Published in final edited form as:

J Minim Invasive Gynecol. 2014 ; 21(4): 656–661. doi:10.1016/j.jmig.2014.01.012.

Trends in the National Distribution of Laparoscopic Hysterectomies from 2003–2010

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Abstract

Study Objective—The purpose of this analysis was to compare the trends in undergoing laparoscopic hysterectomy (versus abdominal or vaginal hysterectomy) based on patient age, race, median income and insurance type, from 2003 to 2010.

Methods—In this retrospective cohort study, we analyzed the Healthcare Cost and Utilization Project-Nationwide Inpatient Sample databases from 2003–2010. All women who underwent a hysterectomy for either menorrhagia or leiomyoma were included, based on ICD-9 coding. The predicted probability of undergoing laparoscopic hysterectomy was determined for each year according to patient age, race, median income, and insurance type. The slopes of these values (i.e. the trend) was compared for each subgroup (i.e. black, white, Asian, etc.) in these categories.

Main Results—A total of 530, 154 cases were included in this study. Total number of hysterectomies decreased by 39% from 60,364 to 36,835 from 2003 to 2010. The percent of hysterectomies that were laparoscopic increased from 11% in 2003 to 29% in 2010. All groups analyzed experienced an increase in predicted probability of undergoing a laparoscopic hysterectomy. Of all women undergoing hysterectomy, the probability of undergoing a laparoscopic hysterectomy remained highest for women who were less than 35 years old, white, with the highest median income, and with private insurance from 2003–2010. The slope was significantly greater for (1) white females versus all other races analyzed ($p<0.01$), (2) females in the highest income quartile versus females in the lowest income quartile ($p<0.01$) and (3) females with private insurance versus females with Medicaid ($p<0.01$) or Medicare ($p<0.01$).

Conclusions—There remains a gap in distribution of laparoscopic hysterectomies with regards to age, race, median income and insurance type that does not seem to be closing, despite the increased availability of laparoscopic hysterectomies.

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INTRODUCTION

Laparoscopic hysterectomy has many advantages over abdominal hysterectomy, including less post-operative pain, shorter hospital stay, faster return to normal daily activity, less blood loss, fewer postoperative complications, and reduced hospital cost^{1–3}. However, according to data from 1998–2002, there has been a disparity in those who have access to laparoscopic hysterectomies based on socioeconomic status and race¹. In a recent analysis on data from 2010, we showed that this discrepancy continues to exist⁴. Given this, we were curious to see if this discrepancy has been decreasing over time, given the increasing prevalence of laparoscopic hysterectomies^{5–7}. The purpose of this analysis was to determine whether the probability of receiving a laparoscopic hysterectomy (versus another route) has become more similar from 2003–2010 among patients of different ages, races, median incomes and insurance types.

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 2003–2010 HCUP-NIS. This is a uniform, multi-state database containing information of approximately 8 million hospital inpatient stays per year of data. Although the data is derived from approximately 20% of national admissions, the sample scheme represents 90% of all US 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 who underwent abdominal, vaginal 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; 68.39 (subtotal abdominal hysterectomy) and 68.49 (total abdominal hysterectomy) for abdominal hysterectomy; 68.59 (total vaginal hysterectomy) for vaginal hysterectomy; and 68.31 (laparoscopic supracervical hysterectomy), 68.41 (laparoscopic total abdominal hysterectomy), 68.51 (laparoscopically assisted vaginal hysterectomy) and any hysterectomy coded with 54.21, 65.01, 65.31, 65.41, 65.53, 65.63, or 65.64 (laparoscopy codes) for laparoscopic hysterectomy.

Variables Studied

The number of abdominal, vaginal and laparoscopic hysterectomies was obtained from 2003 to 2010. Variables studied included age, race, median household income, and insurance type. Age was divided into the following categories: less than 35 years old, 35 to 49 years old, and 50 years old or greater. Race was divided into white, black, and hispanic. 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, or private insurance.

Statistical Analysis

A multinomial logistic regression model was used to determine the predicted probabilities of undergoing a laparoscopic hysterectomy versus abdominal or vaginal hysterectomy according to the variables studied. All probabilities were adjusted for the variables studied. These calculations were done using mlogit in STATA. Then a regression model against time with an interacting effect of treatment was used to compare the slopes of the predicted probabilities obtained. No adjustment was used to report pairwise comparisons. All reported differences were significant at $p < 0.05$ even after Bonferroni adjustment. These calculations were done using PROC GLM in SAS.

RESULTS

Our final sample size consisted of 530,154 patients who underwent laparoscopic and abdominal hysterectomies from 2003 to 2010. The distribution of these hysterectomies per year is depicted in figure 1. Predicted probabilities of undergoing laparoscopic hysterectomy are plotted in figures 2–5. The p-values presented in the figures are ANOVA p-values comparing all slopes. With regards to these trends, the slopes of predicted probabilities were not significantly different among the age groups ($p=0.11$). The slope of the predicted probability that white women would undergo a laparoscopic hysterectomy was significantly larger than that for black women ($p<0.001$), Hispanic women ($p<0.001$) or women in the “other” race category ($p<0.01$). With regards to national income quartile, the slope of the predicted probability that women from the highest income quartile was significantly larger than that for women from the lowest income quartile (0.004). All other quartile comparisons were not significantly different. Finally, the slope of the predicted probability that women with private insurance was significantly larger than the that for women with Medicaid ($p<0.01$). All other insurance comparisons were not significantly different.

DISCUSSION

This study reviews the national trends of undergoing laparoscopic hysterectomy from 2003–2010 and presents results according to patient characteristics. In an analysis of abdominal and laparoscopic hysterectomies from the 2002–2008 HCUP-NIS databases, Wiser et al reported on a 30% decrease in frequency of hysterectomies⁸. A recent publication by Wright et al showed a 21% decrease from 1998–2010 and a 32% decrease from 2003–2008⁹. Our results showed a similar decrease from 2003 to 2008 (20%) and further shows a 39% from 2003 to 2010. These numbers may be different from the analysis reported by Wright et al, as their study accounted for the weights attributed to the values obtained from the HCUP-NIS database, whereas we performed analysis on solely the values reported in the database. In addition, we found that the percent of hysterectomies performed laparoscopically increased from 11% to 29% during this time period. Nevertheless, abdominal hysterectomy continues to be far more frequent, which is consistent with results reported by Wright et al, however is in sharp contrast to the results reported by Turner et al. In their analysis of hysterectomies performed during the same time period at the University of Pittsburgh Medical Center, Magee-Women’s Hospital, Turner et al. reported that the percent of hysterectomies performed laparoscopically had increased to such an extent that it

became the most frequent route of hysterectomy by 2010⁷. The authors point out that the discrepancy between their results and those of the HCUP-NIS based analysis from 2003 and 2005 may be due to the fact that prior to 2006, there was no separate code for laparoscopic hysterectomies and, therefore, tracking of such hysterectomies prior to this year may have been flawed. Our analysis, however, includes this national change in coding of hysterectomies and still shows that abdominal hysterectomy is more frequent than laparoscopic hysterectomy. This discrepancy in results from Pittsburgh and our national results could be explained by the possibility that regional trends in hysterectomies may differ drastically in the US. For example, a university affiliated hospital located in the city of Pittsburgh may be experiencing a trend where the frequency of laparoscopic hysterectomies surpasses that of abdominal hysterectomies, however the majority of the US hospitals that are non-academic and in rural communities may continue to offer mainly abdominal hysterectomies. If this were to be true, it would bring to light a regional disparity in availability of laparoscopic hysterectomies and needs to be studied further.

Our results suggest that the predicted probability of undergoing a hysterectomy laparoscopically has increased for each patient characteristic studied, however at different rates. With regards to age, this increase has been felt by all age groups at a statistically similar rate, with predicted probability highest for women younger than 35 years of age. This may be due to the fact that younger patients have less surgical history and therefore may be considered better candidates for laparoscopic surgery.

All race groups also experienced increases in the predicted probability of undergoing a hysterectomy laparoscopically over the study period. Our results also showed that the probability of undergoing a hysterectomy laparoscopically has been highest among Caucasian and lowest among black women from 2003–2010. Van Hove et al noted a similar trend when comparing white versus non-white patients undergoing laparoscopic appendectomy from 1997–2003¹⁰. There have been multiple references to this discrepancy not only among studies focusing on laparoscopic hysterectomies^{1,6}, but also among studies focusing on other laparoscopic surgeries^{11–13}. The reason for this difference with regards to hysterectomies remains unknown, but a possible reason is the fact that black women have larger and more myomas, thus limiting use of a laparoscopic approach^{14,15}. This, however does not explain the similar discrepancy noted in other laparoscopic surgeries. Another broader possibility that may also explain the discrepancy for other laparoscopic surgeries, is the fact that black Americans are less likely than white Americans to have a usual source of health care, leading to more progression of disease at the time of diagnosis¹⁶. The predicated probability for white females, however, is increasing at a significantly higher rate than any of the other races, suggesting an even greater discrepancy in the future. Further investigation is needed into the etiology of this difference, as our research shows it has persisted for over a decade and may even worsen.

The predicted probability that their hysterectomy was laparoscopic increased for women from all four income quartiles. However, we found that the slope of this change was significantly greater for women from the highest national income quartile than women from the lowest national income quartile ($p < 0.01$), resulting in a wider gap by 2010. We were unable to find any other studies addressing this trend in hysterectomies, however an older

study addressing the trend of the frequency of laparoscopic appendectomies from 1998–2002 showed a different trend whereby the higher laparoscopic percent frequency among women living in richer zip codes was increasing and the lower frequency among women living in poorer zip codes was decreasing, resulting in a wider gap between the two groups¹⁰. We were unable to find a more recent analysis of laparoscopic appendectomies. Possible reasons for this persistent gap are the fact that individuals with less income are less likely to have insurance coverage or seek consistent medical care, possibly leading to more progressive disease (ie larger fibroids) at time of presentation¹⁷. It will be interesting to see how the Affordable Care Act impacts this discrepancy.

With regards to insurance type, the predicted probability of hysterectomies being laparoscopic has been increasing among women of all insurance types, with private insurance patients consistently being most likely to undergo a hysterectomy laparoscopically. The increase in probability is significantly greater for women with private insurance than for women with Medicaid. This may be attributed to the fact that reimbursement for laparoscopic surgery is higher from private insurance or because patients with private insurance are more knowledgeable about laparoscopic hysterectomies and therefore demand this route^{18–20}. Additional research is needed to study this further.

Our results show that the vaginal percent frequency has remained relatively similar from 2003–2010 (figure 1b). The trend suggests that the percent of hysterectomies that are abdominal has decreased as the percent of hysterectomies that are laparoscopic has increased. Perhaps this reflects that laparoscopic cases have replaced abdominal cases and are not being performed so much at the expense of vaginal hysterectomies. If this were the case, it would be in accordance with the American College of Obstetrics and Gynecology (ACOG) recommendations that “vaginal hysterectomy is the approach of choice whenever feasible”. However, research is needed to investigate this theory further.

The results of our study are compatible with those of Guller et al, in which the authors analyzed the 1998–2000 HCUP-NIS to determine predictors of undergoing laparoscopic appendectomy. They reported that of all patient characteristics analyzed (i.e. age, gender, race, median ZIP code income, insurance status, patient’s comorbidities, and presence of abscess or perforation), Caucasian race and private insurance status were significant, independent predictors of undergoing laparoscopic appendectomy. Our results show a similar disparity with regards to race and insurance type; unfortunately, this discrepancy is only worsening over time.

Our study has many important strengths. First the large sample size and the fact that the HCUP-NIS sampling scheme represents 90% of US hospitals decreases sampling bias. Second, the data represented in this study spans a period of 10 years, with the latest data from 2010, allowing for depiction of both widespread and recent trends. Finally, our study excludes endometriosis and malignancies, which may introduce a bias towards an abdominal approach, versus a laparoscopic approach, given the possibility of more extensive adhesions.

This study has a few weaknesses that need to be mentioned. We feel the greatest weakness of our study is the exclusion of outpatient hysterectomies. Studies suggest that there is an

increasing trend towards outpatient laparoscopic hysterectomies, which would introduce a significant sampling bias in our analysis ²¹. The laparoscopic percent frequencies would have been higher had the outpatient laparoscopic hysterectomies been accounted for. Second, we relied on ICD-9 codes for our inclusion criteria. Third, our study only focused on menorrhagia and leiomyomas as the most common benign indications for hysterectomy; we recognized there are other benign indications which are not included in this study.

In conclusion, it appears that all subgroups analyzed are experiencing an overall increase in the probability of undergoing a hysterectomy via a laparoscopic route. Nevertheless, our results also suggest that there remains an obvious discrepancy among the different races, national income quartiles, and insurance types that seems to be worsening from 2003–2010. It will be interesting to see what impact the Affordable Care Act will have on these trends over the next decade.

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Figure 1.

Predicted probability of laparoscopic hysterectomy according to age

Figure 2.

Figure 3.

Predicted probability of laparoscopic hysterectomy according to income

Figure 4.

Predicted probability of laparoscopic hysterectomy according to insurance type

Figure 5.