269 (78.2)	1.00 (referent)		1.00 (referent)	
Self-pay	187 (2.1)	867 (1.6)	0.67 (0.54–0.83)	<.001	0.63 (0.50–0.79)	<.001
No charge	43 (0.5)	217 (0.4)	0.73 (0.47–1.12)	.06	0.65 (0.41–1.03)	.02
Other	210 (2.3)	1,274 (2.4)	0.88 (0.72–1.07)	.09	0.87 (0.70–1.07)	.09
Missing	2	19				
No. of chronic conditions						
0	342 (3.8)	3,922 (7.3)	1.00 (referent)		1.00 (referent)	
1	2,131 (23.4)	13,586 (25.1)	0.56 (0.48–0.65)	<.001	0.82 (0.69–0.97)	.003
2	2,408 (26.5)	13,801 (25.5)	0.50 (0.43–0.58)	<.001	0.85 (0.71–1.01)	.01
3	1,726 (19.0)	9,592 (17.7)	0.48 (0.41–0.57)	<.001	0.95 (0.79–1.14)	.46
4 or more	2,483 (27.3)	13,153 (24.3)	0.46 (0.40–0.54)	<.001	1.01 (0.84–1.21)	.9
Indication						
Any gynecologic cancer						
No	8,940 (98.3)	50,210 (92.9)	1.00 (referent)		1.00 (referent)	
Yes	150 (1.7)	3,844 (7.1)	4.56 (3.67–5.67)	<.001	4.01 (3.19–5.05)	<.001

(continued)



Table 3. Associations Between Patient Characteristics and Laparoscopic Hysterectomy (continued)

Characteristic	Vaginal (n=9,090)	Laparoscopic (n=54,054)	Crude		Adjusted*	
			OR (99% CI)	P	OR (99% CI)	P
Leiomyomas						
No	5,572 (61.3)	24,418 (45.2)	1.00 (referent)		1.00 (referent)	
Yes	3,518 (38.7)	29,636 (54.8)	1.92 (1.81–2.04)	<.001	1.38 (1.29–1.48)	<.001
Endometriosis						
No	6,743 (74.2)	34,203 (63.3)	1.00 (referent)		1.00 (referent)	
Yes	2,347 (25.8)	19,851 (36.7)	1.67 (1.56–1.78)	<.001	1.44 (1.34–1.56)	<.001
Prolapse						
No	5,012 (55.1)	49,187 (91.0)	1.00 (referent)		1.00 (referent)	
Yes	4,078 (44.9)	4,867 (9.0)	0.12 (0.11–0.13)	<.001	0.13 (0.12–0.14)	<.001
Menstrual disorder						
No	4,789 (52.7)	26,006 (48.1)	1.00 (referent)		1.00 (referent)	
Yes	4,301 (47.3)	28,048 (51.9)	1.20 (1.13–1.27)	<.001	0.80 (0.73–0.86)	<.001

OR, odds ratio; CI, confidence interval; NCHS, National Center for Health Statistics.

Data are n (%) unless otherwise specified.

* Adjusted for age, race, median household income state quartile for patient ZIP code, patient location, primary payer, number of chronic conditions, any gynecologic cancer, endometriosis, leiomyomas, prolapse, menstrual disorder.

taken into account. In the four states with reporting of robotic codes, up to 43% of laparoscopic surgeries included robotic assistance, although this must be interpreted with caution as a result of lack of standardization in reporting. In this study, laparoscopic surgeries were associated with shorter length of stay but greater overall charges, findings that are in accordance with previous reports.^{3,11} In light of difficulty separating out the robotically assisted surgeries, typically associated with highest cost,¹⁵ from conventional laparoscopic surgeries, the information regarding charges may not be generalizable. Additionally, a greater level of detail on perioperative complications would be required to thoroughly compare patient outcomes after outpatient vaginal compared with laparoscopic hysterectomy.

This information has considerable implications for business, public health interventions, and insurance carriers among other key stakeholders in women's health care delivery. Strengths of the study include the variety of states in differing regions of the United States that are represented and large number of hysterectomies available for analysis. Although only 16 of the 50 states contributed data to this study, this cohort represents roughly 40% of adult women in the United States. Regarding the age of this data, the database availability typically has a 2- to 3-year lag time. As such, the results we present are by now more than 5 years old and case volume or associated characteristics may have changed over time. Additional limitations include the lack of universal coding for robotic procedures, which limits utility of the

Table 4. Total Charges and Length of Stay by Mode of Hysterectomy

	Vaginal	Laparoscopic	P*
Total charges			
n	7,625	44,624	
Crude mean (99% CI)	\$14,167 (\$13,912–14,427)	\$24,198 (\$24,017–24,381)	<.001
Adjusted [†] mean (99% CI)	\$14,068 (\$13,811–14,330)	\$24,227 (\$24,053–24,402)	<.001
Length of stay			
n	8,433	49,902	
Mean (99% CI)	0.79 (0.78–0.81)	0.65 (0.65–0.66)	
Crude IRR (99% CI)	1.00 (referent)	0.83 (0.80–0.85)	<.001
Adjusted [†] IRR (99% CI)	1.00 (referent)	0.89 (0.86–0.92)	<.001

CI, confidence interval; IRR, incidence rate ratio.

* P values from linear regression for charges and time and Poisson regression for length of stay.

[†] Adjusted for age, race, median household income state quartile for patient zip code, patient location, primary payer, number of chronic conditions, any gynecologic cancer, endometriosis, leiomyomas, prolapse, menstrual disorder.



results on this topic as well as lack of granular patient information and limited ability to interpret cost data. There are also potential errors in coding inherent with database research, which must be considered. Finally, there are variations in the manner in which individual states maintain their databases and there is a possibility of underreporting of outpatient surgeries. The extrapolations to the national number are estimates prone to inaccuracy and influenced by any errors, missing data, or misclassification of the primary source; as such, these estimates should be interpreted with caution.

The perceived decline in national hysterectomy volume may represent lack of reporting of surgeries performed in ambulatory settings, resulting in underestimation of case volume by 100,000–200,000 procedures annually. Because the surgeries performed in ambulatory facilities are predominantly laparoscopic or vaginal hysterectomies, this also results in inaccurate estimates of the relative proportion of surgeries being performed in a minimally invasive fashion.

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