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Disparities in Utilization of Laparoscopic Hysterectomies: A Nationwide Analysis

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Abstract

Study Objective—The objective of our study was to determine patient and hospital characteristics that were associated with undergoing laparoscopic hysterectomy compared with abdominal hysterectomy.

Methods—In this retrospective cohort study, we analyzed the 2010 Healthcare Cost and Utilization Project-Nationwide Inpatient Sample database. All women who underwent laparoscopic or abdominal hysterectomy for either menorrhagia or leiomyoma were included, based on ICD9 coding. Linear model with binomial distribution and logit link function was used to determine patient and hospital characteristics associated with hysterectomy approach.

Main Results—A total of 32,436 patients were included in this study. Of these, 32% patients underwent laparoscopic hysterectomies and 67% underwent abdominal hysterectomies. With regards to patient characteristics, women younger than 35 years old were more likely to undergo laparoscopic hysterectomy when compared to each of the other age categories ($p < 0.001$). White women were more likely to undergo laparoscopic hysterectomy than black women, Hispanic women or women classified as “other” races ($p < 0.001$ for all comparisons). With regards to median income, patients from the lowest national quartile were less likely to undergo laparoscopic hysterectomy when compared to each of the other three national quartiles for income ($p = 0.01$, $p < 0.001$, $p = 0.001$, respectively). Payment by private insurance was associated with laparoscopic hysterectomy when compared to payment by Medicare or payment by insurance category “other” ($p < 0.001$ for both).

With regards to hospital characteristics, hospitals in the Northeast were more likely to have laparoscopic hysterectomies than hospitals in the Midwest or South ($p < 0.001$ for both comparisons); urban hospitals were more likely than rural hospitals ($p < 0.001$); teaching hospitals were more likely than non-teaching hospitals ($p < 0.001$); and government-owned hospitals were less likely than private, non-profit or private, investor owned ($p < 0.001$ for both comparisons).

Conclusions—Despite the increased popularity of and training in laparoscopic hysterectomies, there remains an obvious disparity in its delivery with regards to patient and hospital

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characteristics. Further investigation is needed on the etiology of this disparity and interventions that may alleviate it.

INTRODUCTION

The benefits of laparoscopic hysterectomy over abdominal hysterectomy are well known. When compared with abdominal hysterectomy, laparoscopic hysterectomy is associated with less post-operative pain, shorter hospital stay, faster return to normal daily activity, less blood loss, fewer postoperative complications, and reduced hospital cost¹⁻³. Unfortunately, national data from the 1998–2002 and 2005 Healthcare Cost and Utilization Project Nationwide Inpatient Sample (HCUP-NIS) database shows that there has been a disparity in those who have access to laparoscopic surgery based on socioeconomic status and race^{1,4}. The purpose of this study was to evaluate whether, given the increase in laparoscopic hysterectomy use, there remains a disparity in its availability.

MATERIALS AND METHODS

Patient Sample

After obtaining exemption from the University of Texas, Medical Branch in Galveston Institutional Review Board, we performed a retrospective cohort study using data from the 2010 HCUP-NIS. This is a uniform, multi-state database containing information of approximately 8 million hospital inpatient stays per year of data. Using a stratified, random sampling design, the Nationwide Inpatient Sample (NIS) approximates a 20 percent sample of community hospitals in the U.S. These samples are from 46 states, giving a representation of approximately 97% of the United States population.

The data represents approximately 20% of admissions of the United States Hospitals. Diagnostic and procedural codings are classified according to the *International Classification of Diseases, Ninth Revision, Clinical Modification*.

Inclusion criteria were women with a primary discharge diagnosis of uterine leiomyomas or menorrhagia and having undergone abdominal or laparoscopic hysterectomy as classified by *International Classification of Diseases, Ninth Revision* codes. These codes were as follows: 626.2, 626.6, 626.8, or 627.0 for menorrhagia; 218, 218.0, 218.1, 218.2, 218.9, 219, 219.1, 219.8, 219.9 for leiomyoma; 68.31 (laparoscopic supracervical hysterectomy), 68.41 (laparoscopic total abdominal hysterectomy), 68.51 (laparoscopically assisted vaginal hysterectomy), 68.61 (laparoscopic radical abdominal hysterectomy), 68.61 (laparoscopic radical vaginal hysterectomy) or any hysterectomy coded with 54.21, 65.01, 65.31, 65.41, 65.53, 65.63, or 65.64 (laparoscopy codes) for laparoscopic hysterectomy; and 68.39 (subtotal abdominal hysterectomy), 68.49 (total abdominal hysterectomy), or 68.89 (modified radical abdominal hysterectomy) for abdominal hysterectomy.

Variables Studied

Database variables studied included age, race, median household income, insurance type, hospital region, hospital location, teaching status of hospital, hospital size, hospital ownership, and multi-hospital system status. Age was divided into the following categories:

less than 35 years old, 35 to 39 years old, 40 to 44 years old, 45 to 49 years old, and 50 years old. Race was divided into white, black, Hispanic, and other. Median household income was divided by national quartiles (the first quartile being the lowest income quartile and the fourth quartile being the highest income quartile) depending on the patient's zip-code. Insurance type was divided into the following categories: Medicaid, Medicare, private insurance, or other. Hospital region was defined according to region in the United States: Northeast, Midwest, South and West. Hospital location was defined according to rural versus urban location. Teaching status was defined as teaching versus non-teaching hospital. Hospital size was defined by hospital bed size and categorized as small, medium and large. Number of beds used to define each category varied according to region in the United States, teaching status, and hospital type (rural versus urban). Hospital ownership was divided into the following categories: public hospital, non-profit private hospital, investor-owned private hospital. Hospitals were characterized as either a member or non-member of a multi-hospital system (two hospitals or more).

Statistical Analysis

Generalized linear model with binomial distribution and logit link function was used to assess effects of age, race, median household income, insurance type, hospital region, hospital location, hospital teaching status, hospital ownership, and multi-hospital system status on incidence of laparoscopic hysterectomy. Reference categories were age less than 35 years, white race, lowest national quartile median household income, private insurance, Northeast hospital region, rural hospital location, non-teaching hospital, small hospital size, government hospital ownership, and non-member of a multi-hospital system. STATA statistical software, version 11.1 (STATA Corp., College Station, TX) was used for all analyses.

RESULTS

Our final sample size consisted of 32,436 patients who underwent either laparoscopic or abdominal hysterectomy in 2010. Among these patients, 10,621 (32%) patients underwent laparoscopic hysterectomy and 21,815 (67%) patients underwent abdominal hysterectomy. Descriptive statistics for abdominal and laparoscopic hysterectomy are shown in the first two columns of table 1. The odds ratios for undergoing laparoscopic hysterectomy and associated p-values are depicted in the last 2 columns of table 1.

DISCUSSION

The results of our study suggest that despite the more frequent use of laparoscopic hysterectomies, there remains a disparity in its availability across the US. Unfortunately, our findings are not dissimilar to the results of similar studies performed a decade ago. In their analysis of 341,487 hysterectomies using the 1998–2002 HCUP-NIS database, Abenheim et al reported a significant association of laparoscopic hysterectomies and patients with median household income greater than \$25,000, Caucasian race, and private insurance (versus Medicaid or Medicare). At that time, however, laparoscopic hysterectomies comprised only 9.9% of all hysterectomies⁵. In 2005, the percent of laparoscopic hysterectomies slowly increased to 14%^{6,7}. Despite this slight increase, Jacoby et al continued to find

discrepancies in distribution of laparoscopic hysterectomies in their analysis of the 2005 HCUP-NIS database ⁷. Laparoscopic hysterectomies were associated with Caucasian race, increased household income, and private insurance. Since then, however, laparoscopic hysterectomies have increased at an exponential rate. Turner et al. reported on 13,973 women who underwent hysterectomies at Magee-Women's Hospital in New York and found that from 2000 to 2010, laparoscopic hysterectomies increased from 3.3% to 43% of all hysterectomies ⁸. This is likely attributed to an increase in demand, as women are now more aware of the benefits of laparoscopic hysterectomy versus laparotomy, and also in the number of physicians that are being trained in this approach not only in residency and fellowship, but also in courses dedicated to laparoscopic hysterectomies ⁹. Given this exponential increase, we sought to determine if there was any improvement in distribution of laparoscopic hysterectomies.

Like the 2005 study, our study found that patient factors of white race, increased median household income and private insurance were significantly associated with laparoscopic hysterectomy versus an abdominal approach. In addition, our findings showed that younger patients were also more likely to undergo laparoscopic hysterectomy. This is in accordance with laparoscopic surgeries by other specialties. Saia et al reported on a review of 73,853 hospital discharge records for patients who underwent laparoscopic cholecystectomy from 2001–2010 and also found that younger patients were more likely to undergo laparoscopic cholecystectomy ¹⁰. A possible explanation is the fact that younger patients tend to have less surgical history and therefore may be thought of as better candidates for laparoscopic surgery. With regards to race, it may be argued that black women have larger and more myomas, thus explaining the higher incidence of an abdominal approach versus a laparoscopic one. Further studies, however are needed to support this conjecture ^{11,12}. On the other hand, we could not conceive a medical justification for the fact that patients with greater income continue to undergo laparoscopic hysterectomies more often than patients with lower income. Possible factors that may contribute to this continued discrepancy include the fact that low-income women may be less knowledgeable and thus less likely to insist on undergoing a laparoscopic approach. Multiple studies have supported this phenomenon among both low-income and rural populations with regards to low health literacy and less use of health services, ^{13–16}. However, the fact that both Medicaid and private insurance patients were equally likely to undergo laparoscopic hysterectomy suggests that we are moving towards the right direction, as this equality was not present in 2005 ⁷. Nevertheless, our results support that medically underserved women continue to be deprived of the well-known benefits associated with laparoscopic hysterectomies and that if there is a change towards the right direction, the change is happening too slowly. This highlights an important need to focus medical policy on addressing this unequal distribution of a surgery that has now been available for almost three decades. It will especially be interesting to see impacts the Affordable Care Act has on this currently unequal distribution.

With regards to hospital characteristics, our results are similar to those from 2005, in that laparoscopic hysterectomies were more likely to be performed at urban and academic hospitals. Although this may at first seem intuitive, as both types of hospitals have more access to updated technology, it could be argued that by now laparoscopy is no longer considered “updated” given its extensive use. The fact that rural hospitals have less

laparoscopic hysterectomies may be a reflection of decreased access to medical care and lower financial resources. Finally, FDA approval of robotic-assisted laparoscopic hysterectomies in 2005 likely contributed to increased laparoscopic hysterectomy rates in hospitals with greater financial resources (i.e. urban, private, academic hospitals). With regards to region, the data from 2005 showed a significantly higher occurrence of laparoscopic hysterectomies in the West when compared with the Northeast, South, and Midwest, whereas in our study we found equal distribution between the two regions; however we did find a significantly less occurrence in the Midwest and South when compared with the Northeast. This could mean that the Northeast has caught up with the West in laparoscopic hysterectomies, however, the Midwest and South continue to lag behind. Other studies have also shown that geographical differences in the access to healthcare remains a concern, with little having been done to address this discrepancy^{17–19}. Future studies need to focus on national quality control interventions that may result in closing this gap, especially with regards to distribution of laparoscopic hysterectomy across the nation.

With regards to hospital size, both 2005 and our data showed no significant difference in laparoscopic hysterectomies. This study is one of the few that looks at hospital ownership and multi-hospital network status with regards to laparoscopic hysterectomies. Although the latter had no association with laparoscopic hysterectomies, private hospitals were more likely than government hospitals to perform laparoscopic hysterectomies. This could be a similar phenomenon as is seen with insurance type and hysterectomy approach.

Our observations are not limited to the field of gynecology. Hagendorf et al. reported on predictors of laparoscopic appendectomies using the HCUP-NIS databases from 1996–2002. They also found higher median income (greater than \$45,000), private insurance, and teaching hospital status significantly associated with laparoscopic appendectomies²⁰. We were unable to find a more recent analysis pertaining to laparoscopic appendectomies and patient or hospital demographics. When looking at laparoscopic versus open hernia repairs using the HCUP-NIS database for 2009, Colavita et al also found that patients with private insurance were more likely to undergo a laparoscopic approach. However, with regards to patient median income, there was no difference²⁰.

Our study has many important elements that contribute to its strength. First, the large sample size and the fact that the HCUP-NIS sampling scheme represents approximately 90% of US hospitals decreases sampling bias. Second, we included only patients with a primary diagnosis of menorrhagia and leiomyomas as both diagnoses are reasonable indications for either open or laparoscopic hysterectomies. We chose not to include women with endometriosis or malignancy as the adhesive nature of these diseases may promote an abdominal approach. Finally, data in this study is less than 5 years old and thus represents current practice trends.

Despite these strengths, our study also has a few limitations. First, as with any large database, errors in coding are possible. Second, the database does not reflect outpatient laparoscopic hysterectomies which may bias the results significantly, given the increased pressure to decrease postoperative costs by increasing outpatient procedures. Third, our

study is limited to only diagnoses of menometrorrhagia and fibroids. Although these are the major benign indications for hysterectomy, we acknowledge that there are others. Finally, our study does not reflect data with regards to vaginal hysterectomies. Vaginal hysterectomies are typically reserved for smaller uteri and, therefore, candidates for both vaginal and laparoscopic hysterectomies may overlap. However, given the fact that the percent of hysterectomies performed vaginally has been steadily decreasing, the effect of excluding this approach may be small^{5,6,7,8,13}. Unfortunately, this trend is not in accordance with guidelines from the American College of Obstetrics and Gynecology (ACOG), which recommends that “vaginal hysterectomy is the approach of choice whenever feasible”. Further studies are needed to specifically address whether the increase in laparoscopic hysterectomies are indeed alternatives to abdominal hysterectomies or are at the expense of vaginal hysterectomies²¹.

In conclusion, despite the increased popularity of and training in laparoscopic hysterectomies, there remains an obvious disparity among the national distribution of these surgeries. The fact that low income women, non-Caucasian women, or women who undergo surgery at a government hospital are less likely to undergo a laparoscopic hysterectomy may be one of the facets of a larger shortcoming in our healthcare system, in which medically underserved women are deprived of good quality medical care. Nevertheless, it appears that the system is inching towards bridging this gap as our study found that patients with Medicaid were equally as likely to undergo laparoscopic hysterectomies as patients with private insurance, an observation that was not present in previous studies. Although further investigation is still needed on the reasons for those disparities that remain, it will be interesting to see how the current large scale changes in healthcare will impact them.

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Table 1

Descriptive statistics for each variable

Characteristics	Laparoscopy		Abdominal	
	N	(%)	N	(%)
Age				
<35	991	9.3%	1,425	6.5%
35–39	1,617	15.2%	3,108	14.2%
40–44	2,857	26.9%	6,000	27.5%
45–49	3,117	29.3%	6,846	31.4%
>50	2,039	19.2%	4,436	20.3%
Race				
White	6,165	58.0%	9,406	43.1%
Black	1,640	15.4%	5,855	26.8%
Hispanic	1,059	10.0%	2,612	12.0%
Other	1,757	16.5%	3,942	18.1%
Median Income				
first national quartile *	2,348	22.1%	6,222	28.5%
second national quartile	2,493	23.5%	5,172	23.7%
third national quartile	2,798	26.3%	5,240	24.0%
fourth national quartile	2,782	26.2%	4,749	21.8%
Insurance Type				
Private	8,108	76.3%	15,297	70.1%
Medicare	511	4.8%	1,099	5.0%
Medicaid	1,158	10.9%	2,842	13.0%
Other	805	7.6%	2,512	11.5%
Hospital Region				
Northeast	1,932	18.2%	3,769	17.3%
Midwest	2,146	20.2%	4,995	22.9%
South	3,784	35.6%	8,648	39.6%
West	2,759	26.0%	4,403	20.2%
Hospital Location				

Characteristics		Laparoscopy		Abdominal	
		N	(%)	N	(%)
Teaching Status	Rural	1,174	11.1%	2,804	12.9%
	Urban	9,366	88.2%	18,744	85.9%
Hospital Size	Non-Teaching	6,193	58.3%	12,383	56.8%
	Teaching	4,428	41.7%	9,432	43.2%
Hospital Ownership	Small	1,382	13.0%	2,685	12.3%
	Medium	2,899	27.3%	5,583	25.6%
	Large	6,259	58.9%	13,280	60.9%
Multi-hospital Network Status	Government	1,094	10.3%	3,077	14.1%
	private, non-profit	7,998	75.3%	15,612	71.6%
	private, investor-owned	1,448	13.6%	2,859	13.1%
	Non-member	3,830	36.1%	8,391	38.5%
	Member	6,791	63.9%	13,424	61.5%

* first national quartile is lowest income quartile

Table 2

Odds Ratio of undergoing laparoscopic hysterectomy based on patient characteristics

Variables	Odds Ratio (95% CI)	p-value
Age		
<35 (REF [*])	1.0	
35–39	0.75 (0.68, 0.83)	<0.001
40–44	0.66 (0.60, 0.73)	<0.001
45–49	0.60 (0.55, 0.66)	<0.001
>50	0.56 (0.51, 0.62)	<0.001
Race		
White (REF)	1.0	
Black	0.44 (0.42, 0.48)	<0.001
Hispanic	0.61 (0.56, 0.67)	<0.001
Other	0.70 (0.65, 0.75)	<0.001
Median Income		
first national quartile ^{**} (REF)	1.0	
second national quartile	1.09 (1.02, 1.17)	0.01
third national quartile	1.14 (1.06, 1.22)	<0.001
fourth national quartile	1.13 (1.05, 1.22)	0.001
Insurance Type		
Private (REF)	1.0	
Medicare	0.82 (0.76, 0.89)	<0.001
Medicaid	0.95 (0.85, 1.06)	0.35
Other	0.71 (0.65, 0.77)	<0.001

* REF=reference

** first national quartile is lowest income quartile

Table 3

Odds Ratio of undergoing laparoscopic hysterectomy based on hospital characteristics

Variables	Odds Ratio (95% CI)	p-value
Hospital Region		
Northeast (REF*)	1.0	
Midwest	0.87 (0.80, 0.94)	<0.001
South	0.83 (0.77, 0.89)	<0.001
West	1.01 (0.93, 1.10)	0.80
Hospital Location		
Rural (REF)	1.0	
Urban	1.16 (1.07, 1.25)	<0.001
Teaching Status		
Non-Teaching (REF)	1.0	
Teaching	1.27 (1.19, 1.36)	<0.001
Hospital Size		
Small (REF)	1.0	
Medium	1.02 (0.95, 1.11)	0.57
Large	0.97 (0.90, 1.04)	0.38
Hospital Ownership		
Government-owned (REF)	1.0	
private, non-profit	1.48 (1.36, 1.61)	<0.001
private, investor-owned	1.30 (1.18, 1.44)	<0.001
Multi-hospital Network Status		
Non-Member (REF)	1.0	
Member	0.99 (0.94, 1.04)	0.72

REF=reference