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Insurance Type and Major Complications Following Hysterectomy

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Abstract

Objectives—To investigate the relationship between primary insurance type and major complications following hysterectomy.

Methods—A retrospective analysis was performed of women with Medicaid, Medicare, and private insurance who underwent hysterectomy from January 1, 2012 – July 1, 2014 and were included in the Michigan Surgical Quality Collaborative. Major complications within 30 days of surgery included: deep/organ space surgical site infection, deep venous and pulmonary thromboembolism, myocardial infarction or stroke, pneumonia or sepsis, blood transfusion, readmission, and death. Multivariable logistic regression was used to identify factors associated with major complications and characteristics associated with the Medicaid and Medicare groups.

Results—1,577 women had Medicaid, 2,103 had Medicare, and 11,611 had private insurance. The Medicaid and Medicare groups had a similar rate of major complications, nearly double that of the private insurance group (6.85% vs 7.85% vs 3.79%, $p < .001$). Compared to private insurance, women with Medicaid and Medicare had increased odds of major complications (OR 1.60, 95% CI 1.26–2.04, $p < .001$; OR 1.34, 95% CI 1.04–1.73, $p = .03$, respectively). Women with Medicaid were more likely to be non-white, have a higher body mass index (BMI), report tobacco use in the last year and undergo an abdominal hysterectomy. Those with Medicare were more

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likely to be white, to have gynecologic cancer, and to be functionally dependent. Both groups had increased odds of ASA Class 3 and decreased odds of undergoing hysterectomy at large hospitals (> 500 beds).

Conclusions—Women with Medicaid and Medicare insurance have increased odds of major complications following hysterectomy. Abdominal hysterectomy, BMI, and smoking are potentially modifiable risk factors for women with Medicaid.

Keywords

hysterectomy; insurance; Medicaid; postoperative complications

Introduction

Several studies have shown that surgical morbidity and mortality rates are associated with primary insurance type. Analyses of patients with Medicaid undergoing spinal and pediatric surgery have revealed that postoperative complications are more common, length of hospital stay is increased, mortality rates are higher, and costs are increased in this population compared to those with private insurance.^{1–4} Medicaid and Medicare insurance have also been shown to be independent predictors of poorer outcomes among patients undergoing bariatric surgery.⁵ Although hysterectomy is the most common major gynecologic surgery performed in the United States, there is a paucity of data looking at the impact of payer status on complications following this procedure.^{6–8} A study using 1991 data by Hakim et al found that among women <65 years old undergoing hysterectomy, those with Medicaid had a 40% increased odds of postoperative complications compared to those with private insurance.⁷ This study was limited by age, lack of data regarding the prevalence of specific postoperative complications, and failure to control for hospital variance in the statistical modeling. Further limiting this study's relevance to current practice is the absence of any laparoscopic hysterectomies and the high percentage of abdominal hysterectomies, around 80%, in both insurance groups.

Therefore, our primary aim was to compare rates of major postoperative complications between women with Medicaid, Medicare, and private insurance. As a secondary aim, we sought to identify patient-level factors associated with women in the Medicaid and Medicare insurance groups that may help explain why these patients have higher complication rates.

Materials and Methods

We used data from the Michigan Surgical Quality Collaborative (MSQC), a Blue Cross Blue Shield of Michigan/Blue Care Network-funded database voluntarily populated by both academic and community hospitals throughout the state. Data are abstracted from charts by specially trained, dedicated nurse abstractors. Patient characteristics, intraoperative processes of care, and 30-day postoperative outcomes from hysterectomy cases at member hospitals are routinely collected. To reduce sampling error, a standardized data collection methodology is employed that uses only the first 25 cases of an 8-day cycle (alternating on different days of the week for each cycle). Routine validation of the data is maintained by

scheduled site visits, conference calls, and internal audits. The University of Michigan Institutional Review Board granted “Not Regulated” status to this study (HUM00073978).

Hysterectomies available from the MSQC database and performed between January 1, 2012 and July 1, 2014 were analyzed as part of the study. The 3 primary insurance groups of interest were: Medicaid, Medicare, and private insurance. Patients were considered to have “Medicaid” if they had Medicaid or a Health Maintenance Organization (HMO) Medicaid plan. Women were grouped as having “Medicare” if they had Medicare, Medicare with a supplemental plan (e.g. Medigap), or Medicare Advantage (Blue Cross Blue Shield or Blue Care Network of Michigan). “Private” insurance was defined as having Blue Cross Blue Shield of Michigan, Blue Care Network, HMO plans, or other private insurance plans. We excluded cases with “other” insurance, no insurance or in cases where insurance data were missing. The “other” category includes self-pay, government-sponsored plans excluding Medicare or Medicaid (ex: Veteran’s Affairs, TriCare), Worker’s Compensation, and auto insurance. We also excluded those cases where both Medicaid and Medicare were listed for the same patient, since parsing out the main effect of the payer group would be difficult.

Demographics, perioperative variables and major postoperative complications diagnosed within 30 days of surgery were identified and compared across the 3 groups. Variables compared included: age (years), race, parity, body mass index (BMI, kg/m²), American Society of Anesthesiology (ASA) Class,⁹ smoking status, gynecologic cancer, history of deep venous thromboembolism, urgent or emergent indication for the hysterectomy, surgical time, abdominal hysterectomy, estimated blood loss at the time of surgery (EBL, mL), specimen weight (grams), hospital bedsize 500 and teaching hospital status. Specimen weight (grams) included uterus +/- adnexa(e) removed at the time of surgery. Complications included: deep/organ space surgical site infection (SSI), deep venous thromboembolism, pulmonary embolism, myocardial infarction/stroke, pneumonia/sepsis, blood transfusion, readmission, and death. Bivariate analyses were assessed via Chi-Square analysis or Fisher’s Exact test with small cell sizes; however, for continuous variables, analysis of variance (ANOVA) or Kruskal-Wallis were performed.

Logistic regression was then used to identify factors independently associated with major complications within 30 days of hysterectomy. In order to account for clustering of patient outcomes within hospitals, a mixed model was used. Three hospitals were excluded during the model development process due to small case volume (<20 hysterectomies). Variables that were found to be significant in bivariate analyses were retained for future model analyses and entered via stepwise, forward, and backward selection via fixed effects logistic regression.

Finally, we developed multivariable logistic regression models to identify patient and hospital setting-level attributes associated with Medicaid and Medicare status. All statistical analysis was performed using SAS Version 9.3 (Copyright 2014, SAS Institute, Inc.).

Results

Data for 16,548 hysterectomies were available for analyses. After exclusion of 3 sites for small case volumes, 49 MSQC hospitals were included in the final analyses. The following insurance groups were represented: Medicaid (1,577), Medicare (2,103), private insurance (11,620), both Medicare and Medicaid insurance (297), no insurance (210), other insurance (736), and missing (5). The groups of interest, Medicaid, Medicare, and private insurance, represented 92.5% of all cases with available insurance data (15,291/16,543). The distribution of women undergoing hysterectomy with each insurance type by hospital site is shown in Figure 1. The proportions of Medicaid and Medicare patients undergoing hysterectomy at hospitals in MSQC ranged widely, from 0.8% to 28.0% and from 3.1% to 27.2%, respectively.

Demographics and perioperative variables are presented in Table 1. Patients with Medicare were older than those in the Medicaid and private insurance groups and had the highest prevalence of ASA Class 3, gynecologic cancer, history of deep venous thromboembolism (DVT), and urgent or emergent indication for the hysterectomy. The Medicare group also had the longest surgical time and longest length of hospital stay. Interquartile range for parity and mean BMI were highest in the Medicaid group. Nearly half of women with Medicaid were smokers, which was more than double the prevalence among privately insured patients and 3 times the prevalence seen in Medicare patients. Although the Medicaid group had the highest proportion of hysterectomies done abdominally, median specimen weight in this group was similar to those with private insurance. The interquartile range for EBL was also highest in the Medicaid group.

The overall rate of any major complication within 30 days of hysterectomy was 4.66% (713/15,291). Table 1 shows complications by insurance group. At nearly 8%, the Medicare group had the highest prevalence of any major postoperative complication followed closely by the Medicaid group at 7% and finally, the private insurance group had the lowest prevalence at 4%. Deep/organ space surgical site infections occurred twice as frequently in the Medicaid group compared to the Medicare and private insurance groups. Women with Medicaid also had the highest readmission rate. Blood transfusion rate in the Medicaid and Medicare groups was double that of the privately insured. Women with Medicare had the highest prevalence of pulmonary embolism, myocardial infarction or stroke, pneumonia or sepsis, and death. The frequency of DVT was low and similar across groups.

Using the variables found to be significant in Table 1, a multivariable model was used to identify factors independently associated with postoperative complications (Table 2). After exclusion of cases performed at hospitals for low case volumes (N=10), 181 cases with missing site identification, and 15 cases due to missing data for relevant variables, a total of 15,085 hysterectomy cases were included in the final model. Risk factors present in the final model were Medicaid (vs private insurance), Medicare (vs private insurance), ASA Class 3, gynecologic cancer, surgical time (hours), urgent or emergent indication, and abdominal hysterectomy (referent non-abdominal hysterectomy). Compared to women with private insurance, women with Medicaid had a 60% increased odds of major postoperative complications and women with Medicare had 34% increased odds. Among all variables,

abdominal hysterectomy had the largest impact and was associated with a 370% increased odds of major postoperative complications.

Because both Medicaid and Medicare groups had increased major complications following hysterectomy, we were interested in identifying patient and hospital-level characteristics unique to these women that may help explain this finding. We developed 2 multivariable logistic regression models to identify factors associated with women who have Medicaid (Table 3) and Medicare (Table 4) insurance. Both models were created using the same 15,085 cases that were used to create the model for major postoperative complications. Several patient-level characteristics were unique to each group. Women with Medicaid insurance were more likely to be of non-white race, have a higher body mass index, smoke, and have an abdominal hysterectomy. Women with Medicare insurance were more likely to be white, have a primary diagnosis of gynecologic cancer and to be functionally dependent. Women with Medicaid and Medicare both had increased odds of ASA Class 3. In terms of hospital-level characteristics, both groups had decreased odds of undergoing hysterectomy at large hospitals (> 500 beds) and women with Medicaid also had decreased odds of being treated at a teaching hospital.

Discussion

In this analysis of the relationship between insurance status and major complications following hysterectomy, we found that women with Medicaid and Medicare, compared to the privately insured, have increased odds of major postoperative complications. This relationship was significant with adjustments for potential confounders including age, ASA Class, a diagnosis of gynecologic cancer, surgical time, urgent or emergent indication, and use of an abdominal surgical approach.

A secondary aim of our study was the identification of patient-level factors that may explain the increased complications among women in these insurance groups. Consistent with previous analyses, we found that women with Medicaid have higher BMI, are more likely to smoke, and are more likely to have an ASA Class 3. These findings suggest that the overall health status of women with Medicaid is poorer than that of women with private insurance.^{10–12} However, BMI and smoking are potentially modifiable risk factors. We recognize that these risk factors are difficult to modify, but with significant efforts to encourage healthier behavior, especially for several months prior to elective cases (e.g. increased exercise, healthier eating, and smoking cessation), it may be possible to decrease this group's risk for complications. Unfortunately, the potential to modify the risk of complications for patients with Medicare is not as easily realized. Because functional dependence and gynecologic cancer are conditions that occur with aging and are known to increase postoperative morbidity,^{13,14} it is more difficult to develop strategies to offset these increased risk factors.

In addition to patient-level factors, we identified societal-level factors that imply a difference in access to care for women with Medicaid and Medicare. The first, which is a shared associated factor for both groups, is hospital size. Contrary to prior studies showing that individuals with Medicaid are more likely to receive care at large, teaching hospitals,^{1,7} we

found that women with both Medicaid and Medicare are less likely to undergo hysterectomy at a large (> 500 beds) hospital. Furthermore, we found that those with Medicaid are also less likely to have a hysterectomy at a teaching hospital. Although it is unclear to what extent these findings reflect the distribution of Medicaid and Medicare patients on a national level, our data suggest that hysterectomy care for women with these insurance types is clustered at certain hospitals; therefore, those hospitals that care for proportionally more Medicaid and Medicare patients would be expected to have higher complication rates following hysterectomy. This finding is relevant, because under the Hospital-Acquired Condition (HAC) Reduction Program, hospitals in the bottom (worst) quartile for certain postoperative complications, including surgical site infection after hysterectomy, will be subject to a 1% reduction in reimbursement from the Centers for Medicare & Medicaid.¹⁵ Because the current risk-adjustment model used by the federal government to determine hospital rankings does not consider insurance type, this may ultimately lead to unwarranted financial penalization of hospitals caring for a greater proportion of those insured with Medicaid and Medicare.

Finally, our results suggest that Medicaid patients may have more limited access to minimally invasive routes of hysterectomy. Abdominal hysterectomy is a recognized risk factor for complications compared to less invasive approaches,¹⁶ and consequently, minimally invasive hysterectomy is now the recommended approach whenever feasible.¹⁷ Consistent with prior studies, we also found that abdominal hysterectomy conferred a 3.7-fold increase in the odds of major postoperative complications compared to minimally invasive routes. Although utilization of abdominal hysterectomy has decreased significantly in the last 10–15 years,^{18,19} our findings suggest that the transition from abdominal to minimally invasive approaches of hysterectomy has been more rapid for patients with private and Medicare insurance compared to those with Medicaid. In fact, having Medicaid was independently associated with a 41% increase in the odds of having an abdominal hysterectomy. Although abdominal hysterectomy may be the preferred method when considering uterine size, we found that median specimen weight in the Medicaid group was similar to those with private insurance. Therefore, increased utilization of minimally invasive routes of hysterectomy in women with Medicaid may be a potential target area for quality improvement.

Strengths of this study include the use of a large database of academic and community hospitals. The inclusion of hysterectomies done for any indication allows for greater generalizability of our findings. Furthermore, we were able to track outcomes for 30 days postoperatively. Our data were collected using a validated methodology by specially trained, dedicated nurse data abstractors. Finally, we analyzed the data using a mixed model approach, which adds to the robustness of our results.

Our study is limited by the fact that our results are based on data from a statewide collaborative and may therefore not reflect national trends. Because MSQC membership is voluntary, there is potential for selection bias. There is also the potential for failing to capture complications if patients were seen for postoperative complications at a non-MSQC hospital or if the complication occurred after the 30-day postoperative time frame. We were unable to draw conclusions regarding complications following hysterectomy in the

uninsured population and other smaller insurance groups, as the sample sizes were too small for analyses to be clinically meaningful. Finally, we recognize the inherent complexity in defining and quantifying the multitude of factors that may lead to higher complications for Medicaid patients following hysterectomy, and that comprehensively doing so would require extensive additional analyses beyond the scope of this paper.

In conclusion, women whose primary insurance is Medicaid or Medicare have increased odds of major complications following hysterectomy. This finding is associated with patient and hospital-level characteristics unique to each group. Potential targets for quality improvement, especially among women with Medicaid, include increased utilization of minimally invasive hysterectomy and optimization of preoperative health status, with efforts directed at smoking cessation and weight loss.

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Figure 1.
Distribution By Hospital Site of Women with Medicaid, Medicare, and Private Insurance Undergoing Hysterectomy

Table 1

Demographics, perioperative variables, and major complications within 30 days of surgery for women undergoing hysterectomy

	Medicaid (n=1,577)	Medicare (n=2,103)	Private (n=11,611)	p value
Demographics and Perioperative Variables				
Age, years	41.09 ± 8.82	66.44 ± 12.37	46.87 ± 8.85	<.0001
Caucasian	72.45 (1,086/1,499)	85.85 (1,735/2,021)	82.86 (9,026/10,893)	<.0001
Parity *	2 (2,3)	2 (1, 3)	2 (1,3)	<.0001
Body Mass Index, kg/m ²	32.15 ± 8.58	31.18 ± 9.60	30.61 ± 7.62	<.0001
American Society of Anesthesiologists Class 3	26.14 (412/1,576)	45.64 (959/2,101)	16.62 (1,928/11,603)	<.0001
Smoker	47.75 (753)	14.93 (314)	20.49 (2,379)	<.0001
Gynecologic Cancer	8.56 (135)	30.72 (646)	8.97 (1,042)	<.0001
History of Deep Venous Thromboembolism	4.31 (68)	4.76 (100)	2.48 (288)	<.0001
Emergent/Urgent Indication	2.28 (36)	2.43 (51)	1.47 (171)	.001
Abdominal Hysterectomy	30.77 (484/1,573)	26.69 (558/2,091)	23.75 (2,754/11,597)	<.0001
Surgical Time, hours *	1.97 (1.42, 2.63)	2.08 (1.53, 2.80)	1.98 (1.48, 2.67)	<.0001
Estimated Blood Loss, milliliters *	100 (50, 300)	100 (50, 200)	100 (50, 200)	<.0001
Specimen Weight, grams *	129.0 (90.0, 198.0)	76.0 (49.0, 131.0)	130.0 (87.0, 222.0)	<.001
Hospital Bedsize 500	15.97 (245/1,534)	24.56 (511/2,081)	22.31 (2,566/11,503)	<.0001
Teaching Hospital	52.61 (807/1,534)	63.09 (1,313/2,081)	62.99 (7,246/11,503)	<.0001
Major Postoperative Complications				
Any Major Complication	6.85 (108)	7.85 (165)	3.79 (440)	<.0001
Deep/Organ Space Surgical Site Infection	1.78 (28)	0.81 (17)	0.96 (111)	.006
Deep Venous Thromboembolism	0.25 (4)	0.33 (7)	0.16 (19)	.23
Pulmonary Embolism	0.32 (5)	0.57 (12)	0.25 (29)	.05
Myocardial Infarction or Stroke	0.06 (1)	0.52 (11)	0.03 (4)	<.0001
Pneumonia or Sepsis	1.14 (18)	1.43 (30)	0.78 (90)	.01
Blood Transfusion	3.99 (63)	4.04 (85)	2.04 (237)	<.0001
Readmission	5.50 (84/1526)	5.19 (107/2,060)	3.29 (373/11,330)	<.0001
Death	0 (0/1,576)	0.29 (6/2,100)	0.06 (7/11,607)	.002

Data presented as mean [SD], median [interquartile range], or % (n). P-values for continuous variables calculated using ANOVA or non-parametric Kruskal-Wallis tests and categorical variables with Chi-square tests or Fisher's Exact test.

* Limited data available: Medicaid (n=1,153), Medicare (n=1,553) and Private (n=8,198).

Table 2

Variables associated with major postoperative complications within 30 days of hysterectomy

Variable	Crude Odds Ratio	Adjusted Odds Ratio	95% C.I.	Regression coefficient	Standard error	p value
Constant	----	----	----	-4.74	0.24	<.001
Age (years)	1.02	1.00	0.99 – 1.00	-0.01	0.005	0.23
Medicaid (referent: Private insurance)	1.89	1.60	1.26 – 2.04	0.47	0.12	<.001
Medicare (referent: Private insurance)	2.13	1.34	1.04 – 1.73	0.29	0.13	.03
ASA * Class 3 (referent: < 3)	2.46	1.38	1.14 – 1.65	0.32	0.09	<.001
Gynecologic Cancer	4.19	2.50	2.03 – 3.07	0.92	0.11	<.001
Surgical time (hours)	1.49	1.47	1.38 – 1.57	0.38	0.03	<.001
Urgent/Emergent Indication	5.82	2.98	2.10 – 4.24	1.09	0.18	<.001
Abdominal hysterectomy (referent: non-abdominal hysterectomy)	4.39	3.71	3.13 – 4.41	1.31	0.09	<.001

Based on a mixed multivariable logistic model accounting for variation across hospitals.

* ASA: American Society of Anesthesiologists

Characteristics associated with women with Medicaid insurance who underwent hysterectomy

Table 3

Variable	Crude Odds Ratio	Adjusted Odds Ratio	95% C.I.	Regression coefficient	Standard error	p value
Constant	----	----	----	0.75	0.20	<.001
Age				-0.09	0.004	<.001
Non-White Race (referent: white)	0.91	0.92	0.91–0.92	0.64	0.07	<.001
Body Mass Index	1.96	1.90	1.66–2.18	0.02	0.004	<.001
Smoker (referent: non-smoker)	1.34	1.02	1.01–1.02	1.01	0.06	<.001
ASA [*] Class 3 (referent: < 3)	3.69	2.73	2.42–3.08	0.56	0.08	<.001
Abdominal Hysterectomy (referent: not abdominal hysterectomy)	1.32	1.75	1.51–2.03	0.35	0.07	<.001
Hospital Bedsize 500 (referent: < 500 bed hospitals)	1.44	1.41	1.24–1.61	-0.32	0.08	<.001
Teaching Hospital (referent: non-teaching hospital)	0.64	0.73	0.62–0.78	-0.36	0.06	<.001

Based on a multivariable logistic regression model.

* ASA: American Society of Anesthesiologists

Table 4
 Characteristics associated with women with Medicare insurance who underwent hysterectomy

Variable	Crude Odds Ratio	Adjusted Odds Ratio	95% C.I.	Regression coefficient	Standard error	p value
Constant	----	----	----	-2.66	0.07	<.001
White Race (referent: non-white)	1.41	1.36	1.18–1.57	0.30	0.07	<.001
Gynecologic Cancer	4.23	3.49	3.09–3.95	1.25	0.06	<.001
Functionally Dependent (referent: not dependent)	6.36	4.49	2.61–7.70	1.50	0.28	<.001
ASA * Class 3 (referent: < 3)	3.67	3.10	2.79–3.44	1.13	0.05	<.001
Abdominal Hysterectomy (referent: not abdominal hysterectomy)	1.35	1.11	0.99–1.24	0.10	0.06	.08
Hospital Bedsize 500 (referent: < 500 bed hospitals)	1.14	0.88	0.78–1.00	-0.13	0.06	.04
Teaching Hospital (referent: non-teaching hospital)	0.95	0.93	0.84–1.03	-0.07	0.05	.16

Based on a multivariable logistic regression model.

* ASA: American Society of Anesthesiologists