Hysterectomy: Variations in Rates Across Small Areas and Across Physicians' Practices

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Abstract: This analysis focuses on the practice of hysterectomy across 33 hospital catchment areas of one Canadian province, using claims data from the Manitoba health insurance system. Hysterectomy rates varied five-fold across hospital areas. The availability of hospitals and physicians was unrelated to area rates, and there appeared to be no access barriers in the low-rate areas. High-rate areas were characterized by women who visited large numbers of different physicians and by having larger proportions of French, Polish, and Italian residents (ethnic groups which are largely Catholic in Manitoba). Although women residents of high rate areas made somewhat more visits for gynecologic problems and had many more D&Cs (dilation and curretage of the uterus), it is concluded that this may be due as much to the practice style of physicians treating patients from these areas as to gynecologic need. Residents of high and medium-high rate areas are more likely to have hysterectomy-prone surgeons as their primary physicians. Such physicians appear both more likely to "label" their patients' conditions as gynecologic in origin and more likely to advise surgical intervention (both D&C and hysterectomy) once such conditions are diagnosed. Thus, a combination of patient and physician characteristics may explain much of the variation in small area hysterectomy rates, rather than narrowly defined medical need. (*Am J Public Health* 1984; 74:327–335.)

Introduction

Bunker first drew attention to the fact that residents of the United States underwent surgery at considerably higher rates than residents of England and Wales.[1] Since then, Vayda and collaborators have documented the existence and persistence of surgical rate variations across the Canadian provinces.[2,3] Wennberg and Gittelsohn[4,5] noted widespread variations in surgical rates across small hospital service areas in New England, and McPherson, *et al*,[6,7] have shown the same pattern of variation across National Health Service regions of England and Wales.

The explanation of the variations is not clear. Wennberg, *et al*,[8] have focused on physician practice patterns to explain why certain areas have consistently high rates for some procedures and low rates for others. Others suggest that socioeconomic or health characteristics of a population contribute to these rate variations.[9,10] However, in both New England and Manitoba no relationship has been found between the latter characteristics and surgical rates.[11,12]

Hysterectomy is among the most frequently performed major surgical procedures in North America; rates vary widely. This paper will focus on high and low hysterectomy rate areas in the Canadian province of Manitoba. Multivariate analysis will assess the contribution made by the practice patterns of a woman's primary physician to the probability of her undergoing a hysterectomy, controlling for both her prior health history and characteristics of the area in which she lives. Data from the provincial health claims system and the Canadian census will be used.

Method

Small area analysis assigns individuals to a unique geographical area (to obtain the denominator) and counts all health care utilization by these persons, regardless of where it takes place.[13] This permits age and sex adjustment of the utilization of the population, thus removing one confounding variable for surgical rate variations.

Manitoba's 33 largest hospital areas (containing 92 per cent of the province's population) were used. Areas were included only if area residents would be "expected" to undergo nine or more hysterectomies per year, given the age structure of the area's female population. Most areas contained only one hospital. The 29 areas outside Winnipeg varied in population from 4,532 to 41,555. The city of Winnipeg contains 55 per cent of the provincial population and is the tertiary care center for the province. Winnipeg was divided into four hospital areas ranging in population from 38,015 to 360,089.

To produce a stable numerator for area hysterectomies, three years' (1974–1976) claims for hysterectomy surgery were abstracted and then annualized. Age-adjusted hysterectomy rates were calculated for each area using the indirect method of age adjustment, with all Manitoba females as the standard population. Appendix I describes the size, source, and purpose of all groups used in this analysis.

To determine socioeconomic and ethnic characteristics of the small areas, the 1971 and 1976 Canadian census data were used. Numbers of hospital beds and of physicians practicing in the areas were taken from the Manitoba Health Services Commission (MHSC). Access and utilization patterns of area residents were obtained by using MHSC claims to develop two-year medical and hospital histories for 14,698 rural women (a 13 per cent sample of the residents of the 29 areas) and for 1,787 Winnipeg women (a 1 per cent sample of the four areas' residents).

These histories provide virtually complete records of the women's contacts with the health care system. In Manitoba, with a few minor exceptions, there are no patient charges for medical or hospital care, no coinsurance, and no usage limitation (except on chiropractic care and optometrist visits). Hospital (inpatient and outpatient) and medical care are documented in detail based on the fee-for-service payment system.

The second part of this paper assesses the impact of physicians' practice patterns on the probability of a woman's undergoing hysterectomy. Physician practices were identified using principles similar to those used in small area analysis. A stratified sample of the Manitoba female popula-

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Editor's Note: See also related editorial p 313 this issue.

TABLE 1—Characteristics of High and Low Hysterectomy Rate Areas, Manitoba, Canada

	Low Rate Areas*	Medium Low Rate Areas	Medium High Rate Areas	High Rate Areas
Age-Adjusted Hysterectomy Rate 1974–1976 Annualized (per 1,000 Females Aged 25+)				
For Emergency and Mandatory Indications	.6	.5	.8	.5
For All Other Indications	4.1	6.6	8.7	12.3
Availability of Health Care				
Number of Beds in Area Hospitals per 1,000 Residents	6.4	5.7	5.1	5.9
Physician per 1000 Population ratio	.88	1.0	.91	1.1
Physician Encounters (All Women 25 and Older Age-Adjusted Rates)				
Women with no Physician Contact in 1973–74 (%)	11	13	12	9
Women with 1 or More Visits to Gynecologist in 1972–74 (%)	13	10	12	10

None of the Pearson Correlations between the above variables and the age adjusted 1974–76 hysterectomy rate for nonemergency, nonmandatory conditions (N = 33) was significant.

* Low rate areas include 7 areas with rates more than 1 standard deviation below the mean; medium low—15 areas within 1 standard deviation below the mean; medium high—16 areas 1 standard deviation above the mean; high—5 areas more than 1 standard deviation above the mean.

tion (40,000 females aged 25 and over) was drawn. Each woman was assigned to that physician seen most frequently by her over a two-year period.*

It was then possible to estimate the size and age/sex composition of physician practices and to calculate the number of women "expected" to undergo hysterectomy. Using the number from the practice that actually underwent hysterectomy (the "observed" figure obtained not from a sample but from total provincial data), age-adjusted rates of patients undergoing hysterectomy were calculated for every physician. Methodological details are contained in Appendix I.

For the multiple logistic analysis, three groups of women aged 25–69 were used: 1) all those having hysterectomy for nonemergency nonmandatory reasons (1,342);** 2) all those having a dilation and curretage (D&C) of the uterus in 1974 and no hysterectomy (2,298); and 3) a stratified random sample of 1,425 women from the provincial registry (who had neither D&C nor hysterectomy in 1974). Primary physicians for each of these women were identified using visit patterns during the two years before surgery or the two years before July 1, 1974 for the population sample.

A woman was included in the analysis if she and her primary physician were registered in the insurance system over all years of the study and if the woman's physician would have been expected to perform hysterectomy on five or more primary patients per year over a three-year period, given the size of the physician's practice. The combined effect of these exclusions is to restrict the analysis to 5,065 of the 8,238 cases available (61 per cent). Those included and excluded were very similar along most important dimensions, although included patients were somewhat older (mean age 45 years versus 44 for those excluded), as were their physicians (for details, see Appendix I).

* This assignment criterion is that used in a national study of medical and surgical specialties for defining a person's primary physician: that physician providing the "majority of care" for a "regular" patient.[14,15]

** This "nonemergency, nonmandatory" classification, suggested in policy statements by the American College of Obstetricians and Gynecologists, excludes those hysterectomies performed in association with intra-abdominal hemorrhages or for malignancy.

The reliability and validity of the Manitoba claims data have been investigated extensively[16,17] (see Appendix II). Histories based on these claims describe numbers of physician contacts and specific surgical procedures with considerable accuracy. The conditions bringing women to the physician's office must be inferred from the diagnosis recorded on the claim card. The validity and reliability of these diagnoses are somewhat less, but appear adequate for exploratory studies.

Results

Characteristics of High and Low Rate Areas

In 1974, approximately 2,300 hysterectomies were performed in the province. Although Manitoba had a lower hysterectomy rate (4.4 per 1,000 females) in the 1970s than the United States (6.7), the characteristics of hysterectomies done in Manitoba (type of hysterectomy, indications for surgery, and size of the hospital where performed) are similar to those done in the United States.[18]

The range in rates for hysterectomies performed for nonemergency and nonmandatory conditions rates across the 33 areas was wide in Manitoba, with the highest area rate five times (15 per 1,000 women age 25+) that of the four lowest areas (2 to 3 per 1,000 women).

The 33 areas have been grouped according to whether the area's hysterectomy rate is within one or two standard deviations from the mean (Table 1). Areas varied relatively little in the rates at which hysterectomies for emergency and mandatory conditions were performed. The nonemergency, nonmandatory procedures produce the rate variations from one area to another. Grouping the areas into four larger areas reduced the range of variation, but a three-fold difference remains.

Availability of and Access to Health Care

Table 1 shows no relationship between hysterectomy rates and availability of hospital beds and physician supply. Such measures as the average size and occupancy rates of the in-area hospitals also were unrelated to hysterectomy rates. There appear to be few barriers to access in low hysterectomy rate areas.

TABLE 2—Characteristics of Population Resident in High and Low Hysterectomy Rate Areas, Manitoba, Canada

	Low Rate Areas	Medium Low Rate Areas	Medium High Rate Areas	High Rate Areas
Possible Indicators of Gynecologic "Need" or Physician "Labeling"				
Women with 1 or More Visits for Menstrual Disorders in 1972–74 (%)	9	9	8	9
Women with 2 or More Visits for Gynecologic Problems in 1972–74 (%)	17	17	18	19
Women with 1 or More Dilation and Curretage of Uterus (D&C) in 1974 (%)	12.8	13.3	15.8	22.4**
Possible Indicators of "Demand"				
High Visitors: Women With 5 or More Physician Visits per Year in 1973–74 (%)	39	41	39	49
Women With 1 or More Visits for Vague Psychological Diagnoses in 1973–74 (%)	28	28.9	27	30
Women Seeing 4 or More Different Physicians during 1972–74 (%)	29	33.5	28	43*
Mean Household Income of Area in 1971 ($)	5488	7547	6832	6810
Per Cent Residents with Mother Tongue French, Italian or Polish in 1971	4.9	6.4	11.1	21.1**

Levels of significance of Pearson Correlation between variable and age adjusted 1974–76 hysterectomy rate for nonemergency, nonmandatory conditions (N = 33). All area rates have been age adjusted using the indirect method. For inclusions in each type of area, see Table 1.

*$p < .05$

** $p < .001$

Characteristics of Women Residents

Table 2 lists three possible indicators of gynecologic "need" or "labeling". There was no systematic variation in the rate of visits for menstrual disorders in the two years prior to hysterectomy. Visit rates for abdominal symptoms (a diagnosis which might be used as a substitute for menstrual disorders) also were similar across high and low rate areas. The data suggested a weak positive relationship between overall rates of visits for gynecologic problems (the percentage of women having two or more visits for a large group of diagnoses including menstrual disorders, prolapse, fibroids, etc.) and area hysterectomy rates ($p < .056$). There was also a strong positive relationship between operative rates for dilation and curretage (D&C) and area hysterectomy rates ($p < .001$). This latter relationship might result from underlying gynecologic need affecting the frequencies of both operations or from such other factors as physician preference for gynecologic surgery.

Patient demand may also affect hysterectomy rates. Manitoba women undergoing hysterectomy (compared with a matched age sample) have been shown to have a high rate of physician contact in both the two years before and the two years after hysterectomy.[18] Women who are less willing to tolerate symptoms may be concentrated in certain areas, resulting in higher physician contact rates and higher surgery rates. The bottom half of Table 2 presents several possible indicators of patient "demand" including: the proportion of women in the population who are "high visitors" (making five or more physician visits in a year), the proportion of women who had seen four or more different physicians over a two-year period (possibly an indicator of doctor shopping), and the rate of visits for a group of rather vague psychological diagnoses (neuroses, nervousness, and headache).*** Only the "doctor shopping" indicator varied systematically with the hysterectomy rate.

*** Physicians may use these diagnoses when they cannot identify a more specific complaint bringing a woman to the office.

Although health care is universally insured in Manitoba, income and education might influence sophistication in the use of elective surgery or willingness to tolerate discomfort. The areas did not vary systematically in the level of education of women aged 25 and over, in the education of the household head, or in any of a variety of income measures used (means and per cent high and low on the various measures).

In Manitoba ethnic and cultural factors must also be considered. It has been suggested that among traditional Catholic women, a hysterectomy performed for gynecologic problems may provide the only acceptable method of sterilization.[19] Three ethnic groups in Manitoba are largely Catholic: the French (87 per cent), the Polish (67 per cent), and the Italians (89 per cent). The last line of Table 2 indicates that residents of high rate areas are more likely to belong to these three ethnic groups.

Factors Influencing the Odds of Having a Hysterectomy

Does the practice style of a woman's primary physician influence the odds of her having a hysterectomy, after controlling for area of residence and previous gynecologic history? Two dimensions of practice might be important: whether or not the physician performed hysterectomies, and/or the physician's hysterectomy preference (estimated here by the age-adjusted rate at which the physician's primary patients undergo hysterectomy regardless of who performs the surgery). If, given the age and sex structure of a physician's primary practice, the physician would be expected to have ten patients undergo hysterectomy and 20 patients actually underwent surgery, his observed/expected ratio would be 2.0, twice as high as expected. Physicians with ratios 2.0 or higher are referred to subsequently as hysterectomy prone. If only 5 of this same physician's patients underwent hysterectomy, his observed/expected ratio would be a low .5. Appendix I describes the methodology for calculating these rates.

Table 3 suggests that hysterectomy-prone primary care physicians are most likely to be gynecologists or general

TABLE 3—Characteristics of Physicians Associated with Differing Rates of Their Primary Patients Undergoing Hysterectomies, Manitoba, Canada

Physician Characteristics	Observed/Expected Ratio of Physician's Primary Patients Undergoing Hysterectomy			
	Low (less than .5) (N:83)	Average (.5–1.49) (N:237)	Medium High (1.5–1.99) (N:48)	High—Hysterectomy Prone (2.0 or greater) (N:30)
Specialty of Physician (%)				
Gynecologist	1.2	3.8	16.7	46.7
General Surgeon	4.8	9.3	6.3	10.0
General Practitioner	80.7	78.9	75.0	40.0
Internist	13.3	8.0	2.1	3.3
Number of Hysterectomies Performed in 1974 (%)				
20+	0	.8	8.3	46.7
5–19	0	8.4	10.4	13.3
1–4	20.2	16.9	12.5	0
0	80.0	73.8	68.9	40.0
Place of Residence of Physicians' Primary Patients (%)*				
High Hysterectomy Rate Areas	2.3	2.6	1.4	4.3
Medium High Rate Areas	10.8	20.3	18.2	27.5
Medium Low Rate Areas	61.3	70.0	80.1	68.2
Low Rate Areas	25.7	7.0	.4	0

*Number of Primary Patients in the Population Sample whose Primary Care Physician had: Low Ratios—252, Average—769, Medium High—176, High—88. Percentages in table are based on sample reweighted to reflect population. 140 people were not residents of the 33 largest hospital catchment areas and are therefore excluded.
This population sample of 1425 women is subsequently used in the Table 4–6 analyses.

practitioners. Viewed somewhat differently, of the primary care physicians, 44 per cent of gynecologists, 4 per cent of the general practitioners, 9 per cent of the general surgeons, and 3 per cent of the internists were hysterectomy prone. Hysterectomy-prone physicians were more likely to perform the procedure themselves (although 40 per cent of them performed no hysterectomy in 1974). Hysterectomy-prone primary care physicians are also more likely to have primary patients residing in areas with high and medium high hysterectomy rates.

The practice sizes of primary care hysterectomy-prone physicians were not significantly smaller than those of other physicians, whether judged by total size (1,807 versus 1,931 different patients seen in a year) or by number of women assigned to the physician as primary patients (470 versus 494). Patients of hysterectomy-prone physicians were somewhat younger (average age 40.8 years versus 45.6), averaged somewhat more visits for gynecologic problems a year (.1 to .5 visits more depending on the year), but had fewer physician visits overall (.3 to .8 less depending on the year). Both of these comparisons included all visits made by the hysterectomy-prone physicians' patients, regardless of whom the patient saw.

The interaction between hysterectomy proneness and performing surgery might well influence the probability of physicians' primary care patients undergoing hysterectomy. A dummy variable was created identifying a woman's primary physician according to whether or not the physician was hysterectomy prone and performed five or more hysterectomies a year (9 per cent of the 5,065 women had such a primary physician); this physician is referred to subsequently as a "hysterectomy-prone surgeon".‡

Stepwise multiple logistic regression (forward elimination) was used to compare the characteristics of women aged 25–69 having hysterectomy for nonemergency, nonmandatory reasons in 1974 (1,342) with two groups of women aged 25–69 not having a hysterectomy: a sample drawn from the 1974 Health Services Commission Master Registry (1,425) and (2,298) women having a D&C in 1974. The former group approximates a representative patient sample, and the latter a sample of women with identified gynecologic problems but for whom the decision for hysterectomy has not yet been made.

Analyses were performed for all women as well as analyses for women with a diagnosis (benign neoplasm of the uterus, menstrual disorders, pregnancy) or procedure (D&C or tubal ligation) indicating the presence of a uterus. The latter analysis represented an attempt to control for the fact that some women in the population group (particularly women resident in high rate areas) will have had a hysterectomy prior to 1974 and therefore are not appropriate controls.

Available for analysis were all those variables discussed previously in this paper as well as counts of physician visits for specific types of gynecologic disease (including endometriosis, fibroids, prolapse, etc.). The final logistic model included all variables with a statistically significant ($p < .05$) regression coefficient and specific variables of prior interest (i.e., specialty of the woman's primary physician, whether the primary physician performed surgery at a teaching hospital, and whether the woman was a resident of the

‡ Other combinations of hysterectomy proneness and surgical practice patterns were examined including: primary physicians who were hysterectomy-prone but performed four or fewer hysterectomies per year (3 per cent of the women had such a primary physician), those who were nonhysterectomy-prone but performed surgery (12 percent of the women had such a physician), and those who were nonprone and performed little surgery (76 per cent). However, none of these factors consistently entered the prediction equations. When the criteria for hysterectomy proneness was relaxed to include physicians with observed/expected ratios of 1.75 or larger to increase the numbers particularly in the hysterectomy-prone nonsurgeon category, the results were the same: having a hysterectomy prone *surgeon* as primary physician was the only such factor increasing the odds of a woman coming to hysterectomy.

Winnipeg tertiary care center). Various combinations of predictor variables and various methods for including specific variables (dichotomizing, continuous, and dummy) were tried. Since the results were generally not sensitive to methods of categorization, dummy variables were used to facilitate interpretation. The data were randomly split into halves; one-half of the records were used to derive the logistic equation. Once developed, the final model was tested on the other half of the records to see if the same variables entered the equation and provided similar odds estimates. All data have been pooled for presentation, since the larger "n" provides better estimates of the betas and smaller confidence intervals. The tables include those variables which behaved similarly in both split half analyses and footnotes those which did not.

Table 4 presents the results of the logistic regression. A woman having a D&C in the prior two years or two or more visits for gynecologic problems in the previous year is five times as likely to undergo hysterectomy as a woman with no such surgery or visits, controlling for all other variables in the model (preoperative visits were excluded). Having two or more visits to a gynecologist (regardless of the specialty of a woman's primary physician) also increased the odds of her coming to surgery, although having a large number of visits for nongynecologic problems decreased such odds. Women aged 40–49 were almost three times as likely to have a hysterectomy given the same history as women aged 20–39. Residence in areas with large numbers of French, Polish, and Italian was also associated with having a hysterectomy. However, after controlling for age, previous utilization history, and residence, having a hysterectomy-prone surgeon as primary physician increased the odds of having a hysterectomy. Including only women with an intact uterus in the logistic model produced results very similar to those presented in Table 4.‡‡

TABLE 4—Factors Associated with the Risk of Hysterectomy in the Manitoba Population (Logistic Regression Results Based on 1,342 Women with Hysterectomy and 3,723 Controls)

	Standardized Coefficient*	Standard Error	Odds Ratio	95% Confidence Interval
Physician Visits for Gynecologic Diagnosis in Prior Year				
One	1.14	.11	3.1	(2.5, 3.9)
Two or More	1.62	.10	5.1	(4.1, 6.2)
Woman had a D&C in Prior Two Years	1.65	.10	5.2	(4.3, 6.4)
Woman Had 6 or More Physician Visits for Nongynecologic Problems in Prior Year	−.95	.16	.4	(.3, .5)
Woman's Age				
40-49 Years	.99	.09	2.7	(2.2, 3.2)
50 Years or Older	.45	.10	1.6	(1.3, 1.9)
Woman Had 2 or More Visits to Gynecologist in Prior 2 Years	.73	.09	2.1	(1.7, 2.5)
Per Cent Residents with Mother Tongue French, Italian or Polish	.02	.00	1.0**	
Woman's Primary Physician was a Hysterectomy-Prone Surgeon	.48	.13	1.6	(1.3, 2.1)

*All Chi-square values were significant at the .01 level or better. Variables entering one of the split half models and the full model with their standardized coefficients and standard error (in parentheses) were as follows: woman visited 4 or more different physicians .37(.08), woman had 1–5 physician visits for nongynecologic problems −.40(.14). The reference category for each variable was as follows: Gynecologic diagnoses—none; prior D&C—none; nongynecologic visits—none; age—25–39; visits to gynecologist −0 or 1, hysterectomy prone surgeon—all other primary physicians. The Catholic–Ethnic variable was used as a continuous variable.

**Since this variable was entered as a per cent, an increase of 1 per cent does not increase the odds of being in the hysterectomy group, although the variable had a chi-square of 15.63 ($p<.0001$) in the final model.

Factors Influencing the Odds of Having Gynecologic Visits and a D&C

The number of gynecologic visits and having had a D&C consistently emerge as the most important predictors of a woman having a hysterectomy. We have referred to these as "need-labeling" characteristics because, although these factors may suggest patient "need", physicians may diagnose symptoms differently; once a condition is diagnosed, physicians may be biased towards particular types of treatment.[20] A woman's risk of having a hysterectomy might be greater if her physician's practice style was such that her symptoms were more likely to be diagnosed as gynecologic problems and a D&C was more likely to be recommended for treatment.

Table 5 presents the results from the logistic regression used to assess factors distinguishing women diagnosed as having two or more visits for gynecologic problems, a very significant risk factor for hysterectomy (n = 1,936, for controls, n = 3,129). For this analysis no distinction was made as to whether the woman was in the population, hysterectomy or D&C group. Visiting multiple physicians, being aged 25–49, and having a general practitioner as primary physician all increased the odds of women having two or more visits for gynecologic problems. However, after controlling for these factors, having a hysterectomy-prone surgeon as a primary physician increased the odds of a woman's being diagnosed or "labeled" as having gynecologic problems. For this analysis, nongynecologic visits were separated into those for vague psychological diagnoses such as nervousness and neuroses and those for other reasons. However, neither category of visits consistently entered the model.

Table 6 presents the analysis of the factors distinguishing between women who had a D&C in 1974 (n = 2,298) from controls (the population sample after eliminating women with a 1974 D&C, n = 1,385). Several factors including the number of gynecologic visits, the number of nongynecologic visits, age, and the number of physicians seen were associated with a higher risk of having a D&C. However, after controlling for all these factors, women with a hysterectomy-prone surgeon as a primary physician were almost three times as likely to have a D&C as those whose physician had a different practice style. This again suggests a labeling effect.

Discussion

This paper has attempted to identify factors which might explain variations in hysterectomy rates and to determine if physician practice patterns influence the probability of a patient undergoing a hysterectomy. Some of the measures used were crude, particularly those of socioeconomic and ethnic status (estimated from census data according to a woman's area of residence). Better indicators of condition severity and quality of life (the "need-labeling" measures) than the number of visits for gynecologic problems or having had a D&C would have been desirable. However, the

‡‡ This analysis, although providing control on prior surgery, would be biased toward women with high utilization patterns.

TABLE 5—Factors Associated with the Risk of Having Two Physician Visits in a 12-Month Period for Gynecologic Problems (Logistic Regression Results Based on 1,936 Women With 2 or More Visits and 3,129 Controls)

	Standardized Coefficient*	Standard Error	Odds Ratio	95% Confidence Interval
Woman Visited 4 or More Different Physicians in That and Prior Year	.8	.06	2.3	(2.0, 2.6)
Woman's Primary Physician Was a General Practitioner	.5	.10	1.7	(1.4, 2.1)
Woman's Age 25–49 Years	.5	.07	1.6	(1.4, 1.9)
Woman's Primary Physician was a Hysterectomy Prone Surgeon	.6	.14	1.8	(1.4, 2.3)

*All Chi-square values were significant at the .0001 level or better. Variables entering only one of the split half models and the final model with their standardized coefficients and standard error (in parentheses) were as follows: primary physician was a gynecologist .4(.14), woman was a resident of Winnipeg .2(.06), woman made 5 or more visits for diagnoses not associated with gynecologic or psychological problems that year .4(.07), woman made 2 or more visits for psychological problems that year .2(.09). The reference category for each variable was as listed in Table 4 except as follows: number of physicians visited—3 or fewer, primary physician was general practitioner—general surgeons and internists since gynecologists as primary physician also entered the final model, age—50 years and older was the reference.

indicators of physician supply, access to care, and practice style are based on extensive and complete data accumulated as part of a national health insurance data system.

Identifying a woman's primary physician and by inference the physician who is likely to have participated in the woman's decision to have a hysterectomy would be difficult with any methodology. Spiegel *et al*,[21] have shown that identification of a primary care physician is sensitive to the method used. Our definition—the physician seen most frequently—was more likely to identify a specialist as the primary care provider than were definitions based on the physician to whom screening tests results were sent or on the physician seen for common conditions such as hypertension. However, the Spiegel *et al*,[21] study only assessed claims patterns over a one-year period; our assignment rules are based on two years' data. A longer time period might diminish the effects of short-term problems on a patient's seeking specialist care.

With the criteria used here, gynecologists are disproportionately included in the hysterectomy-prone group, particularly in that group which performs surgery. Should gynecologists never be considered primary physicians? Are patients usually seen or referred to gynecologists only when they have a medical problem likely to require a hysterectomy? While this possibility cannot be eliminated, several things suggest that "hysterectomy-prone surgical practice style" is a valid concept. First of all, Manitoba has open access to specialists and, in the two years prior to hysterectomy, patients of hysterectomy-prone surgeons were much less likely to be referred to their surgeons than were patients of primary physicians with other practice styles (7 per cent versus 23 per cent). Secondly, 56 per cent of gynecologists

TABLE 6—Factors Associated with the Risk of Dilation and Curretage of the Uterus (D&C) in the Manitoba Population (Logistic Regression Results Based on 2,298 Women with D&C and 1,385 Controls)

	Standardized Coefficient*	Standard Error	Odds Ratio	95% Confidence Interval
Physician Visits for Gynecologic Diagnosis in Prior Year				
One	1.2	.10	3.2	(2.6, 3.9)
Two or More	1.7	.10	5.5	(4.5, 6.8)
Physician Visits for Nongynecologic Diagnosis in Prior Year				
1–5	1.4	.16	4.1	(3.0, 5.6)
6 or More	1.5	.18	4.7	(3.3, 6.6)
Woman's Primary Physician Was a Hysterectomy-Prone Surgeon	1.0	.20	2.8	(1.9, 4.1)
Woman's Age				
40–49 Years	.4	.10	1.5	(1.2, 1.9)
50 Years or Older	−.6	.09	.5	(.5, .7)
Woman Visited 4 or More Physicians in Prior 2 Years	.3	.09	1.4	(1.2, 1.6)

*All chi-square values were significant at the .001 level or better. Variables entering only one of the split half models and the full model with their standardized coefficients and standard error (in parentheses) were as follows: primary physician was a general practitioner .7(.14), primary physician was a general surgeon .6(.19), woman's primary physician was a nonhysterectomy-prone surgeon .5(.13), woman was a resident of Winnipeg .2(.08). The reference category for each variable was as listed in Table 4 except as follows: nongynecologic diagnosis—none, number of physicians visited—3 or fewer.

Since both hysterectomy-prone surgeons and nonhysterectomy-prone surgeons entered the final model, the reference category for these two variables is primary physicians who performed few hysterectomies.

meeting all other practice size criteria were not classified as hysterectomy-prone surgeons. Thirdly, hysterectomy-prone surgeons are reasonably similar to other physicians in the numbers of different patients seen (their total practice) and in their numbers of primary patients (using our definition); thus their practices do not appear to be mainly referral-based. Finally, patients of hysterectomy-prone surgeons appear to have been very much their patients during the two years prior to hysterectomy. Their patients saw on average the same number of different physicians in the two years prior to surgery as did patients of nonhysterectomy-prone surgeons, (4.5 versus 4.2); in the same two years, hysterectomy-prone surgeons received 45 per cent of all their primary patients' physician contacts. (Patients of nonhysterectomy-prone surgeons made 57 per cent of their visits to their primary physicians and also scored somewhat higher on continuity of care measures.) For further checks on the primary physician concept, see Appendix I.

Statistical instability associated with the small size of some of the hospital areas and of some physician practices might also be a matter of concern. Larger areas would provide more stable numbers but likely mask important sources of variation. The analysis has attempted to overcome this problem by basing hysterectomy rates on three years' data and by drawing large samples from the rural areas for assessing resident characteristics. The observed variation in hysterectomy rates across the 33 hospital catchment areas was statistically significant at better than the .05 level according to the systematic component of variance test outlined by MacPherson,[6,7] suggesting that this approach was successful. When the analysis was restricted to women (3,366) with physicians having larger practices (those expected to have 10 or more patients undergoing hysterectomy rather than five or more), the results were almost identical.

This analysis reinforces and supplements findings from previous research on small area rate variations. The lack of a relationship between physician supply and hospital beds and variations in *specific* surgical rates is similar to results previously reported by Wennberg and Gittelsohn.[13] However, in contrast to previous studies, the importance of ethnicity persists even after controlling for other patient and physician variables.

Although residents of high rate areas had more D&Cs and marginally more visits for gynecologic problems, it cannot necessarily be concluded that these are indicators of greater "need" in such areas. Residents of high rate areas are more likely to have hysterectomy-prone surgeons as primary physicians (12 per cent of the residents of high rate areas versus none of low rate areas residents); such physicians are both more likely to "label" their patients' conditions as gynecologic in origin and more likely to advise surgical intervention (both D&C and hysterectomy) once such conditions are diagnosed. This analysis thus reinforces the conclusions of others that physician decision making behavior varies markedly in the face of similar evidence and that variations in such decision making may lead to variations in elective surgical rates.[22-24]

The paper provides no assessment of the "necessity" of hysterectomies performed in high rate areas or by hysterectomy-prone surgeons. The American College of Obstetricians and Gynecologist's Committee on Gynecologic Practice[25] has recently reviewed this topic and concluded that "the question of unnecessary hysterectomies is difficult to evaluate because of the lack of agreement over the definition of necessary . . ." Previous analyses using the Manitoba data have suggested that hysterectomy may expose a woman to significant risks, while the pattern of her contact with the health care system shows little change. These data and the conclusions of the ACOG Committee on Gynecologic Practice[25] support recommendations that the opinion of both nonsurgical and surgical specialists should be sought when discretionary surgery such as elective hysterectomy is being considered.[26]

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ACKNOWLEDGMENTS

An earlier version of this paper was presented at a workshop on Small Area Variations in Surgery at the 1982 American Public Health Association Meeting in Montreal.

This research was supported by a grant (6607-1197-44) from the Research Programs Directorate, Health and Welfare, Canada and by a Career Scientist Award (6607-1001-22). The author is indebted to the Manitoba Health Services Commission which helped make this research possible. Interpretations of the data are the author's own and do not necessarily represent the official opinion of the Manitoba Health Services Commission or Health and Welfare, Canada. The useful comments on earlier versions of this manuscript by Marsha Cohen, Carol Korenbrot, Gordon Flowerdew, David Fish, Robert Cooke, Mark Chassin, John McBeath, Charles Burns, George Godber, Madelon Finkel and Pat Kaufert are all acknowledged with thanks. The author also gratefully acknowledges the assistance of Andre Wajda, Carmen Steinbach, Donna Westman, Linda Ewashko and Larry Tallman in the file preparation and data analysis, and Debbie Doan in the preparation of the manuscript.

APPENDIX I

To identify physician practices, each person from a stratified sample of 40,000 Manitoba women (18% sample of the population 25 and over) was assigned to the physician seen most frequently over a two-year period. Eight different assignment rules were used to test the sensitivity of practice size estimates. These rules included: 1) assign woman to physician seen most frequently over the two-year period 1972–1974 regardless of specialty; 2)

APPENDIX TABLE—Design of the Study: Size, Source and Use of the Groups Defined for this Analysis

Population	A—Sampling Fraction B—Total N Available C—Years of Data Available	Analysis Based on Data
1) Manitoba females age 25+	A—18% B—40,000 C—1974 sample, 1972–76 histories	Defining denominator for hysterectomy-prone physician practice analysis (Tables 3–6).
	A—13% of 29 rural areas B—14,698 C—1974 sample, 1972–76 histories	Defining access to care, indicators of gynecologic need, and indicators of patient demand in each of 33 areas (Tables 1, 2).
	A—1% of 4 urban areas B—1,787 C—1974 sample, 1972–76 histories	
Manitoba females age 25–69, fully covered by insurance plan, and primary physician qualifies under #4	A—1% sample B—1,425 C—1974 sample, 1972–76 histories	Comparison group for logistic analysis and characteristics of primary physicians' patients (Tables 3–6).
2) Manitoba females age 25+ having hysterectomy	A—100%	Defining rates for 33 small areas (Table 1).
	B—6,038	Defining number of hysterectomies performed by a physician.
	C—1974–76	Defining numerator for hysterectomy prone physician practice analysis (Table 3).
Manitoba females age 25–69, who had a hysterectomy fully covered by insurance plan, and primary physician qualifies under #4	A—100% B—6,038 C—1974–1976	As above, except subtract one from numerator if woman is a hysterectomy case, not is she is D&C or population case, to control for bias. Used in multiple logistic regressions (Tables 4–6)
	A—100% B—3,909 C—1975–76	Defining numerator for hysterectomy-prone physician practice analysis not biased by 1974 cases.
	A—100% B—1,342 C—1974 cases, 1972–76 histories	Used in multiple logistic regression (Tables 4, 5).
3) Manitoba females age 25+ having a D&C	A—100% B—3,800 C—1974	Defining rates for 33 small areas (Table 2).
Manitoba females age 25–69, who had a D&C fully covered by insurance plan and primary physician qualifies under #4	A—100% B—2,298 C—1974 cases, 1972–76 histories	Used in multiple logistic regression (Tables 4–6).
4) Manitoba physicians registered in province 1971–76 with practice of age and sex composition such that 5 or more expected hysterectomies among primary patients.	A—100% B—398 C—1971–1976	Used in analysis of physician characteristics (Table 3). 99% of these physicians were used in practice style analysis indicator for logistic regressions (Tables 4–6).
5) Census data available at small area level only	C—1971–1976	Small area analysis of household income, education, ethnic background (Tables 1, 4).

assign woman to the primary care specialist (general practitioner, internist, gynecologist, or general surgeon) seen most frequently over a two-year period; 3 and 4) assign woman to physician only if 50 per cent or more of her visits were to that physician using definitions one and two. Rule 5–8, use definitions 1 through 4 on a different two-year period of utilization, i.e., 1974 through 1976. Estimates of the number of women aged 25 and older in a physician's practice were very stable, with Pearson correlations ranging from .89 to .99 across the eight measures (n = 568 to 778 depending on the measure used). If the estimates of practice size had not proved stable from year to year and across definitions, our approach would not have worked. Independent measures of practice size (number of different patients seen regardless of age or sex) based on *all* patients seen in 1971 and 1976 were available for each physician. These measures were significantly correlated with our measures based on the 40,000 sample of women (Pearsons r = .33 – .55; $p < .0001$).

Given the age and sex composition of a physician's practice (as defined in previous paragraph), the number of women in the physician's practice expected to undergo hysterectomy (given provincial averages) versus the actual number undergoing hysterectomy could be calculated. The resulting observed/expected ratio has been interpreted as a measure of a physician's hysterectomy proneness. (See Appendix Table for a description of the size, source and purpose of all groups used in this analysis.)

To obtain stable estimates of the actual number of a physician's patients undergoing hysterectomy (the numerator), all women undergoing hysterectomy for nonemergency, nonmandatory reasons over three years (1974 through 1976) were identified and assigned to their primary physician. The correlation in the observed/expected ratios was also high across these eight measures, once the analysis was restricted to physicians expected to have five or more women undergoing hysterectomy (Pearson's r = .73 – 1.0; n = 393 – 398). When analysis was based on all physicians including those with smaller practice sizes, the correlations were much lower suggesting instability in the measures. With larger practice sizes (physicians expected to perform 10 or more hysterectomies), there was little change in the correlations and the number of physicians available for analysis was significantly lower (n = 205 – 207). Therefore, the criterion of 5 or more was used, along with the criterion that the physician was registered as practicing in the province over the entire period 1971–1976. Our analyses include 99 per cent of the 398 physicians in the province meeting these criteria.

To avoid the statistical artifact, that women could only be in the hysterectomy group if their primary physician had at least one patient with hysterectomy in 1974–1976, when calculating the hysterectomy proneness of a woman's physician, we have subtracted one from his numerator count. No subtraction was made from the population sample's physician tally, nor from the D&C group. A second method of correcting for this artifact was also tried, i.e., calculating rates from years (1975–76) different from the target year being examined (1974). The results were not sensitive to this correction.

To test the validity of the primary physician concept, all cases (266) where there was a referral made to the surgeon performing the hysterectomy (at any time in the two years prior to surgery) were examined. One would expect that usually the primary physician should be the physician making the referral and 79 per cent of the time this was true. In 5 per cent of the cases, although a referral was made to the surgeon, the surgeon was identified as the primary physician. This is plausible if the surgeon took over the case early in the two year history. In 16 per cent of the cases, the referral to the surgeon was made by a physician other than the primary physician.

The analysis of the factors influencing the odds of a woman having a hysterectomy was based on 61 per cent of the available cases (66 per cent of the hysterectomy women and 60 per cent of the controls). Women were excluded from the analysis for the following reasons: woman made no physician visits or only visits to out-of-province physicians over the focal two-year period and therefore no primary physician could be identified (2 per cent of the hysterectomy women and 6 per cent of the controls were excluded on this basis); woman's primary physician was not practicing in the province over the full period of the study (12 per cent of the hysterectomy women and 13.5 per cent of the controls); woman's primary physician would have been expected to have four or fewer women undergoing hysterectomy per year given the small size of the physician's practice (16 per cent and 21 per cent respectively); woman was not covered by the provincial insurance system over the full period of the study, a loss to follow-up problem (15 per cent and 18 per cent); and finally, woman's claims identifiers were not consistent over the period of the study (3.5 per cent of both groups).

An analysis of those women having hysterectomies who were included in the study versus those excluded suggested the following: those included were slightly older (mean age 45.0 years versus 43.8), and their physicians were somewhat older (mean age 50.0 versus 45.5). Included women were somewhat more likely to have made two or more physician visits for gynecologic problems in the year before surgery (63 per cent versus 58 per cent) although there were no statistically significant differences in the overall number of physician visits in the year before surgery. There were also no significant differences between those included and excluded across the following: the proportion of women seeing four or more different physicians, the proportion who had D&C prior to surgery, the proportion who lived in Winnipeg, the proportion who made two or more visits to a gynecologist, and the proportion who had a gynecologist as a primary physician. Comparisons of the controls included in the study versus those excluded produced generally similar results with the exception that those included averaged more physicians visits than did those excluded (6.5 per year versus 5.7).

APPENDIX II

The reliability and validity of the Manitoba claims data have been investigated extensively. A comparison of Health Services Commission data with cooperating doctors' medical records showed few differences in episode counts. Measures of intra- and interphysician diagnostic reliability approximated those obtained in clinical trials.[16,17] Diagnoses recorded in the hospital medical record and those contained in the hospital claims were found to correspond closely, both in a study of elderly patients based in an urban teaching hospital and in a study of myocardial infarction using data from rural and urban hospitals. Our research, as that of others, has found the recording of diagnoses to be most reliable when fine distinctions are not made.[27,28]

In a special study of the validity of claims as they relate to hysterectomies, the procedures independently billed for by surgeons and anesthetists were compared with those in the hospital file when a hysterectomy was coded by either physician or hospital. Ninety-four per cent of the records showed an identical match: e.g., when an abdominal hysterectomy was recorded in the hospital discharge, the surgeon billed for this procedure. Discrepancies almost always were due to minor date discrepancy or to the surgeon billing for a more extensive procedure associated with an abdominal malignancy; in this latter case, the hysterectomy was secondary. In all these cases, the more extensive procedure was also recorded in the hospital claim.

Diagnoses recorded on surgeons' claims and hospital discharge abstracts were identical less frequently. In 69 per cent of the cases the surgeon's diagnosis was in the same gynecological category as at least one of the three hospital discharge diagnoses, and in 26 per cent of the cases the surgeon's diagnosis was in a gynecological category differing from the hospital's diagnosis. The gynecologic/nongynecologic diagnostic distinction appears to be made quite reliably in the claims. As noted elsewhere, disagreement as to diagnosis seems ubiquitous and can result from a number of sources.[29] Observations based on fine distinctions must be made cautiously.