USE OF ALTERNATIVE TECHNIQUES OF HYSTERECTOMY IN OHIO, 1988–1994

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ABSTRACT

Background Laparoscopically assisted vaginal hysterectomy has been promoted as a substitute for both abdominal and vaginal hysterectomy, with claimed benefits of lower costs, shorter hospital stays, and quicker postoperative recovery.

Methods Using computerized hospital-discharge data for 1988–1994 from 180 hospitals in Ohio, we analyzed rates of abdominal, vaginal, and laparoscopically assisted vaginal hysterectomy and their association with characteristics of patients, complications, in-hospital mortality, and hospital charges.

Results The annual age-adjusted rate of hysterectomy fell 10 percent, from 4.53 per 1000 female state residents in 1988 to 4.07 per 1000 in 1994 ($P<0.001$). In 1988, 1.1 percent of all hysterectomies were performed by the laparoscopically assisted vaginal technique; this proportion increased to 9.2 percent in 1993 and declined to 7.5 percent in 1994. For gynecologic conditions other than cancer or pregnancy, women undergoing laparoscopically assisted vaginal hysterectomy as compared with one of the other techniques were more likely to have commercial insurance and to have their surgery at an urban hospital for diagnoses related to pain, endometriosis, or pelvic inflammatory disease. With abdominal and laparoscopically assisted vaginal hysterectomy, the complication rates were similar and were higher than those with vaginal hysterectomy. In-hospital mortality was similar for vaginal and laparoscopically assisted vaginal hysterectomy and was lower than for abdominal hysterectomy. Median hospital charges were $8,108 for laparoscopically assisted vaginal hysterectomy, $5,723 for abdominal hysterectomy, and $5,049 for vaginal hysterectomy.

Conclusions The rate of hysterectomy in Ohio decreased from 1988 to 1994, as laparoscopically assisted vaginal hysterectomy became more common. Laparoscopically assisted vaginal hysterectomy was associated with higher hospital charges than the other techniques. (N Engl J Med 1996;335:483-9.)

LAPAROSCOPIC procedures have been rapidly introduced into clinical practice over the past decade, often before they have been critically compared with standard procedures. Laparoscopically assisted vaginal hysterectomy has been promoted as a substitute for abdominal and vaginal hysterectomy, with claimed benefits of lower costs, shorter hospital stays, and quicker postoperative recovery.[1,2] However, higher charges have been reported with this procedure, because of longer operating times and the use of expensive disposable instruments.[3,4] New forms of technology may be responsible at least in part for escalating health care costs. Despite the cost-saving potential of laparoscopic cholecystectomy, for example, it has resulted in an increased rate of cholecystectomy and in higher overall costs.[5,6]

We studied the use of abdominal, vaginal, and laparoscopically assisted vaginal hysterectomy in Ohio from 1988 to 1994. We sought to determine whether the introduction of the laparoscopically assisted vaginal technique was associated with changes in the rate of hysterectomy and whether differences in the characteristics of patients, complications, in-hospital mortality, and hospital charges were associated with the various procedures.

METHODS

Sources of Data

The study data were obtained from a computerized data base on inpatients maintained by the Ohio Hospital Association that contains information on 96 percent of hospital discharges in the state. Psychiatric and specialty hospitals are excluded from the data base, and 16 hospitals do not participate, leaving 180 nonfederal, short-stay hospitals.

The hospital-discharge data from January 1, 1988, through December 31, 1994, include information on the age, race, and county and state of residence of the patients; health-insurance status; length of hospital stay; vital status at discharge; diagnosis-related group, with information on complications; and hospital charges (not including physicians' fees). For more than 99 percent of patients, the data were complete for all variables except race; data on race were missing for 27 percent. The association estimates that the error rate in the coding is 1 percent. Codes from the *International Classification of Diseases, 9th Revision, Clinical Modification* (ICD-9-CM) were obtained for up to five procedures and five diagnoses per discharge. Hospitals were grouped according to the number of discharges per year and were classified as small (with fewer than 9000 discharges; 124 hospitals), medium-sized (9000 to 14,999 discharges; 29 hospitals), or large (15,000 or more discharges; 27 hospitals). They were also grouped according to location, as either urban (located in one of six metropolitan counties; 69 hospitals) or rural (located in any other county; 111 hospitals). Health insurance was classified as commercial (including Blue Cross–Blue Shield and other private insurers), provided by the government (including Medicare, Medicaid, and workers' compensation), or other (including health

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maintenance organizations and self-pay plans). Hospital-specific data were not available.

Identification of Cases

ICD-9-CM procedure codes were used to identify hospitalizations during which hysterectomy was performed. Abdominal hysterectomy was identified by codes 68.4 (total hysterectomy, 132,761 cases), 68.3 (subtotal hysterectomy, 283 cases), 68.6 (radical abdominal hysterectomy, 269 cases), 68.8 (pelvic evisceration, 60 cases) and 68.9 (unspecified hysterectomy, 128 cases). Vaginal hysterectomy was identified by codes 68.5 (37,821 cases) and 68.7 (radical hysterectomy, 6 cases). Since there was no unique code for laparoscopically assisted vaginal hysterectomy, that procedure was identified by the appearance of any hysterectomy code together with code 54.21, for laparoscopy (7979 cases).

Statistical Analysis

All cases with a diagnostic code for hysterectomy were analyzed initially, and then, to limit the analysis to benign gynecologic conditions, the data were reanalyzed after the exclusion of cases with codes related to genitourinary cancer (codes 179 through 189) or pregnancy (codes 630 through 676).

Crude and age-adjusted rates of hysterectomy were determined for each calendar year. The denominators for the rates were derived from the census figures for Ohio; the size of the population in 1988, 1989, 1991, 1992, and 1993 was estimated[7]; the data for 1990 were taken from the census[8]; and the 1994 data were projections.[9] Age-adjusted rates were calculated by direct adjustment for age, with the 1990 census population selected as the standard population.[10] Without accurate information about the percentage of women of each age in each year who had already undergone hysterectomy, it was not possible to calculate rates specifically applicable to women at risk for the operation. If women who have already undergone hysterectomy are not excluded from the denominator of women at risk for the procedure, the use of the uncorrected rates may underestimate the true rates of hysterectomy by up to 25 percent.[11,12]

The diagnostic codes were used to determine what complications had occurred, and the complications were grouped according to organ system. In-hospital mortality was defined as death during the hospitalization in which hysterectomy was performed. Data on the length of hospital stays and on charges were aggregated and expressed as medians with interquartile ranges (from the 25th percentile to the 75th percentile), since these are less sensitive to the effect of extreme values than means and standard deviations. Values were compared by nonparametric Kruskal–Wallis tests.[13] Hospital charges for the years 1988 through 1993 were adjusted for inflation to the equivalent of 1994 dollars; adjusted charges for each year were then aggregated to calculate medians and ranges. The univariate association of each factor with surgical technique (in pairwise comparisons) and with in-hospital mortality was evaluated by the chi-square test or Fisher's exact test for categorical variables and by Student's t-test for continuous variables. Changes over time were tested by the Armitage test for linear trend.[14] All tests were two-sided; P values of 0.05 or less were considered to indicate statistical significance.

The logistic-regression analyses used a forward stepwise procedure, with a P value of 0.15 required for a variable to be included in the model and a P value of 0.05 for it to remain. Adjusted odds ratios are shown for all characteristics in the model that were statistically significant.[15] As stated above, all the data were analyzed initially, and the analysis was then repeated after the exclusion of cases related to cancer or pregnancy. Because data on race were missing in 27 percent of cases, the analysis was performed with and without that variable; the odds ratios did not differ significantly with either method. Hosmer–Lemeshow goodness-of-fit tests were used with each logistic-regression model to test how the model fit the data.[16] Discrepancies between the observed and the expected data were summarized by Pearson chi-square statistics. A nonsignificant result on the Hosmer–Lemeshow goodness-of-fit test indicates a good fit of the model. In addition, we used the C-statistic, which measures the predictive power of the model; the higher the value of the statistic (range, 0 to 1), the greater the predictive value.

TABLE 1. AGE-ADJUSTED RATES OF HYSTERECTOMY IN OHIO, 1988 THROUGH 1994, ACCORDING TO THE SURGICAL TECHNIQUE USED.

YEAR	ABDOMINAL HYSTERECTOMY	VAGINAL HYSTERECTOMY	LAPAROSCOPICALLY ASSISTED VAGINAL HYSTERECTOMY	ALL THREE
	procedures per 1000 women			
1988	3.56	0.92	0.052	4.53
1989	3.46	0.86	0.067	4.39
1990	3.78	0.93	0.073	4.78
1991	3.47	0.88	0.129	4.48
1992	3.32	1.02	0.338	4.68
1993	2.95	1.02	0.403	4.37
1994	2.77	0.99	0.306	4.07

RESULTS

The data base included 179,307 hysterectomies, of which 133,501 were abdominal (74.5 percent), 37,827 were vaginal (21.1 percent), and 7979 were vaginal with laparoscopic assistance (4.4 percent). Table 1 shows the age-adjusted rates at which the three techniques of hysterectomy were used in each calendar year. Overall, the rate of hysterectomy decreased 10 percent between 1988 and 1994 ($P<0.001$). In 1988, 1.1 percent of all hysterectomies were performed by the laparoscopically assisted vaginal technique; this proportion increased to 9.2 percent in 1993, then dropped to 7.5 percent in 1994. Vaginal hysterectomy was performed at a similar rate throughout the study period, but the proportion of such hysterectomies increased from 20.3 to 24.3 percent ($P<0.001$). The proportion of abdominal hysterectomies decreased from 78.6 percent in 1988 to 68.0 percent in 1994 ($P<0.001$).

The characteristics of the patients are shown in Table 2. From 1988 to 1994, the median hospital stay decreased from 5.0 days to 2.0 days with laparoscopically assisted vaginal hysterectomy, from 5.0 to 3.0 days with abdominal hysterectomy, and from 4.0 to 2.0 days with vaginal hysterectomy.

The characteristics of the patients with benign gynecologic conditions who underwent abdominal and laparoscopically assisted vaginal hysterectomy are compared by multiple logistic-regression analysis in Table 3, and the characteristics of those who underwent vaginal and laparoscopically assisted vaginal hysterectomy are compared in Table 4. In both analyses, the women who underwent laparoscopically as-

TABLE 2. CHARACTERISTICS OF 179,307 PATIENTS WHO UNDERWENT HYSTERECTOMY FROM 1988 THROUGH 1994, ACCORDING TO THE SURGICAL TECHNIQUE USED.*

CHARACTERISTIC	ABDOMINAL HYSTERECTOMY (N=133,501)	VAGINAL HYSTERECTOMY (N=37,827)	LAPAROSCOPICALLY ASSISTED VAGINAL HYSTERECTOMY (N=7979)
Mean (±SD) age (yr)	45±12	48±15	42±10
Race (% of patients)			
White	78.2	84.9	85.6
Black	11.6	6.3	8.6
Other	10.2	8.8	5.8
Type of health insurance (% of patients)			
Commercial	68.4	62.9	76.4
Government	19.5	26.4	12.3
Other	12.1	10.7	11.3
Hospital size (% of patients)†			
Small	32.3	29.0	30.7
Medium	21.6	23.1	20.6
Large	46.1	47.9	48.7
Hospital location (% of patients)			
Urban	58.7	58.5	61.7
Rural	41.3	41.5	38.3
Hospital stay			
No. of days			
Median	4.0	3.0	3.0
Interquartile range	3.0–5.0	3.0–4.0	2.0–4.0
Stay >7 days (% of patients)	8.6	2.5	2.9
Primary diagnostic group (% of patients)			
Cancer	11.1	0.9	1.4
Pregnancy	0.6	0.02	0.3
Myomas	30.4	11.1	23.8
Uterovaginal prolapse	3.2	53.4	8.5
Endometriosis	16.8	7.7	25.1
Abnormal bleeding	11.3	11.7	13.6
Pain	3.2	2.2	6.3
Precancerous condition‡	4.1	3.9	3.0
Pelvic inflammatory disease	3.3	0.3	4.5
Other	15.9	8.8	13.5
Salpingo-oophorectomy or oophorectomy (% of patients)§	76.5	18.4	66.6

*P<0.001 in the univariate analysis for all pairwise comparisons between groups, except with regard to hospital location (P=0.64) and the diagnosis of precancerous conditions (P=0.09) for the comparison of abdominal with vaginal hysterectomy.

†Hospital size was defined according to the number of discharges per year as small (<9000 discharges), medium (9000 to 14,999), or large (≥15,000).

‡These conditions included endometrial hyperplasia and cervical dysplasia.

§This category includes all unilateral and bilateral procedures.

sisted vaginal hysterectomy were more likely to have commercial health insurance and to have their surgery at an urban hospital for a diagnosis related to pain (dysmenorrhea, pelvic pain, or unspecified abdominal pain), endometriosis, or pelvic inflammatory disease. Women who underwent laparoscopically assisted vaginal hysterectomy or vaginal hysterectomy were more likely than those undergoing abdominal hysterectomy to be white (85.6 percent, 84.9 percent, and 77.5 percent, respectively). Unilateral or bilateral oophorectomy or salpingo-oophorectomy was performed in 66.7 percent, 18.4 percent, and 75.3 percent of laparoscopically assisted vaginal, vaginal, and abdominal hysterectomies, respectively. There was a strong interaction between the year of the study and the type of insurance. A higher proportion of women with commercial insurance as compared with government or another type of insurance underwent laparoscopically assisted vaginal hysterectomy in 1994 (9.4 percent vs. 5.5 percent) than did so in 1988, when the proportions were more similar (1.2 percent vs. 1.3 percent).

The percentage of procedures to treat benign gynecologic conditions during which there were com-

TABLE 3. CHARACTERISTICS OF THE SUBGROUP OF 90,880 PATIENTS WHO UNDERWENT ABDOMINAL HYSTERECTOMY OR LAPAROSCOPICALLY ASSISTED VAGINAL HYSTERECTOMY FOR BENIGN GYNECOLOGIC CONDITIONS, 1988 THROUGH 1994, AND ODDS RATIOS FOR LAPAROSCOPICALLY ASSISTED SURGERY.*

CHARACTERISTIC	ABDOMINAL HYSTERECTOMY (N=85,138)	LAPAROSCOPICALLY ASSISTED VAGINAL HYSTERECTOMY (N=5742)	ADJUSTED ODDS RATIO (95% CONFIDENCE INTERVAL)
Mean (±SD) age (yr)†	43±10	42±10	0.996 (0.992–0.999)
Race (% of patients)			
White‡	77.5	85.6	
Black	12.2	8.7	0.62 (0.56–0.68)
Other	10.3	5.7	0.51 (0.45–0.57)
Type of health insurance (% of patients)			
Commercial‡	71.6	77.8	
Government	15.6	11.0	0.68 (0.62–0.74)
Other	12.8	11.2	0.77 (0.71–0.84)
Hospital size (% of patients)			
Small‡	31.4	26.5	
Medium§	21.4	18.1	0.91 (0.84–0.99)
Large	47.2	55.4	1.23 (1.14–1.33)
Hospital location (% of patients)			
Urban	58.8	69.2	1.56 (1.45–1.67)
Rural‡	41.2	30.8	
Primary diagnostic group (% of patients)¶			
Uterovaginal prolapse	3.5	8.0	3.21 (2.88–3.59)
Endometriosis	19.0	24.8	1.72 (1.60–1.85)
Abnormal bleeding	13.0	14.6	1.42 (1.31–1.55)
Pain	3.6	6.2	2.27 (2.01–2.56)
Pelvic inflammatory disease	3.8	4.2	1.59 (1.38–1.83)
Salpingo-oophorectomy or oophorectomy (% of patients)	75.3	66.7	0.65 (0.61–0.69)

*Adjusted odds ratios were derived by multiple logistic regression, with each ratio adjusted for all the other characteristics shown. (P=0.03 by the Hosmer–Lemeshow goodness-of-fit test; C-statistic=0.65.) Diagnoses of myomas and precancerous conditions were not significant factors in this model. An adjusted odds ratio of less than 1 indicates that patients with the characteristic in question have lower odds of undergoing laparoscopically assisted vaginal hysterectomy as compared with abdominal hysterectomy than those without the characteristic, and a ratio of more than 1 indicates that patients with the characteristic have higher odds. P<0.001 for all comparisons between groups, except as noted.

†Adjusted odds ratio shown is per year of increasing age. P=0.008 for the comparison between groups.

‡This was the comparison group in the calculation of the adjusted odds ratio.

§P=0.03 for the comparison between groups.

¶Adjusted odds ratios shown are for each patient with the diagnosis as compared with a patient without the diagnosis.

plications was similar for abdominal hysterectomy and laparoscopically assisted vaginal hysterectomy (9.1 percent and 8.8 percent) and lower for vaginal hysterectomy (7.8 percent) (Table 5). Complications related to hemorrhage (intraoperative and postoperative) or the accidental laceration of blood vessels, nerves, or organs were most common with laparoscopically assisted vaginal hysterectomy. There were no clear trends over the study period in the rate of complications with laparoscopically assisted vaginal hysterectomy. Urinary complications, such as oliguria, anuria, and acute renal failure, were more common with vaginal hysterectomy. Abdominal hysterectomy was associated with a higher rate of gastrointestinal complications, such as intestinal obstruction.

Of the 179,307 patients, 274 died, for an overall in-hospital mortality rate of 15.3 per 10,000 procedures. Multiple logistic-regression analysis showed that age, insurance, and technique of hysterectomy were significant factors (P=0.07 by the Hosmer–Lemeshow goodness-of-fit test; C-statistic=0.85). For all patients, the adjusted odds ratio for death after vaginal or laparoscopically assisted vaginal hysterectomy as compared with abdominal hysterectomy was 0.23 (95 percent confidence interval, 0.15 to 0.36). Of the 17,038 patients with cancer or pregnancy, 152 died (55 percent of all deaths), for an in-hospital mortality rate of 89.2 per 10,000 procedures. The in-hospital mortality rate for women with benign gynecologic conditions was 7.5 per 10,000 procedures (8.8, 4.3, and 3.8 per 10,000 procedures for abdominal, vaginal, and laparoscopically assisted vaginal hysterectomies, respectively). Among these women, multiple logistic-regression analysis revealed that after adjustment for age and insurance status, the odds ratio for death after vaginal or laparoscopically assisted vaginal hysterectomy as compared with abdominal hysterectomy was 0.19 (95 percent confi-

TABLE 4. CHARACTERISTICS OF THE SUBGROUP OF 33,653 PATIENTS WHO UNDERWENT VAGINAL HYSTERECTOMY OR LAPAROSCOPICALLY ASSISTED VAGINAL HYSTERECTOMY FOR BENIGN GYNECOLOGIC CONDITIONS, 1988 THROUGH 1994, AND ODDS RATIOS FOR LAPAROSCOPICALLY ASSISTED SURGERY.*

CHARACTERISTIC	VAGINAL HYSTERECTOMY (N=27,911)	LAPAROSCOPICALLY ASSISTED VAGINAL HYSTERECTOMY (N=5742)	ADJUSTED ODDS RATIO (95% CONFIDENCE INTERVAL)
Mean (±SD) age (yr)†	48±15	42±10	0.978 (0.974–0.981)
Race (% of patients)			
White‡	84.9	85.6	
Black§	6.3	8.7	1.01 (0.89–1.14)
Other	8.8	5.7	0.74 (0.64–0.85)
Health insurance (% of patients)			
Commercial‡	63.8	77.8	
Government	25.4	11.0	0.81 (0.73–0.90)
Other	10.8	11.2	0.80 (0.72–0.89)
Hospital location (% of patients)			
Urban	60.2	69.2	1.30 (1.21–1.40)
Rural‡	39.8	30.8	
Primary diagnostic group (% of patients)¶			
Myomas	11.7	25.6	1.30 (1.16–1.45)
Vaginal prolapse	52.6	8.0	0.16 (0.14–0.18)
Endometriosis	7.9	24.8	1.50 (1.33–1.68)
Abnormal bleeding‖	12.3	14.6	0.83 (0.73–0.94)
Pain	2.3	6.2	1.43 (1.21–1.70)
Precancerous conditions**	4.0	3.1	0.55 (0.45–0.66)
Pelvic inflammatory disease	0.3	4.2	4.88 (3.68–6.49)
Salpingo-oophorectomy or oophorectomy (% of patients)	18.4	66.7	7.26 (6.76–7.79)

*Adjusted odds ratios were derived by multiple logistic regression, with each ratio adjusted for all the other characteristics shown. (P<0.001 by the Hosmer–Lemeshow goodness-of-fit test; C-statistic=0.86.) Hospital size was not a significant factor in this model. An adjusted odds ratio of less than 1 indicates that patients with the characteristic in question have a lower odds of undergoing laparoscopically assisted vaginal hysterectomy as compared with vaginal hysterectomy than those without the characteristic, and a ratio of more than 1 indicates that patients with the characteristic have a higher odds. P<0.001 for all comparisons between groups, except as noted.

†Adjusted odds ratio shown is per year of increasing age.

‡This was the comparison group in the calculation of the adjusted odds ratio.

§P=0.87 for the comparison between groups.

¶Adjusted odds ratios shown are for each patient with the diagnosis as compared with a patient without the diagnosis.

‖P=0.002 for the comparison between groups.

**These conditions included endometrial hyperplasia and cervical dysplasia.

dence interval, 0.12 to 0.32; P=0.67 by the Hosmer–Lemeshow goodness-of-fit test; C-statistic=0.83). Women with Medicare or Medicaid insurance were more likely to die than women with private or other insurance (odds ratio after adjustment for age and technique of hysterectomy, 2.9; 95 percent confidence interval, 1.6 to 5.4).

The median hospital charges for the three procedures differed significantly when all the cases were included in the analysis. The median charge for laparoscopically assisted vaginal hysterectomy was $8,108 (interquartile range, $6,074 to $10,404), as compared with $5,723 for abdominal hysterectomy (interquartile range, $4,245 to $7,797) and $5,049 for vaginal hysterectomy (interquartile range, $3,675 to $6,798).

DISCUSSION

In contrast to the increased rate of cholecystectomy associated with the introduction of laparoscopic cholecystectomy,[5,6] the rate of hysterectomy in Ohio decreased between 1988 and 1994 as laparoscopically assisted vaginal hysterectomy became more common. Our findings are consistent with other reports of a nationwide decrease in the rate of hysterectomy since 1975.[17,18] Although the rate of vaginal hysterectomy remained virtually unchanged, the rate of abdominal hysterectomy decreased more than the rate of laparoscopically assisted vaginal hysterectomy increased. Despite initial claims of a savings in cost with laparoscopically assisted vaginal hysterectomy,[2] we found, as have others,[3,4,19-21] that this technique was associated with higher charges than the other two techniques.

Although factors such as the type of health insurance, the location of the hospital, and the presence of a diagnosis related to pain, endometriosis, or pelvic inflammatory disease were significantly associated with the technique of hysterectomy chosen, other

TABLE 5. COMPLICATIONS ASSOCIATED WITH HYSTERECTOMIES FOR GYNECOLOGIC CONDITIONS OTHER THAN PREGNANCY OR CANCER, ACCORDING TO THE SURGICAL TECHNIQUE USED.*

TYPE OF COMPLICATION	ABDOMINAL HYSTERECTOMY (N=117,136)	VAGINAL HYSTERECTOMY (N=37,313)	LAPAROSCOPICALLY ASSISTED VAGINAL HYSTERECTOMY (N=7820)
		percent	
Cardiovascular	0.4	0.5	0.2
Respiratory	1.2	0.6	0.9
Gastrointestinal	1.9	0.6	1.3
Urinary tract	0.8	1.9	0.9
Bleeding	1.4	1.4	2.5
Accidental puncture	0.9	1.0	1.9
Evisceration	0.2	0.03	0.1
Postoperative infection	1.0	0.7	0.5
Unspecified	2.3	1.8	1.7
Total	9.1	7.8	8.8

*P<0.001 for all comparisons between groups. Some patients had more than one type of complication.

considerations that we could not study are also important. For example, the practice style and surgical experience of the physician have been identified as important variables influencing the decision to perform hysterectomy by a specific technique.[22,23]

Several limitations of our study should be acknowledged. The validity of the data base depends on complete and accurate reporting by the participating hospitals. It was impossible to verify the accuracy of the data independently. There was no unique ICD-9-CM code for laparoscopically assisted vaginal hysterectomy, and there may have been misclassification for that reason. The combination of the procedure codes for laparoscopy and hysterectomy was used as a proxy for laparoscopically assisted vaginal hysterectomy, but we had no way of determining what portion of the procedure was accomplished laparoscopically.

The data base includes only procedures performed on an inpatient basis. There is no centralized mechanism for reporting outpatient hysterectomy in Ohio, although the feasibility of performing vaginal hysterectomy for selected patients as outpatients under tightly controlled conditions has been reported.[4,24] Some such outpatients may have required admission to the hospital because of complications. These complications and the associated charges would tend to be overestimated by the lack of access to data on uncomplicated outpatient hysterectomies (which, presumably, would have been vaginal or laparoscopically assisted vaginal procedures, rather than abdominal ones). Given the small proportion of hysterectomies performed on an outpatient basis, however, their effect, if any, was probably small.

Our analysis probably underestimates the complications and mortality associated with hysterectomy. Data were not available on hospital readmissions, delayed postoperative complications, and deaths, except for deaths that occurred during the hospitalization for hysterectomy. The mortality rate of patients undergoing hysterectomy has been reported as 10.8 to 12 per 10,000 procedures, and the rate of rehospitalization after hysterectomy for benign gynecologic conditions as 2.3 percent.[25,26] Although we found that the mortality rates associated with vaginal and laparoscopically assisted vaginal hysterectomy were similar and that the rate associated with abdominal hysterectomy was lower, the rate of complications associated with laparoscopically assisted vaginal hysterectomy was similar to that associated with abdominal hysterectomy and higher than that associated with vaginal hysterectomy. Patients are selected for these procedures in relation to the risk of complications; abdominal hysterectomy, for example, is traditionally performed when surgery is likely to be difficult. The relative risk of complications associated with the various techniques requires further study.

The charges we studied represent overall hospital charges per admission. It was impossible to determine what specific elements accounted for the higher charges associated with laparoscopically assisted vaginal hysterectomy. Other studies have shown that although hospital stays are shorter, these higher charges are due to longer operating times and to the use of expensive disposable instruments.[3,4,19-21] Hospital stays have decreased dramatically for all types of admissions. However, in the case of surgical admissions, shorter stays have less effect on the total cost, since the costs for the first day (the day of surgery) are high in relation to the overall costs. Savings from shorter stays may be offset by increased intraoperative charges. Therefore, reducing intraoperative costs is particularly important for decreasing overall costs.

The distinction between costs and charges is crucial. Costs denote the cost to the provider of producing the care. There is considerable merit in reporting the actual costs of providing care rather than the charges for the care, but data on cost were not available to us. Hospital charges reflect the amounts billed and do not closely correlate with costs; charges do not include physicians' fees and are not necessarily the amounts reimbursed by third-party payers. To the hospital, charges are less important than costs, but charges are important to the insurer, since they are the amounts billed, and to the patient, who may be responsible for copayments based on those amounts. In addition, data on charges are useful in a relative sense rather than an absolute one.

We also could not assess the indirect costs of hysterectomy, such as the time needed to recover and the patient's time away from work. The return to full

activity depends on many factors other than the procedure itself, factors that include personal motivation and the amount of time a patient is permitted by her insurance to remain on disability. The higher hospital charges associated with laparoscopically assisted vaginal hysterectomy may be offset if recovery is faster. It is not known whether this is so.

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CORRECTION

Use of Alternative Techniques of Hysterectomy in Ohio, 1988–1994

Use of Alternative Techniques of Hysterectomy in Ohio, 1988–1994 . On page 488, the sentence that begins in line 10 of the right-hand column should have read, ``Although we found that the mortality rates associated with vaginal and laparoscopically assisted vaginal hysterectomy were similar *and lower than the rate associated with abdominal hysterectomy,*´´ not ``were similar *and that the rate associated with abdominal hysterectomy was lower,*´´ as printed. We regret the error.

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