ROUTE OF HYSTERECTOMY FOR WOMEN WITH BENIGN UTERINE DISEASE IN BRITISH COLUMBIA

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Running head:

Route of hysterectomy in British Columbia

Keywords

Hysterectomy, technicity, laparoscopic hysterectomy, vaginal hysterectomy.

ABSTRACT

Background: Minimally invasive hysterectomies performed vaginally or laparoscopically are associated with decreased perioperative morbidity. We examine temporal trends and patient and hospital factors associated with routes of hysterectomy in British Columbia.

Methods: We used a retrospective cohort design to study all women who had an elective hysterectomy for a benign indication between 2007 and 2011 in any of eight hospitals in the Vancouver Coastal Health and Providence Health Care regions. Logistic regression modeling with mixed effects was used to estimate adjusted odds ratios and 95% confidence intervals for patient factors and hospital characteristics associated with the hysterectomy approach.

Results: The study included 4,372 women who underwent abdominal (52.3%), vaginal (25.5%), or laparoscopic (22.3%) hysterectomy. From 2007 to 2011, abdominal hysterectomies decreased from 58.4% to 47.7%; vaginal hysterectomies decreased from 27.5% to 21.1%; and laparoscopic hysterectomies increased from 14.2% to 31.2% ($p<0.001$ for all trends). Patient factors associated with laparoscopic versus abdominal hysterectomy included young age, pain or prolapse indication, absence of fibroid indication, absence of concurrent gynaecologic procedure, rural residence, and lower socioeconomic status. Patient factors associated with vaginal hysterectomy included older age, prolapse indication, and absence of concurrent procedure for prolapse. Hospital location and size were not significantly associated with vaginal hysterectomy, but urban hospital location was associated with laparoscopic hysterectomy.

Interpretation: The proportion of minimally invasive hysterectomies is increasing and represents approximately half of all hysterectomies in British Columbia. Vaginal hysterectomies are associated with patient characteristics, while laparoscopic hysterectomies are associated with patient and hospital characteristics.

BACKGROUND

Hysterectomy is the most frequently performed gynaecologic operation, with approximately 50,000 being performed each year in Canada.[1,2] Traditionally, hysterectomies have been performed via the abdominal route, which involves a relatively large abdominal incision. However, hysterectomies performed via the vaginal route or via smaller incisions using the laparoscopic approach have been shown to be associated with significantly faster recovery and decreased operative morbidity.[3-5] The evidence in favour of minimally invasive hysterectomies is reflected in current national guidelines.[6,7] Vaginal hysterectomy is the preferred type of minimally invasive hysterectomy, but its use may be limited in cases of concurrent pelvic pathology, large uterine size, or lack of uterine descent. In these cases, the laparoscopic approach may avoid a prolonged recovery period and increased morbidity.[2,8] The concept of technicity - i.e., the use of a vaginal or laparascopic approach - was introduced to measure the proportion of minimally invasive hysterectomies among all hysterectomies, and it has also been proposed as a quality indicator in gynaecologic practice.[2,9]

Despite the wealth of evidence favouring minimally invasive hysterectomies for benign gynaecologic disease, a national study on hysterectomies from 1981 to 1997 indicated that most hysterectomies in Canada were being performed abdominally,[1] and a recent national survey suggested that nearly forty percent of gynaecologists were not offering hysterectomy by laparoscopy.[10] More recent reports from Ontario[11,12] and Quebec[13] suggest that 40 to 45% of hysterectomies are performed by minimally invasive routes. However, these studies were limited by the absence of adequate information on patient and clinical factors

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We therefore carried out a study to examine temporal trends in minimally invasive hysterectomy in British Columbia, Canada, and to identify patient and hospital factors associated with the different routes of hysterectomy. In addition, we compared surgical time, length of stay in the hospital, rehospitalisation, and emergency visit rates for each type of hysterectomy.

METHODS

We used a population-based retrospective cohort design that included women undergoing hysterectomy for benign gynecological conditions at any hospital in Vancouver Coastal Health and Providence Heath Care regions. Data sources included the hospitals' Discharge Abstract Database (DAD), which was linked to the Operating Room Management Information System (ORMIS) database, as well as the Emergency Database. These three data sources captured demographic, hospitalization, surgical, and emergency room information for women who were hospitalized between April 1st, 2007 and December 31st, 2011. Women with elective hysterectomy for benign gynaecologic indications who were residents of British Columbia at the time of surgery were included in the study.

The Canadian Classification of Health Interventions (CCI) procedure codes version 10 (CCI-10) were used to distinguish between routes of hysterectomy, and the International Classification of Diseases version 10 (ICD-10) diagnostic codes were used to determine indication for surgery. Hysterectomies were classified into abdominal (CCI 1RM89LA), vaginal (CCI 1RM89CA), and laparoscopic hysterectomies (CCI 1RM89AA and 1RM89DA). Cases of partial excision of the

uterus or subtotal hysterectomy (CCI 1RM87BAGX and 1RM87CAGX for vaginal hysterectomy; 1RM87DAGX for laparoscopic; and, 1RM87LAGX for abdominal) were only classified as hysterectomies if they were also classified as hysterectomies in the ORMIS database. Minimally invasive hysterectomy was defined as vaginal or laparoscopic hysterectomy. In cases where a minimally invasive hysterectomy was converted to a laparotomy, the hysterectomy was still classified according to the initial approach.

Patient and hospital characteristics that were considered to be associated with hysterectomy route included age, urban or rural residence, socio-economic status, indication for hysterectomy, and concurrent gynaecologic procedure. Rural residence was defined by residential postal codes corresponding to areas with <10,000 inhabitants.[14] Socio-economic status was inferred from residential postal codes using neighbourhood income quintile (1 to 5 from lowest to highest income level) relative to the income distribution in British Columbia in 2006. Neighbourhood income level has been considered an adequate approximation of household income in studies of health outcomes in Canada.[15]

The indication for hysterectomy was identified from diagnoses coded by ICD-10 codes in the DAD and categorised into the following categories: fibroids (ICD-10 D25), menstrual bleeding disorders (N92, N93), endometriosis (N80), pain (N94), prolapse (N81), and other. Concurrent gyneacological procedures were identified from procedure codes in the DAD and the ORMIS databases and included ovarian procedures (CCI 1RB, 1RD89), prolapse (1RS51, 1RS74, 1RS80, 1PL74, 1PL80, 1NQ74, 1NQ80), and other. Hospital characteristics included size of hospital (<100 beds vs. ≥100 beds) and urban or rural setting according to hospital postal code.

Information related to surgical outcomes, such as operative time, length of hospital stay, return to emergency room, and readmission to hospital within 60 days after discharge was also collected. The proportion of each type of hysterectomy was calculated for each year to determine temporal trends. Baseline patient and hospital characteristics and surgical outcomes were contrasted between women who had vaginal, laparoscopic, and combined minimally invasive routes of hysterectomy versus those who had an abdominal hysterectomy. Continuous variables were compared using a t-test or Wilcoxon test to assess the statistical significance of differences, while categorical variables were compared using chi-square or Fisher's exact test. The Cochran-Armitage test for trend was used to assess the statistical significance of temporal trends. We used mixed effects models with a logit link function (GLIMMIX procedure) to identify independent predictors for different routes of hysterectomy. The results were expressed as adjusted odds ratios (AOR) and 95% confidence intervals (95% CI). All analyses were carried out using SAS version 9.3. (SAS Institute Inc., Cary, NC, USA) and 2 sided p-values <0.05 were considered significant. Ethics approval for this study was granted by the University of British Columbia Research Ethics Board.

RESULTS

There were 4,372 women who had elective hysterectomy for a benign gynaecologic indication in Vancouver Coastal Health and Providence Health Care regions of British Columbia between April 2007 and December 2011. Overall, 52.3% of hysterectomies were abdominal, 25.5% were vaginal, and 22.3% were laparoscopic. Taking vaginal and laparoscopic routes together, the overall rate of minimally invasive hysterectomies was 47.7%. The proportion of abdominal

hysterectomies decreased from 58.3% to 47.7%; vaginal hysterectomies decreased from 27.5% to 21.1%; while laparoscopic hysterectomies increased from 14.2% to 31.2% between 2007 and 2011. Overall, the rate of minimally invasive hysterectomies (vaginal or laparoscopic) increased from 41.7% to 52.3% ($p<0.001$ for all trends) (Figure 1).

Most women (71.0%) were between 40 and 60 years of age. Uterine fibroids were the most common indication for hysterectomy (52.1%), followed by menstrual bleeding disorder (30.3%), prolapse (22.0%), endometriosis (21.5%), and pelvic pain (6.7%). The majority of the women resided in urban areas (94.0%) and most hysterectomies were performed in urban settings (95.0%). Women with laparoscopic hysterectomy were on average younger, compared to mostly older women who underwent vaginal hysterectomy. Rural residence was more common among women with minimally invasive hysterectomies, while the abdominal approach was more likely among women with lower socio-economic status. Fibroids were associated with abdominal hysterectomy while prolapse was associated with a vaginal approach. Similarly, a concurrent procedure for prolapse was more to likely to occur with a vaginal approach. Patient and hospital characteristics by route of hysterectomy are summarized in Table 1.

After adjustment for patient and hospital characteristics, the odds of using a minimally invasive approach to hysterectomy increased significantly between 2007 and 2011 (25% increase in odds per year, 96% CI 19%-32% increase, Table 2). The separate odds of either a laparoscopic or a vaginal approach relative to an abdominal approach also increased in recent years (Table 2).

Patient factors associated with laparoscopic versus abdominal hysterectomy were young age (AOR=4.59, 95% CI 2.10-10.0 for <30 vs. 40-49 years), rural residence (AOR=1.89, 95% CI 1.28-2.78), indication of pain (AOR=2.08, 95% CI 1.53-2.83) or prolapse (AOR=3.28, 95% CI 2.14-5.03). Fibroids, (AOR=0.37, 95% CI 0.29-0.46), concurrent ovarian and prolapse procedure (AOR=0.71, 95% CI 0.58-0.86 and AOR=0.50, 95% CI 0.29-0.85), and lower socioeconomic status (AOR=0.58, 95% CI 0.46-0.74 for lowest vs. highest quintile) were associated with lower odds of laparoscopic versus abdominal surgery. Patient factors associated with vaginal hysterectomy were older age (AOR=1.75, 95% CI 1.05-2.92 for 60-69 vs. 40-49 years), prolapse indication (AOR=34.4, 95% CI 21.1-56.3), and concurrent procedure for prolapse (AOR=1.68, 95% CI 1.07-2.64). After adjustment for patient characteristics, urban hospital location was associated with laparoscopic hysterectomy (AOR=22.2, 95% CI 2.6-192.3).

In terms of surgical outcomes, the median operative time was significantly different between laparoscopic hysterectomies (median 140, inter-quartile range 71 minutes), versus both abdominal and vaginal hysterectomies (both medians 100 minutes and both inter-quartile ranges 54 minutes, p<0.0001). Length of hospital stay was also significantly different between abdominal, vaginal, and laparoscopic hysterectomies (median 3, 2 and 1 day, respectively, and inter-quartile range 1,2, and 1 day, respectively, p<0.0001). No significant differences were observed in prolonged hospitalization, return to emergency room, or rehospitalisation (Table 3).

DISCUSSION

More than half (52%) of hysterectomies for benign indications in Vancouver Coastal Health and Providence Health Care regions of British Columbia, Canada, were performed using minimally invasive techniques in 2011. This proportion had been steadily increasing from 41.7% to 52.3% between 2007 and 2011. Patient factors associated with vaginal hysterectomy were surgery performed more recently, older age, and vaginal prolapse, while factors associated with laparoscopic hysterectomy were surgery performed more recently, younger age, indication of pain or prolapse, rural residence and higher socioeconomic status. Laparoscopic approach was less likely in the presence of fibroids, concurrent prolapse or ovarian procedure, and lower socio-economic status. Hospital characteristics were not significantly associated with a minimally invasive approach after adjustment for patient characteristics, except for the laparoscopic approach, which was more likely to be performed in urban area hospitals.

The observed rate of minimally invasive hysterectomy is consistent with reports from Ontario in 2007 which found a 41% rate of minimally invasive hysterectomy[11,12], and studies from Quebec[13] which showed a temporal rise from 39.9% in 2002-3 to 44.3% in 2008-9. In a national survey of endoscopic practice, lack of training was identified as a major barrier to the laparoscopic approach to hysterectomy, so the increase in minimally invasive hysterectomies in recent years may reflect the increased exposure to laparoscopic hysterectomy in residency and fellowship training programs, as well as initiatives to mentor existing gynaecologists. Indeed, several mentorship programs were present in the Vancouver Coastal Health Region, and our results may reflect the effectiveness of such initiatives. The strong association seen between urban hospitals

and laparoscopic hysterectomy (AOR= 22.2, CI 2.6-192.3) suggests the need for surgeon education and mentorship programs to expand into rural areas.

Even though a temporal decline in vaginal hysterectomies was observed, this was not apparent after adjustment for temporal changes in patient characteristics. The results of multivariable analysis showed that the odds of vaginal hysterectomy increased significantly over the study period by 12% per year (95% CI 1%-22%) compared with abdominal hysterectomy. Therefore the crude temporal decline was likely due to changes in patient characteristics over time. However, it is also possible that women with structurally normal uteri who would have been candidates for vaginal hysterectomy benefitted from increasingly effective conservative treatments for menstrual bleeding disorders – such as hormonal or ablative therapies – and were less likely to require hysterectomy. This is consistent with the observation that fibroids represented the most common indication for hysterectomy. Further, a prophylactic salpingectomy for ovarian cancer prevention has become more common in British Columbia in recent years. As the performance of salpingectomy by the vaginal route can be technically challenging, it is possible that more laparoscopic rather than vaginal hysterectomies have been performed for this purpose.

Whereas it is generally accepted that patient clinical factors will determine route of hysterectomy, the observed association between social and demographic factors and route of hysterectomy was less expected. We observed that women with lower socioeconomic status were less likely to undergo laparoscopic hysterectomy, after adjustment for concurrent factors. While it is possible that the relationship between route of hysterectomy and socioeconomic status

could be confounded by patient comorbidities that were not documented in the data source, the association between rates and routes of hysterectomy and socioeconomic status, race, and geographic location has been previously documented in the literature.[16-18] Large variations in routes of hysterectomy by geographic region have been observed in Ontario, with some local health areas having a two-fold higher rate of laparoscopic hysterectomy compared with others (63% vs. 30%). However, these studies did not find significant variation in the route of hysterectomy with neighbourhood income or educational attainment.[11,12] Further population-based studies in Canada are needed to corroborate these findings.

The use of a population-based dataset that includes multiple hospitals within a defined geographical areas including and urban and rural locations was a major strength of this study. The use of standardized databases also ensured that consecutive patients were captured using consistent data collection procedures. However, not all hospitals in the province of British Columbia were included, and thus our analysis serves only as an estimate of the rate of minimally invasive hysterectomy in the province. Other limitations include the lack of detailed clinical information, including patient body-mass index and comorbid conditions. In addition, potential underreporting and coding errors inherent in the use of hospital administrative data may have been present.

CONCLUSION

Approximately half of all hysterectomies are performed using a minimally invasively approach in British Columbia, and the frequency of minimally invasive approaches has increased

significantly in recent years. Vaginal hysterectomies are associated with patient clinical factors, while laparoscopic hysterectomies are associated with clinical, socio-demographic, and hospital characteristics. The association between route of hysterectomy and socioeconomic status in a Canadian population is a novel finding and warrants further study.

ACKNOWLEDGEMENTS

We are grateful to the Vancouver Coastal Health Authority Decision Support and Providence Health Care Decision Support for providing the data used in this study. Innie Chen is supported by a Frederick Banting and Charles Best Canada Graduate Scholarship Award from the Canadian Institutes of Health Research, and K.S. Joseph is supported by a Chair in maternal, fetal and infant health services research from the Canadian Institutes of Health Research.

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APPENDIX:

FIGURE LEGENDS

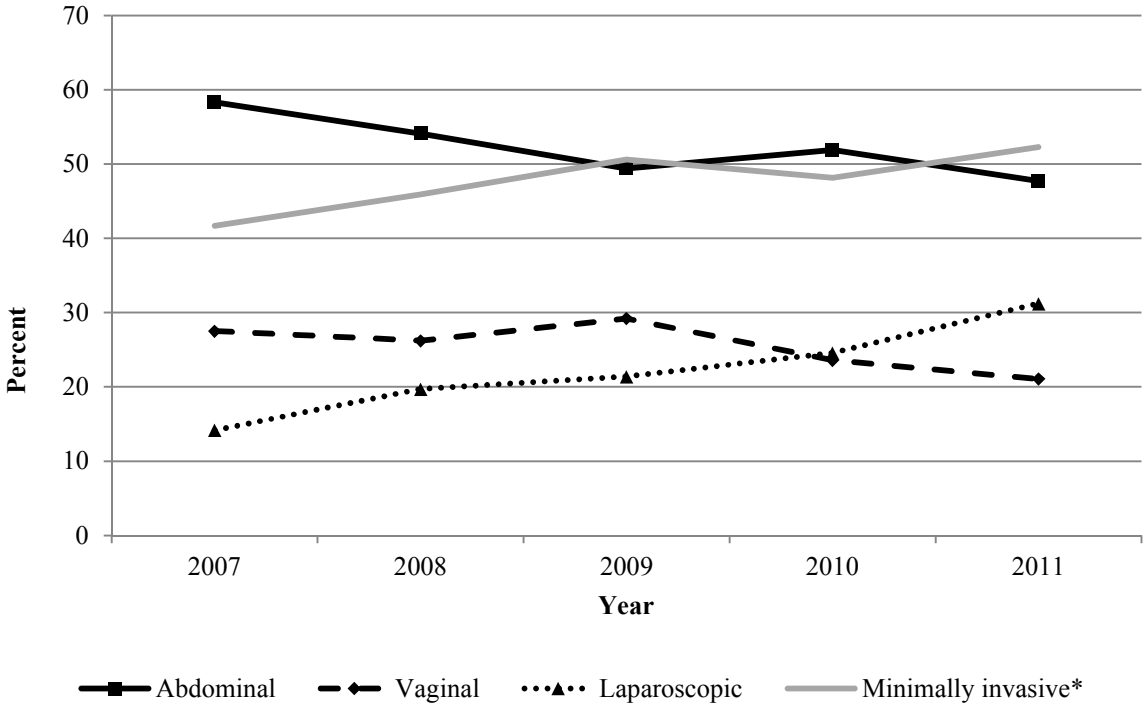
Figure 1. Temporal trends in elective abdominal, vaginal, laparoscopic, and minimally invasive hysterectomies for benign indications, British Columbia, 2007-2011.

Table 1. Patient and hospital characteristics of women with elective hysterectomies for benign indications, British Columbia, 2007-2011.

Table 2. Unadjusted and adjusted odds ratios for factors associated with elective vaginal, laparoscopic, and minimally invasive hysterectomy among women with benign indications, British Columbia, 2007-2011.

Table 3. Hospital stay, emergency visits, and rehospitalization by route of hysterectomy among women with elective hysterectomies for benign indications, British Columbia, 2007-2011.

Figure 1. Temporal trends in elective abdominal, vaginal, laparoscopic, and minimally invasive hysterectomies for benign indications, British Columbia, 2007-2011.



* Minimally invasive hysterectomies include vaginal and laparoscopic hysterectomies.

Table 1. Patient and hospital characteristics of women with elective hysterectomies for benign indications,

Demographic/clinical factors	Hysterectomy approach			P-value	Minimally invasive*	P-value
	Vaginal	Laparoscopic	Abdominal			
	N=1113 (%)	N=974 (%)	N=2285 (%)		N=2087 (%)	
Age (years)				**<.001**		**<.001**
<29	4 (0.36)	34 (3.49)	10 (0.44)		38 (1.82)	
30-39	77 (6.92)	172 (17.66)	229 (10.02)		249 (11.93)	
40-49	289 (25.97)	508 (52.16)	1281 (56.06)		797 (38.19)	
50-59	261 (23.45)	184 (18.89)	583 (25.51)		445 (21.32)	
60-69	263 (23.63)	60 (6.16)	126 (5.51)		323 (15.48)	
70-79	177 (15.90)	13 (1.33)	42 (1.84)		190 (9.1)	
80+	42 (3.77)	3 (0.31)	14 (0.61)		45 (2.16)	
Rural residence	81 (7.28)	73 (7.49)	107 (4.68)	<.001	154 (7.38)	<.001
Socio-economic quintile**				<.001		<.001
1 (lowest)	302 (27.66)	279 (28.94)	813 (35.81)		581 (28.26)	
2	107 (9.80)	106 (11.00)	274 (12.07)		213 (10.36)	
3 (median)	260 (23.81)	161 (16.70)	445 (19.60)		421 (20.48)	
4	175 (16.03)	183 (18.98)	336 (14.80)		358 (17.41)	
5 (highest)	248 (22.71)	235 (24.38)	402 (17.71)		483 (23.49)	
Indication (main diagnosis)						
Fibroids	219 (19.68)	431 (44.25)	1627 (71.20)	<.001	650 (31.15)	<.001
Menstrual bleeding disorder	225 (20.22)	355 (36.45)	745 (32.60)	<.001	580 (27.79)	<.001
Endometriosis	72 (6.47)	272 (27.93)	595 (26.04)	<.001	344 (16.48)	<.001
Pain	48 (4.31)	126 (12.94)	120 (5.25)	<.001	174 (8.34)	<.001
Prolapse	801 (71.97)	77 (7.91)	82 (3.59)	<.001	878 (42.07)	<.001
Other	70 (6.29)	189 (19.40)	252 (11.03)	<.001	259 (12.41)	0.16
Concurrent procedure						
Ovarian procedure	113 (10.15)	500 (51.33)	1236 (54.09)	<.001	613 (29.37)	<.001
Prolapse	801 (71.97)	95 (9.75)	159 (6.96)	<.001	896 (42.93)	<.001
Other/none	268 (24.08)	443 (45.48)	971 (42.49)	<.001	711 (34.07)	<.001
Hospital characteristics						
Large hospital (≥100 beds)	829 (74.48)	573 (58.83)	1609 (70.42)	<.001	1402 (67.18)	0.02
Urban area location	1000 (89.85)	970 (99.59)	2185 (95.62)	<.001	1970 (94.39)	0.06

* Minimally invasive hysterectomies include vaginal and laparoscopic hysterectomies.

** Derived from the residential postal codes.

P-values based on chi-square test.

Table 2. Unadjusted and adjusted odds ratios for factors associated with elective vaginal, laparoscopic, and minimally invasive hysterectomy among women with benign indications, British Columbia, 2007-2011.

Demographic/clinical factors	Vaginal*		Laparoscopic*		Minimally invasive*	
	OR (95% CI)	AOR (95% CI)	OR (95% CI)	AOR (95% CI)	OR (95% CI)	AOR (95% CI)
Year	0.98 (0.93-1.04)	1.12 (1.02-1.22)	1.25 (1.18-1.32)	1.32 (1.24-1.40)	1.10 (1.05-1.15)	1.25 (1.19-1.32)
Age (years)						
≤29	1.77 (0.55-5.69)	1.11 (0.26-4.69)	8.57 (4.20-17.5)	4.59 (2.10-10.0)	6.11 (3.03-12.3)	3.77 (1.78-7.95)
30-39	1.49 (1.12-1.99)	0.87 (0.59-1.31)	1.89 (1.52-2.37)	1.30 (1.01-1.68)	1.75 (1.43-2.14)	1.24 (0.98-1.56)
40-49	Ref.	Ref.	Ref.	Ref.	Ref.	Ref.
50-59	1.98 (1.64-2.41)	1.25 (0.89-1.75)	0.80 (0.66-0.97)	0.77 (0.61-0.96)	1.23 (1.05-1.43)	0.89 (0.73-1.09)
60-69	9.25 (7.22-11.8)	1.75 (1.05-2.92)	1.20 (0.87-1.66)	0.66 (0.44-0.98)	4.12 (3.29-5.16)	0.91 (0.65-1.27)
≥70	17.3 (12.6-23.9)	1.74 (0.94-3.22)	0.72 (0.41-1.27)	0.33 (0.17-0.61)	6.75 (4.97-9.15)	0.78 (0.51-1.21)
Rural residence	1.60 (1.19-2.15)	1.12 (0.63-2.01)	1.65 (1.21-2.24)	1.89 (1.28-2.78)	1.62 (1.26-2.09)	1.62 (1.14-2.29)
Socio-economic quintile**						
1 (lowest)	0.58 (0.47-0.71)	0.81 (0.56-1.16)	0.58 (0.47-0.72)	0.58 (0.46-0.74)	0.58 (0.49-0.69)	0.62 (0.50-0.77)
2	0.61 (0.46-0.79)	0.76 (0.46-1.24)	0.66 (0.50-0.87)	0.58 (0.43-0.80)	0.63 (0.51-0.79)	0.58 (0.43-0.77)
3 (median)	0.91 (0.73-1.13)	1.07 (0.70-1.64)	0.62 (0.49-0.78)	0.67 (0.50-0.89)	0.77 (0.64-0.92)	0.74 (0.58-0.96)
4	0.81 (0.64-1.03)	0.87 (0.58-1.29)	0.93 (0.73-1.18)	0.86 (0.66-1.11)	0.86 (0.71-1.05)	0.86 (0.68-1.09)
5 (highest)	Ref.	Ref.	Ref.	Ref.	Ref.	Ref.
Indication (main diagnosis)						
Fibroids	0.23 (0.18-0.3)	0.24 (0.18-0.33)	0.37 (0.3-0.45)	0.37 (0.29-0.46)	0.31 (0.26-0.37)	0.31 (0.26-0.38)
Menstrual disorders	Ref.	Ref.	Ref.	Ref.	Ref.	Ref.
Prolapse	33.9 (25.1-45.7)	34.4 (21.1-56.3)	1.76 (1.24-2.50)	3.28 (2.14-5.03)	12.3 (9.47-16.0)	9.85 (6.85-14.2)
Endometriosis	0.37 (0.27-0.51)	0.74 (0.51-1.07)	1.02 (0.84-1.23)	0.95 (0.77-1.17)	0.80 (0.67-0.95)	0.95 (0.78-1.15)
Pain	1.70 (1.12-2.57)	1.53 (0.95-2.46)	2.20 (1.66-2.91)	2.08 (1.53-2.83)	2.02 (1.55-2.63)	1.89 (1.42-2.52)
Other	0.66 (0.46-0.96)	1.81 (1.14-2.89)	1.11 (0.84-1.46)	1.37 (1.00-1.87)	0.92 (0.72-1.18)	1.34 (1.02-1.78)
Concurent procedure						
Ovarian procedure	0.33 (0.26-0.42)	0.08 (0.05-0.12)	0.89 (0.76-1.03)	0.71 (0.58-0.86)	0.68 (0.59-0.78)	0.42 (0.36-0.51)
Prolapse	34.0 (26.0-44.5)	1.68 (1.07-2.64)	0.87 (0.57-1.34)	0.50 (0.29-0.85)	13.4 (10.4-17.2)	2.28 (1.59-3.26)
Other/none	Ref.	Ref.	Ref.	Ref.	Ref.	Ref.

Hospital characteristics						
Large hospital (≥100 beds)	1.23 (1.04-1.44)	2.09 (0.19-22.7)	0.60 (0.51-0.70)	0.47 (0.08-2.67)	0.86 (0.76-0.98)	0.66 (0.19-2.29)
Urban area location	0.41 (0.54-0.31)	0.25 (0.02-3.18)	11.1 (30.3-4.07)	22.2 (2.6-192.3)	0.77 (0.59-1.01)	1.84 (0.47-7.32)

* Minimally invasive hysterectomies include vaginal and laparoscopic hysterectomies.

** Derived from the residential postal codes.

Odds ratios relative to abdominal hysterectomy.

Table 3. Hospital stay, emergency visits, and rehospitalization by route of hysterectomy among women with elective hysterectomies for benign indications, British Columbia, 2007-2011.

Surgery outcomes	Hysterectomy approach			P-value	Minimally invasive*	P-value
	Vaginal N=1113 (%)	Laparoscopic N=974 (%)	Abdominal N=2285 (%)		N=2087 (%)	
Hospital stay > 7 days	6 (0.54)	2 (0.21)	14 (0.61)	0.317	8 (0.38)	0.285
Return to emergency	21 (1.89)	31 (3.18)	67 (2.93)	0.129	52 (2.49)	0.371
Hospital readmission	30 (2.70)	43 (4.41)	99 (4.33)	0.048	73 (3.5)	0.156

* Minimally invasive hysterectomies include vaginal and laparoscopic hysterectomies.