Variations in hysterectomy rates in Ontario: Does the indication matter?

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Objectives: To examine variations in rates of hysterectomy for the five main indications for the procedure in regions of Ontario.
Design: Cross-sectional population-based analysis of hospital discharge abstracts.
Setting: All acute care facilities in Ontario.
Participants: All 65 599 women whose hospital record contained a procedure code indicating that a hysterectomy was performed between Apr. 1, 1988, and Mar. 31, 1991. Duplicate cases, records of cancelled procedures and nonresidents were excluded.
Main outcome measures: Crude and age-adjusted rates of hysterectomy, by indication, for each region of Ontario.
Results: Five indications accounted for more than 80% of hysterectomies performed. The median age-adjusted rate of hysterectomy for Ontario regions during the study period was 6.25 per 1000 women, with a 2.7-fold variation among regions. The regions with rates of hysterectomy in the highest quartile tended to be rural, and those with rates in the lowest quartile tended to be urban areas with teaching hospitals. When rates of hysterectomy for specific indications were examined, they showed substantial variations among regions in the rate of the procedure for menstrual hemorrhage (18-fold variation), uterine prolapse (9.3-fold) and endometriosis (6.3-fold). A smaller but still significant variation was shown in the rate of hysterectomy for leiomyoma (2.3-fold). Regional variation in the rate of hysterectomy for cancer (2.5-fold) was not statistically significant.
Conclusions: There are large interregional variations in rates of hysterectomy, especially for indications that are more discretionary than others (i.e., menstrual hemorrhage, uterine prolapse and endometriosis) and less variation in rates when treatment options and diagnosis are clear-cut. This result suggests the need for more definitive practice guidelines on treatment of the indications for which the rate is more variable.

Objectifs : Examiner les variations, entre les diverses régions de l'Ontario, des taux d'hystérectomie en fonction des cinq principales indications de l'intervention.
Conception : Analyse démographique transversale de résumés de sortie d'hôpital.
Contexte : Tous les établissements de soins actifs de l'Ontario.
Participantes : Les 65 599 femmes dont le dossier d'hôpital contenait un code d'intervention indiquant qu'elles avaient subi une hystérectomie entre le 1er avril 1988 et le 31 mars 1991. Les cas en double, les dossiers d'intervention annulée et les non-résidentes ont été exclus.
Principales mesures des résultats : Taux d'hystérectomie, selon l'indication, bruts et ajustés selon l'âge, dans chaque région de l'Ontario.

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Résultats : On a justifié par cinq indications plus de 80 % des hystérectomies exécutées. Le taux médian d'hystérectomie, ajusté selon l'âge, dans les régions de l'Ontario au cours de la période à l'étude s'est établi à 6,25 par 1 000 femmes, l'écart entre les régions étant de 2,7 fois. Les régions où les taux d'hystérectomie s'établissaient dans le quartile le plus élevé avaient tendance à être rurales et celles où les taux s'établissaient dans le quartile le plus bas avaient tendance à être urbaines et dotées d'hôpitaux d'enseignement. Lorsqu'on a examiné les taux d'hystérectomies dans le cas d'indications précises, les résultats ont indiqué des écarts importants entre les régions quant aux taux des interventions pour cause d'hémorragie menstruelle (écart de 18 fois), de prolapsus utérin (9,3 fois) et d'endométriose (6,3 fois). On a constaté un écart moindre mais quand même important dans le taux d'hystérectomies pour cause de fibromyome (2,3 fois). L'écart entre les régions quant au taux d'hystérectomie pour cause de cancer (2,5 fois) n'était pas important sur le plan statistique.

Conclusions : Les taux d'hystérectomie varient considérablement entre les régions, particulièrement dans le cas des indications plus discrétionnaires que d'autres (c.-à-d. hémorragie menstruelle, prolapsus utérin et endométriose) et l'écart entre les taux se referme lorsque les options de traitement et le diagnostic sont clairs. Ce résultat indique le besoin de guides de pratique plus précis sur le traitement des indications à l'égard desquelles le taux varie le plus.

Hysterectomy is one of the most frequently performed elective surgical procedures in industrialized countries. The rates of hysterectomy in Ontario, the province with the largest population in Canada, have not been reviewed in recent years. In 1986 the first members of the "baby boom" generation turned 40, and in 1987 those in the peak of the boom turned 30.[1] Women of this generation are now in the age range — 31 to 50 years — when most hysterectomies are performed. This demographic trend lends urgency to a reexamination of how often and why hysterectomy has been performed in Ontario.

Many studies have looked at variations in hysterectomy rates, but few have distinguished among indications.[2-7] The degree of agreement among professionals on whether hysterectomy is indicated varies depending on the reason. Thus, examination of the performance of the procedure by indication may test Wennberg's hypothesis that when there is professional consensus on diagnosis and efficacy of treatment, there will be little variation observed.[8]

The main indications for a hysterectomy are cancer of the uterus, cervix, fallopian tubes or ovaries, symptomatic leiomyoma, long-term disabling endometriosis, uterine prolapse, and menstrual hemorrhage and sequelae.[9,10] There is general agreement on the need for hysterectomy in the treatment of uterine cancer, but not in the treatment of cervical cancer. There is less agreement on hysterectomy to treat noncancerous uterine conditions; this uncertainty is due in part to the lack of data on the outcomes of hysterectomy and on the availability of alternative medical and surgical treatments of the conditions.[10]

The indications for hysterectomy to treat leiomyoma and uterine prolapse are relatively clear. The presence of fibromas alone is not a sufficient indication for a hysterectomy; an estimated one in five women have them.[11] Uterine size may be readily ascertained from ultrasonographic examination, and there are published criteria for the performance of hysterectomy for leiomyoma.[12,13] The incidence of prolapse in parous women is up to 50%; treatment of prolapse by vaginal hysterectomy is indicated for symptomatic women with prolapse of the third degree or greater (the cervix protrudes beyond the ostium vaginae).[11]

Endometriosis has a wide variety of symptoms, which makes diagnosis difficult.[14] The methods for detecting endometriosis include laparoscopic and ultrasonographic examination and magnetic resonance imaging. In addition, there are numerous treatment options, including observation, therapy with antiprostaglandins, hormones or antihormone alternatives, conservative or radical surgery, or combinations of these options.[11] Unfortunately, no single or combination therapy is successful in treating most patients, and side effects of the various drug therapies are significant. For menstrual hemorrhage, the only objective measure of severity is whether it causes anemia. For this condition, patient tolerance of dysmenorrhea and menorrhagia plays a major role in the decision to perform a hysterectomy. Hysterectomy is indicated if the patient has severe anemia or if the condition does not respond to therapy with hormonal or anti-inflammatory drugs and if the patient has no desire to have children.[11,13]

The objectives of our study were to analyse variations among the rates of hysterectomy in regions in Ontario and to examine the small-area variations in rates of hysterectomy by indication for the procedure.

Methods

Hospital discharge abstracts collected by the Hospital Medical Records Institute (HMRI) were obtained for Apr. 1, 1988, to Mar. 31, 1991. The fields analysed were four diagnosis codes, five procedure codes, the physician or surgeon performing the procedure and his or her specialty as well as characteristics of the patient, including birth date, admission date and category, discharge date, length of stay, postal and residence code, scrambled health care number and institution number. Diagnoses

were coded according to the clinical modification of the *International Classification of Diseases,* 9th revision, (ICD-9-CM)[15] and procedures according to the ICD-9-CM and the *Canadian Classification of Diagnostic, Therapeutic and Surgical Procedures.*[16]

We included all records that had a code for hysterectomy in any of the first five procedure fields (Appendix 1). Records were excluded if the procedure had been cancelled or delayed, if the length of stay was 2 days or less, in which case it is unlikely that a hysterectomy was performed, if age or sex were missing or if the code for the patient's residence showed that she lived outside Ontario. These exclusions resulted in less than 1% of the records being deleted. The number of hysterectomy cases analysed was 65 599.

Categories of indications for surgery, based on published reviews and discussions,[10,11,13] were identified from the database with the use of the ICD-9-CM diagnostic codes. We collapsed these codes into five main indications: cancer, leiomyoma, menstrual hemorrhage and pain, endometriosis and uterine prolapse (Appendix 2), since these indications accounted for over 80% of all hysterectomies. All other indications were grouped into one category.

A hierarchic rule was used to classify the main indication for hysterectomy in each patient, since some records had multiple indications. For example, the "most responsible diagnosis" recorded may have been menstrual hemorrhage but other diagnosis codes may have indicated leiomyoma as well. The following hierarchic approach was used.

1. If any of the diagnosis codes indicated a malignant or premalignant tumour, the indication for hysterectomy assigned was "cancer."
2. For the remaining records, if any of the four diagnosis codes indicated leiomyoma, this was the indication assigned.
3. The next indication assigned was endometriosis, followed by prolapse.
4. Finally, a case was assigned an indication of menstrual hemorrhage and sequelae only if this diagnosis appeared in the abstract and none of the other four diagnoses appeared. Cases that did not fall into one of these five indications were classified as "other."

To conduct the regional analysis, we defined the geographic area by the residence code for the patient. The 49 Statistics Canada census divisions were used. Since some counties in Ontario are very small and some cities very large, the three largest census divisions were divided and some of the smaller regions were combined with their adjacent neighbour so that there would be an observed mean rate of 10 hysterectomies per 10 000 women or more during the study period. This combination of small regions precluded problems with statistical analysis caused by small numbers of cases. Thus we analysed 47 regions, with populations ranging from 12 599 to 251 504 women and a mean population of 76 250.

The province-wide crude and age-adjusted hysterectomy rates were calculated on the basis of 5-year age-specific population data for Ontario for 1988 to 1990 obtained from Statistics Canada.[17] We used an indirect method to standardize the rates. Four age groups were calculated: 20 to 35 years, 35 to 44 years, 45 to 54 years, and 55 years and older. Ages were thus grouped because the number of hysterectomies for women in smaller age groups, when broken down by region, were too few to allow statistical analysis.

Since rates based on data from more than 1 year are more statistically stable,[18] we combined the total number of patients who had hysterectomies in three fiscal years (22 048 in 1988–89, 21 264 in 1989–90 and 22 293 in 1990–91) to derive stable rates in small regions of Ontario. A mean hysterectomy rate per 100 000 women was then calculated for each region.

The null hypothesis was that the underlying hysterectomy rate was the same in all areas and that the observed differences were due to random variation or chance. Measures of variation include the extremal quotient (EQ), the coefficient of variation (CV), the systematic component of variation (SCV) and the χ^2 statistic.[19] Because there is a lack of agreement on the best statistical methods to study small-area variation, we used all of the above statistical approaches. The EQ is the highest regional age-adjusted rate divided by the lowest rate. The CV is the standard deviation of the rates among regions, weighted by the population in each region. The SCV, a descriptive statistic developed by McPherson and associates,[4] measures variance within a group of regions. It is an estimate of the amount of variation "left" between the regions after the variation "within" the regions has been removed. Large values of the SCV indicate true differences among the regions. The χ^2 statistic was calculated with the use of logistic regression analysis to test whether there were differences in hysterectomy rates among the regions after rates were adjusted for age. Small-area analysis was performed for all hysterectomies and for the five main indications.

The proportion of hysterectomies performed for each indication was determined for each region. The mean proportion of hysterectomies performed for each indication was calculated for regions of the province in the quartiles with the highest and the lowest rates of hysterectomy; the means in those quartiles were then compared. To determine whether hysterectomies performed to treat cancer of the reproductive system reflected the underlying incidence of such cancer, data on the number of incident cases of cancer were obtained from the Ontario Cancer Registry. The number of hysterectomies performed to treat cancer of the reproductive system in each region was correlated with the number of incident cases of such cancer in the region.

Results

The median age-adjusted rate of hysterectomies in Ontario for the 47 regions during the study period was 6.3 per 1000 women over 20 years of age. Toronto had the lowest age-adjusted rate (3.9 per 1000 women), and Thunder Bay had the highest (10.8 per 1000 women), yielding an EQ of 2.7. The CV for the provincial rates was 26, and the SCV was 85.4.

Of the 47 regions, 20 had hysterectomy rates that were significantly higher than the provincial mean ($p < 0.001$; Table 1). The regions with rates higher than the mean tended to have small populations (10 000 to 49 000 women) and were located mainly in northern, southwestern and northeastern Ontario. There were nine regions with rates significantly lower than the provincial mean rate ($p < 0.001$). These regions were primarily cities in southern Ontario.

Table 2 shows the summary statistics for the small-area analysis by indication. The CV, the SCV and the EQ showed that variation was greatest for rates of hysterectomy to treat menstrual hemorrhage. The rates of hysterectomy for cancer and leiomyoma yielded the lowest CV, SCV and EQ; in fact, the SCV for cancer-related hysterectomy was negative. The results of the age-adjusted χ^2 test showed significant variations ($p < 0.0001$) among regional rates of hysterectomy for all indications except cancer.

Fig. 1 shows the percentage of all hysterectomies performed, by indication, in regions in the quartiles with the highest and lowest rates of hysterectomy. In the regions in the highest quartile a higher percentage of hysterectomies was performed for menstrual hemorrhage (31% v. 20% in the regions in the lowest quartile) and endometriosis (10% v. 8%), whereas in the regions in the lowest quartile a higher percentage of hysterectomies was performed for cancer (9% v. 7% in the regions in the highest quartile) and leiomyoma (30% v. 19%). The percentage of hysterectomies performed to treat uterine prolapse was similar in the regions in the high and low quartiles. In the regions in the highest quartile and in the lowest quartile 14% of hysterectomies were performed for prolapse.

The number of hysterectomies performed to treat cancer closely parallelled the number of cancers of the reproductive system recorded in the Ontario Cancer Registry from 1988 to 1990 for each region (Pearson correlation coefficient, $r = 0.90$).

Table 1: Indirectly standardized hysterectomy rates per 100 000 women over 20 years of age in Ontario by region, Apr. 1, 1988, to Mar. 31, 1991

Region	Rate*	Region	Rate*
Thunder Bay District	1078†	Hastings and Prince Edward counties	623
Cochrane and Timiskaming districts	990†	Perth County	594
Parry Sound and Nipissing districts	980†	City of Ottawa‖	581
Algoma District	943†	Regional Municipality of Halton	579
Stormont, Dundas and Glengarry County	923†	Simcoe County	567
City of Sudbury	891†	Middlesex County‖	568
Renfrew County	859†	Regional Municipality of Hamilton-Wentworth‖	552‡
Prescott and Russell County	859†	Peterborough and Northumberland counties	547
Elgin County	856†	City of Scarborough	546‡
Sudbury and Manitoulin districts	834†	Lennox and Addington County	534
Lambton County	835†	Regional Municipality of York	529§
Regional Municipality of Haldimand-Norfolk	781†	Regional Municipality of Ottawa–Carleton, west (excludes City of Ottawa)	513‡
Kent County	774†	City of Mississauga	506†
Oxford County	750†	Regional Municipality of Ottawa–Carleton, east (excludes City of Ottawa)	490†
Muskoka District Municipality and Haliburton County	728§	Brant County	483‡
Essex County	728†	City of York	479†
Grey and Bruce counties	710‡	City of North York‖	470†
Regional Municipality of Niagara	699†	Borough of East York	470†
Wellington and Dufferin counties	691‡	City of Brampton	459†
Kenora and Rainy River districts	689	Frontenac County‖	443†
Regional Municipality of Waterloo	676†	City of Etobicoke	440†
Leeds and Grenville and Lanark counties	658	City of Toronto‖	385†
Victoria County	655		
Huron County	640		
Regional Muncipality of Durham	633		

*Rates are based on the population of Ontario in 1991.
†$p < 0.001$ (compared with the provincial mean rate).
‡$p < 0.01$.
§$p < 0.05$.
‖Regions where teaching hospitals are located.

Discussion

The age-adjusted rate of hysterectomies performed in Ontario (6.3 per 1000 women) appears to be lower than that in the United States in 1984 (6.9 per 1000 women over 15 years of age[1]) and higher than that in New South Wales, Australia, in 1992 (3.4 per 1000 women over 15 years of age).[2] However, it is difficult to compare the rate of hysterectomy in Ontario with that in other jurisdictions because of different age ranges used and years of publication. According to Statistics Canada, the rank of Ontario among Canadian provinces in terms of hysterectomy rates has risen from 7th highest in 1985–86 to 4th highest in 1989–90.[20] Previous studies that examined rates of hysterectomy showed that it is a highly variable procedure, with an SCV of 50 to 96.[3,4] The SCV of 85.4 found in our study is comparable with the values found in other studies, and it confirms that hysterectomy may be classified as a highly variable procedure.[5] However, in results of previous studies the degree of variation was masked by the aggregation of indications. Hence, these studies underestimated the true variation in rates of this procedure.

We found that regions with teaching hospitals had lower overall rates of hysterectomy than other regions, lower rates of the procedure for discretionary indications and higher rates for cancer and leiomyoma. In a study of surgery rates in Quebec, Blais[21] also found that the regions farthest from teaching hospitals had the highest rates of hysterectomy. These findings raise the issue of diffusion of ideas and technology from teaching hospitals, which are presumably on the forefront of medical knowledge, to more remote areas. For example, newer technologies such as endometrial ablation are not widely available except in teaching centres. In regard to specific indications for hysterectomy, our results showed less variation in rates for indications for which physicians agree on the use of hysterectomy as a treatment or for which a definitive diagnosis can be made. Rates of hysterectomy for cancer of the reproductive system varied little, as shown by the the negative SCV, the insignificant value of the χ^2 statistic and significant differences between regional rates and the provincial mean in only two regions. The rate of hysterectomy for cancer in Ontario is likely determined largely by the incidence of cervical, uterine and ovarian cancer. This conclusion assumes that there is agreement on the use of hysterectomy in treating cervical cancer in an early stage. There was little regional variation in the rate of hysterectomy for leiomyoma. This may reflect the ease of diagnosis of this condition and the agreement among physicians on the best treatment options.

Despite specific guidelines for the treatment of uterine prolapse, the variation observed in the rate of hysterectomy to repair prolapse was very large. Since

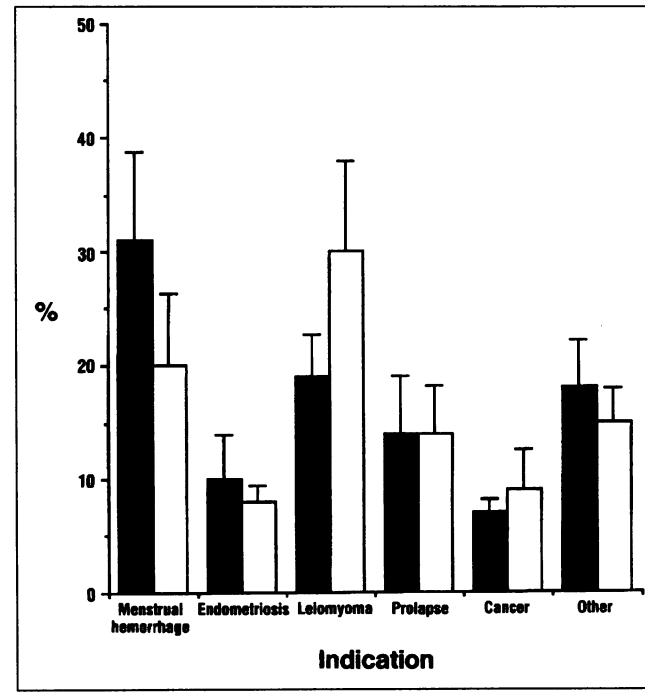

Fig. 1: Mean (bar) and standard deviation (whisker) of the percentages of hysterectomies performed for each of the five main indications and other indications in Ontario from Apr. 1, 1988, to Mar. 31, 1991. The black bars show the mean percentages of procedures in the regions with hysterectomy rates in the highest quartile; the white bars show those for regions with rates in the lowest quartile.

Table 2: Values of summary statistics for variations in rates of hysterectomy for the five main indications among the 47 regions of Ontario, Apr. 1, 1988, to Mar. 31, 1991*

Indication	CV	SCV × 1000	EQ	Age-adjusted χ^2
Cancer	16.8	−11.9	2.5	32.8
Endometriosis	44.5	244.1	6.3	526.8†
Leiomyoma	17.9	23.0	2.3	187.9†
Menstrual hemorrhage and sequelae	56.3	581.8	18.4	1024.9†
Uterine prolapse	53.2	327.1	9.3	480.3†
All	26.0	85.4	2.7	1045.2†

*CV = coefficient of variation, SCV = systematic component of variation, EQ = extremal quotient.
†$p \leq 0.0001$.

the percentages of hysterectomies performed for prolapse were similar in regions with high and low overall rates, the variation may reflect interregional differences in the risk factors for uterine prolapse, such as parity.[6] The large variation in rates of hysterectomy for menstrual hemorrhage and endometriosis suggests that the region of residence had a significant influence on rates. The incidence, the severity of symptoms and the desire to bear children are important factors in determining the rates of hysterectomy for these indications; however, it is unlikely that these factors vary from one region to another. Community hospitals performed more hysterectomies to treat endometriosis than did teaching hospitals, which suggests that there is a variation in physician practices. This variation may be related to differences in the use of medical technology or in the dissemination of new treatment options (i.e., hormonal therapy, endometrial ablation, pelvoscopy and laser therapy).

Small-area comparisons are subject to the limitations of any cross-sectional administrative database analysis that does not track individual patients over time. One limitation affects the determination of hysterectomy rates by indication. The HMRI abstracts are created after hospital discharge by trained abstracters, and the discharge diagnosis may not reflect the patient's symptoms on admission. However, we obtained consistent results with the use of a hierarchic rule and the most responsible diagnosis to define the indication. A further limitation affects the denominator used in rate calculations. The denominator should be the number of women eligible for hysterectomy (i.e., those with an intact uterus); women who have already had a hysterectomy should be excluded. Unfortunately, we did not have data on the number of women who had had a hysterectomy; a special survey would have been required to determine this. As a result, we included all women in the region in the denominator.[22] The effect of this limitation on the small-area analysis can be estimated. If exclusion of women who had had a hysterectomy resulted in a 30% to 40% increase in the hysterectomy rate for women over 50 years of age, the EQ and CV would be essentially unchanged. The SCV and the χ^2 value would increase, but the relative ratings for the various indications would likely be unaffected.

The findings of our study support Wennberg's hypothesis that, when there is consensus on the treatment and its efficacy, little variation in its use will be observed.[8] According to this theory, the degree of variation in the rate of a surgical procedure is a measure of the relative importance of professional discretion in the decision to use the procedure. In Ontario, since districts within a region are usually served by a small number of specialists, clinical opinion could have a significant effect on the decision to admit a patient to hospital and to perform a procedure. There may be other plausible explanations for variations, such as patient preferences for treatment; however, determination of such factors was beyond the scope of the study.

Our findings have several policy implications. Provincial ministries of health, physician organizations and hospital administrators concerned about resource utilization may wish to address the variations in rates of hysterectomy for indications other than cancer. We cannot judge whether this variation reflects overutilization of hysterectomy for indications other than cancer in the northern, northeastern and southwestern regions of the province or underutilization in south-central Ontario. However, the lower rates of hysterectomy for these indications in urban areas, especially near teaching centres, suggests that the high rates in rural areas need to be explained first.

Physicians and physician organizations should look closely at the indications associated with large variations and take appropriate action to improve physician agreement on the use of this procedure. Such action could include continuing medical education courses, development and dissemination of practice guidelines and quality improvement programs. Other options include education and feedback processes similar to those described by Dyck and collaborators[23] and Gambone and colleagues.[24] In addition, research is needed to expand the knowledge base about the factors contributing to rates of hysterectomy.

From the patients' perspective, more information on treatment options for conditions other than cancer may be useful. A well-informed and sophisticated consumer is essential to any strategy for elimination of large variations in rates of discretionary surgical procedures.[25] Therefore, any strategy to reduce hysterectomy rates should include a patient-directed component. For example, by informing a patient about what is known and not known about the outcomes of hysterectomy, a physician can help a patient to determine whether hysterectomy is the best alternative. Reduced hysterectomy rates may also be achieved through a media information campaign sponsored by government and physician organizations, such as the one conducted during 9 months in 1984 in Switzerland.[26]

Conclusion

Our study found marked variations in the rates of hysterectomy for indications other than cancer among regions in Ontario. In particular, we observed the largest regional variations in rates of hysterectomy for menstrual hemorrhage and sequelae and for endometriosis. Our study is descriptive in nature, and, therefore, the results cannot definitively explain the variations observed. However, the magnitude and pattern of variation suggests a need for a closer look at practice patterns in the treatment of the indications with large regional variations. With the advent of new laparoscopic surgical approaches, it will be important to monitor hysterectomy rates to determine if

the new procedures have any effect on regional variations. Finally, our study results pointed to areas where further research is needed to explain rate variations, including the role of patient characteristics, tolerance of symptoms and treatment preferences.

We received financial support from the Institute for Clinical Evaluative Sciences in Ontario, North York, Ont.

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Appendix 1: Procedure codes for hysterectomy*

Procedure	CCP code	ICD-9-CM code†
Subtotal abdominal hysterectomy	80.2	68.3
Total abdominal hysterectomy	80.3	68.4
Total or subtotal vaginal hysterectomy	80.4	68.5
Radical abdominal hysterectomy	80.5	68.6
Radical vaginal hysterectomy	80.6	68.7
Pelvic evisceration	80.7	68.8

*CCP = *Canadian Classification of Diagnostic, Therapeutic and Surgical Procedures*,[16] ICD-9-CM = clinical modification of the *International Classification of Diseases*, 9th revision.[15]
†About 20% of hospitals in Ontario used the ICD-9-CM to classify procedures in 1990.

Appendix 2: Indications for hysterectomy

Indication	ICD-9-CM code
Cancer	179, 180, 182, 183, 199, 233.0, 233.1, 233.2, 233.3, 233.7, 233.9
Uterine leiomyoma	218
Endometriosis	617
Menstrual hemorrhage and sequelae	626, 625.4, 625.3, 625.2, 280
Uterine prolapse	618
Noninflammatory genitourinary disorders and related conditions	596, 599, 621, 622, 623, 624, 625.0, 625.1, 625.5, 625.6, 625.8, 625.9, 568, 752
Inflammatory disease	614, 615, 616
Benign neoplasm of the uterus, ovary or female genitals	219, 220, 221
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