

GYNECOLOGY

Use of other treatments before hysterectomy for benign conditions in a statewide hospital collaborative

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OBJECTIVE: We sought to analyze use of alternative treatments and pathology among women who underwent hysterectomy in the Michigan Surgical Quality Collaborative.

STUDY DESIGN: Perioperative hysterectomy data including demographics, preoperative alternative treatments, and pathology results were analyzed from 52 hospitals participating in the Michigan Surgical Quality Collaborative from Jan. 1 through Nov. 8, 2013. Women who underwent hysterectomy for benign indications including uterine fibroids, abnormal uterine bleeding (AUB), endometriosis, or pelvic pain were eligible. Pathology was classified as “supportive” when fibroids, endometriosis, endometrial hyperplasia, adenomyosis, adnexal pathology, or unexpected cancer were reported and “unsupportive” if these conditions were not reported. Multivariable analysis was done to determine independent associations with use of alternative treatment and unsupportive pathology.

RESULTS: Inclusion criteria were met by 56.2% ($n = 3397$) of those women who underwent hysterectomy ($n = 6042$). There was no documentation of alternative treatment prior to hysterectomy in 37.7% ($n = 1281$). Alternative treatment was more likely to be considered among women aged <40 years vs those aged 40-50 and >50 years (68% vs 62% vs 56%, $P < .001$) and among women with larger uteri. Unsupportive pathology was identified in 18.3% ($n = 621$). The rate of unsupportive pathology was higher among women age <40 years vs those aged 40-50 and >50 years (37.8% vs 12.0% vs 7.5%, $P < .001$), among women with an indication of endometriosis/pain vs uterine fibroids and/or AUB, and among women with smaller uteri.

CONCLUSION: This study provides evidence that alternatives to hysterectomy are underutilized in women undergoing hysterectomy for AUB, uterine fibroids, endometriosis, or pelvic pain. The rate of unsupportive pathology when hysterectomies were done for these indications was 18%.

Key words: alternative treatment, hysterectomy, pathology

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Hysterectomy is the most commonly performed major gynecologic surgery in the United States. Over 400,000 hysterectomies are performed annually in the United States and it is estimated that 1 in 3 women will have had a hysterectomy by age 60 years.¹⁻³ Of the benign hysterectomies

EDITORS' ★ CHOICE

performed in the United States, 68% are done for the primary indication of abnormal uterine bleeding (AUB), uterine leiomyomata, and endometriosis.³ The American Congress of Obstetricians and Gynecologists (ACOG)

supports the use of alternatives to hysterectomy including hormonal management, operative hysteroscopy, endometrial ablation, and use of the levonorgestrel intrauterine device (IUD) as primary management of these conditions in many cases.⁴⁻⁷ Although use of these alternative treatments has recently led to a decrease in the utilization of hysterectomy, assessing the appropriateness of hysterectomy continues to be a target for quality improvement.^{8,9} Applying appropriateness criteria to hysterectomy, overutilization has been estimated to range from 16-70%.¹⁰

Using data from the Michigan Surgical Quality Collaborative (MSQC), we sought to examine the medical records for documentation of alternative treatment prior to hysterectomy and whether the specimen pathology was supportive or unsupportive of the need for surgery.

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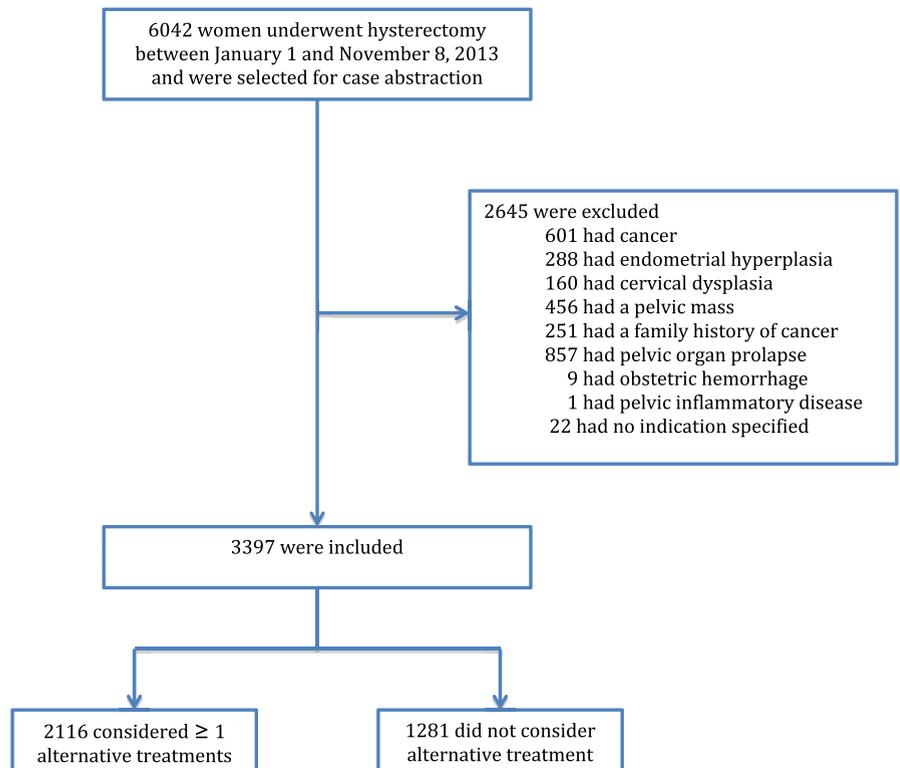
MATERIALS AND METHODS

This study was performed using a dataset from the MSQC. Funded by the Blue Cross and Blue Shield of Michigan/Blue Care Network, MSQC is a coalition of 52 academic and community hospitals across the state of Michigan that voluntarily participate in this statewide surgical quality improvement collaborative using an audit and feedback system as well as regular meetings and site visits. At each participating hospital, specially trained, dedicated nurse abstractors collect patient characteristics, intraoperative processes of care, and 30-day postoperative outcomes from general and vascular surgery and hysterectomy cases in accordance with established policies and procedures.¹¹ To reduce sampling error, a standardized data collection methodology is employed that uses only the first 25 cases of an 8-day cycle (alternating on different days of the week for each cycle). The clearly defined and standardized data collection methodology is routinely validated through scheduled site visits, conference calls, and internal audits. The collection of hysterectomy-specific data (eg, parity, indication for surgery, pathology) in MSQC began on Jan 1, 2013. This study met the criteria for “exempt” status by the University of Michigan Institutional Review Board-Medical (HUM00073978).

Inclusion criteria for this study were women aged >18 years; a preoperative indication of AUB, uterine fibroids, chronic pelvic pain, and/or endometriosis; and hysterectomy performed from Jan. 1, through Nov. 8, 2013. Exclusion criteria included a preoperative indication of high-grade cervical dysplasia, endometrial hyperplasia with atypia, any cancer, pelvic mass, family history of cancer, or pelvic organ prolapse. Abstracted data included demographics, preoperative health history, preoperative nonsurgical treatments, and pathology from the hysterectomy specimens. Access to outpatient data and/or office notes was not routinely available.

The primary outcome was the use of medical management or minor procedures as treatment alternatives prior to hysterectomy. Counseling regarding the use of hormonal therapy, a levonorgestrel IUD, pain management, endometrial

FIGURE 1
Participant flow diagram



Corona. Alternative treatments and specimen pathology in hysterectomy. *Am J Obstet Gynecol* 2014.

ablation, and/or hysteroscopy prior to hysterectomy was abstracted from the medical record. Information regarding uterine artery embolization was not documented in the database, and thus was not available for analysis. Each alternative treatment was counted as “considered” if documentation was available indicating that the patient declined, was unable to tolerate, or had an unsuccessful course of treatment.

Pathology reports were examined to determine if there were findings supporting the need for hysterectomy. Pathology findings were considered “supportive” if cervical or uterine fibroids, cervical dysplasia (cervical intraepithelial neoplasia [CIN] 2 or CIN 3), simple endometrial hyperplasia with atypia, complex endometrial hyperplasia with or without atypia, adenomyosis, endometriosis, benign pelvic masses, or cancer of any type were identified. In contrast, pathology was defined as “unsupportive” if the cervix, endometrium, and myometrium,

fallopian tubes, and ovaries were all described as “normal” or “unremarkable” or were not described. Pathology was also considered “unsupportive” if only the following were used to describe the cervix or endometrium: low-grade cervical dysplasia (CIN 1), cervicitis, cervical hyperplasia, nabothian cysts, cervical or endometrial polyps, inactive/atrophic endometrium, endometritis, metaplasia, or proliferative or secretory endometrium. Specimen weights (uterine or uterine + adnexa) were abstracted from the pathology report.

All statistical analyses were performed using software (STATA, version 13; College Station, TX). The demographics, medical comorbidities, surgical details, and pathology were compared among those women who did and did not have documentation of alternative treatment using χ^2 analysis and Student *t* tests. Women were divided into age groups of <40, 40-50, and >50 years and χ^2 analysis and analysis of variance were

TABLE 1
Demographics of women undergoing hysterectomy for benign conditions

Variable	Alternative treatment (n = 2116)	No alternative treatment (n = 1281)	P value	Aged <40 y n = 942	Aged 40-50 y n = 1800	Aged >50 y n = 655	P value
Age, y ^a	43.1 ± 7.8	44.9 ± 8.5	< .001				
Parity ^b	2 (1–3)	2 (1–3)	.87	2 (1–3)	2 (1–3)	2 (1–3)	.51
Race, % (n)			.01				< .001
White	72.7 (1539)	68.1 (873)		78.0 (735)	67.4 (1214)	70.7 (463)	
Black	20.7 (438)	23.5 (301)		16.6 (156)	24.6 (442)	21.5 (141)	
All other	6.6 (139)	8.4 (107)		5.4 (51)	8.0 (144)	7.8 (51)	
Ethnicity, % (n)			.50				.01
Non-Hispanic	90.6 (1917)	90.5 (1159)		88.0 (829)	91.3 (1643)	92.2 (604)	
Hispanic	1.7 (35)	2.2 (28)		2.9 (27)	1.5 (27)	1.4 (9)	
Unknown	7.8 (164)	7.3 (94)		9.1 (86)	7.2 (130)	6.4 (42)	
BMI ^a	30.9 ± 7.4	30.8 ± 8.1	.44	30.6 ± 7.9	30.8 ± 7.5	31.2 ± 8.5	.36
Smoker, % (n)	26.7 (566)	26.3 (337)	.78	37.5 (353)	23.8 (428)	18.6 (122)	< .001
COPD, % (n)	2.7 (58)	2.3 (30)	.48	2.4 (23)	2.3 (42)	3.5 (23)	.25
CAD, % (n)	1.2 (25)	1.8 (23)	.14	.74 (7)	1.3 (23)	2.8 (18)	.003
HTN, % (n)	22.7 (480)	26.5 (339)	.013	12.3 (116)	23.3 (419)	43.4 (284)	< .001
DVT, % (n)	2.2 (47)	3.1 (40)	.11	3.6 (34)	2.3 (41)	1.8 (12)	.05
Diabetes, % (n)	5.3 (111)	6.6 (85)	.09	3.7 (35)	5.6 (101)	9.2 (60)	< .001
Bleeding disorder, % (n)	1.1 (23)	0.7 (9)	.26	1.3 (12)	0.9 (16)	0.6 (4)	.38
Uterine weight, g ^a	230 ± 318.8 (n = 1159)	317.3 ± 502.9 (n = 705)	< .001	173.6 ± 280.3 (n = 556)	293 ± 447.5 (n = 1012)	328.1 ± 396.5 (n = 296)	< .001
Uterine + adnexa weight, g ^a	347.5 ± 497.2 (n = 547)	243 ± 347.2 (n = 914)	< .001	172.4 ± 261.3 (n = 359)	315.5 ± 433.1 (n = 153)	324.6 ± 471.8 (n = 40)	< .001
Alternative treatment, % (n)	—	—	—	67.6 (637)	61.9 (1115)	55.6 (364)	< .001

P values determined using *t* test for continuous variables and χ^2 for categorical variables.

BMI, body mass index; CAD, coronary artery disease; COPD, chronic obstructive pulmonary disease; DVT, deep venous thrombosis; HTN, hypertension.

^a Data given as mean ± SD; ^b Parity presented as median (interquartile range).

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used to make comparisons. A multivariable logistic regression model to evaluate what predicted use of alternative treatment was developed. Factors with a plausible relationship to the utilization of alternative treatment to hysterectomy or with a significant ($P < .05$) or marginally significant ($P < .15$) relationship in bivariate analysis were initially included in the model. Factors with no significant relationship were removed from the model unless there was a marginally significant relationship

and there was a plausible relationship to the outcome of interest. In a similar fashion, multivariable logistic regression was developed to analyze associations between clinical factors and the finding of unsupportive pathology. A significance level of alpha = .05 was used for all bivariate analyses.

RESULTS

From Jan. 1 through Nov. 8, 2013, data were available for 6042 hysterectomies performed at the 52 participating MSQC

hospitals. Inclusion criteria were met by 56.2% (n = 3397) (Figure 1). Demographics and medical comorbidities are presented in Table 1. The primary indications for the hysterectomy were endometriosis and/or chronic pelvic pain in 9.2% (n = 311), AUB and/or uterine fibroids in 49.1% (n = 1667), and a combination of endometriosis, chronic pain, AUB, and/or fibroids in 48.1% (n = 1419). Documentation of at least 1 alternative treatment was identified in 62.3% (n = 2116). Women with a

TABLE 2

Types of alternative treatments considered before hysterectomy by age groups

Type of alternative treatment, % (n)	Aged <40 y n = 637	Aged 40-50 y n = 1115	Aged >50 y n = 364	P value
Hormonal therapy	51.5 (328)	46.8 (522)	40.1 (146)	.002
Levonorgestrel IUD	12.7 (81)	12.4 (138)	9.3 (34)	.234
Endometrial ablation	44.1 (281)	48.3 (538)	31.6 (115)	< .001
Hysteroscopic surgery	32.7 (208)	33.3 (371)	44.8 (163)	< .001
Pain management	25.4 (162)	20.6 (230)	16.5 (60)	.003

P values determined using χ^2 . These options are not mutually exclusive so percentages will be >100%.

IUD, intrauterine device.

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preoperative indication of uterine fibroids/AUB were less likely to receive at least 1 alternative treatment than those women with endometriosis or a

combination of endometriosis/pain and uterine fibroids/AUB (58.2% vs 68.8% vs 65.7%, $P < .001$). Women who had documentation of any alternative

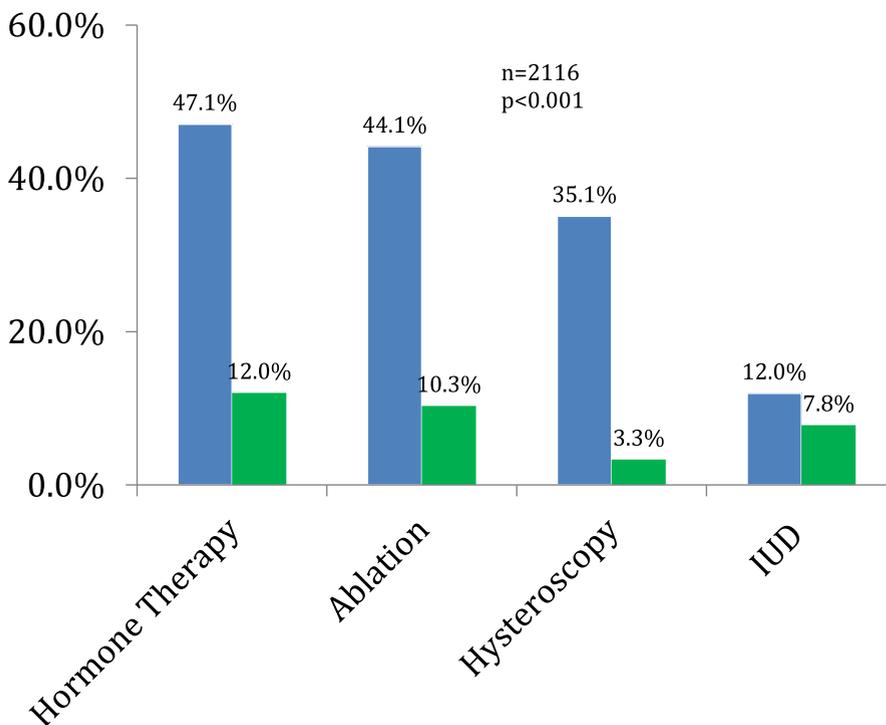
treatment prior to hysterectomy were younger than those who did not (43.1 ± 7.8 vs 44.9 ± 8.5 , $P < .001$). Hypertension was more common in those who did not use alternative treatment and white women were more likely than black women and women classified as neither white nor black to receive alternative treatment. Parity, body mass index, insurance, and other common medical comorbidities (pulmonary disease, coronary artery disease, diabetes, history of deep venous thrombosis) did not differ among the groups. Due to the difference in age observed among those with and without documentation of alternative treatment, we then analyzed cases by the following age groups: <40, 40-50, and >50 years (Table 1). Women aged <40 years were more likely to have documentation of alternative treatment, more likely to be Hispanic, more likely to smoke, more likely to have a history of deep venous thromboembolism, and less likely to have hypertension, diabetes, or coronary artery disease compared to women aged 40-50 or >50 years. The age groups did not differ in body mass index or in the rates of chronic obstructive pulmonary disease or bleeding disorders.

Alternative treatments documented in the database were also analyzed. These treatments included hormonal therapy, pain management, levonorgestrel IUD, hysteroscopy, and endometrial ablation. How frequently each alternative was considered among hysterectomy cases analyzed by age group is presented in Table 2. The frequency with which each alternative treatment was considered and then undertaken (eg, failed or not tolerable) is illustrated in Figure 2. The rate at which the levonorgestrel IUD was "considered" and attempted was much lower than that for hormonal therapy, hysteroscopy, or endometrial ablation. The levonorgestrel IUD was "considered" by 12% and only one third of those either failed or found it not tolerable. The total number of treatments considered among women of different age groups is provided in Figure 3. For purposes of analyses, alternative treatments were further categorized as "medical only" if documentation of any combination of the following was found: hormonal therapy,

FIGURE 2

Types of alternative treatments considered and declined

■ Considered ■ Declined

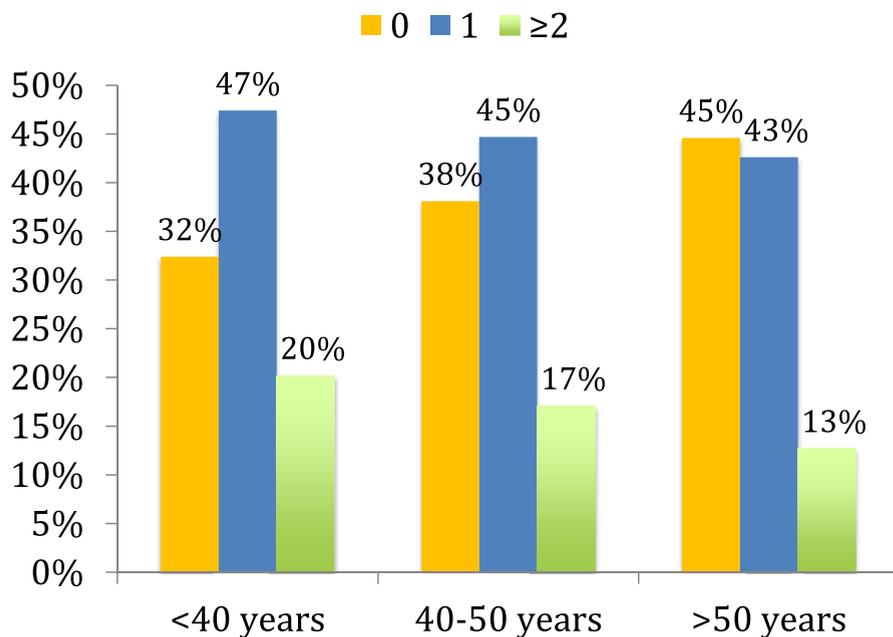


Types of alternative treatments considered (blue) and declined (green). Difference between those who considered and declined treatment is percentage of women who either failed or did not tolerate treatment.

IUD, intrauterine device.

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FIGURE 3
Number of alternative treatments considered by age



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pain management, and levonorgestrel IUD, and “minor surgery only” if only hysteroscopy and/or endometrial ablation were attempted (Figure 4).

A multivariable logistic regression model was created to determine independent predictors of utilization of alternative treatment (Table 3). Women aged 40-50 and >50 years (compared to those aged <40 years) and women with larger specimen weights were less likely

to “consider” a trial of alternative treatment. There was a trend not reaching statistical significance in which women with a history of deep venous thrombosis were less likely to “consider” a trial of alternative treatment.

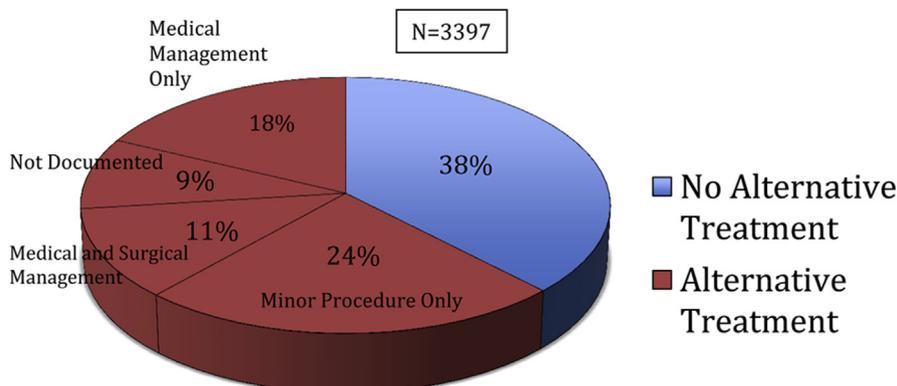
An analysis of unresponsive pathology was also undertaken. Among all women, the overall rate of unresponsive pathology was 18.3% (621/3397). Among women who did not consider alternative

treatment, pathology was unresponsive in 14.9% (191/1281). The frequency of unresponsive pathology was significantly higher among women aged <40 years when compared to those aged 40-50 years and those aged >50 years (37.8% vs 12% vs 7.5%, $P < .001$). The indication for surgery was also significantly associated with unresponsive pathology. The frequency of unresponsive pathology was highest among women with endometriosis or chronic pain, lowest among women with fibroids or AUB, and intermediate among women with a combination of endometriosis or pain and fibroids or AUB (40.4% vs 14.1% vs 20.4%, $P < .001$). Mean specimen weights were significantly different among women with supportive and unresponsive pathology (uterus only: 308 ± 448 g vs 116 ± 112 g, $P < .001$; and uterus + adnexa: 318 ± 292 g vs 124 ± 146 g, $P < .001$). The existence of severe adhesive disease did not significantly differ among those with unresponsive or supportive pathology (12.8% vs 14.2%, $P = .670$). When adjusted for age, preoperative indication, and specimen weight, the odds ratios for an unresponsive pathology remained significantly greater among women age <40 years compared to those age 40-50 and those >50 years and among those with a diagnosis of endometriosis or chronic pain compared with fibroids (Table 4).

COMMENT

In this analysis of 3397 women from 52 hospitals participating in a statewide quality collaborative, we found evidence that alternatives to hysterectomy appear to be underutilized among women undergoing hysterectomy for AUB, uterine fibroids, endometriosis, or pelvic pain. There was no documentation of any alternative treatment for 38% and only 12% were counseled regarding a levonorgestrel IUD. Among those who had alternative treatment, the majority had only 1 documented therapy, when >1 therapy may have resulted in adequate treatment without the need for hysterectomy. Furthermore, the rate of unresponsive pathology—18% for all women and 38% for women age <40 years—reflects the likelihood that a

FIGURE 4
Combinations of alternative treatments considered



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TABLE 3

Multivariable model to identify predictors associated with use of alternative treatment prior to hysterectomy

Model variable	Odds ratio	5% CI	95% CI	P value
Age				
<40 y	1.00			
40-50 y	0.83	0.69	0.98	.028
>50 y	0.63	0.51	0.78	< .001
Specimen weight (referent: each gram)	0.99	0.99	0.99	< .001
History of DVT (referent: none)				
Yes	0.71	0.46	1.10	.124

CI, confidence interval; DVT, deep venous thrombosis.

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significant number of women with AUB due to ovulatory dysfunction undergo hysterectomy. These patterns of practice are unlikely to be consistent with guidelines from the ACOG that recommends the use of medical rather than surgical therapy for primary management of AUB due to ovulatory dysfunction.⁴ As appropriateness of surgery becomes an increasingly important area of focus, justification for performing elective surgical procedures is also being emphasized. Adherence to management guidelines and documentation of conservative or nonsurgical treatment prior to hysterectomy will become imperative,

not only for improved outcomes, but also for reimbursement.

Over the past decade, there has been a substantial decline in the number of hysterectomies performed annually in the United States. Wright et al² analyzed annual inpatient hysterectomy rates in the United States and found a 36.4% decrease in number of hysterectomies performed in 2010 (433,621) as compared to 2002 (681,234). One explanation for these results is an increase in utilization of uterine-sparing alternatives to hysterectomy. However, despite the decrease in numbers of hysterectomies in the United States, appropriateness of hysterectomy is

still an area of concern. In 1 study of 497 hysterectomies in California, 76% of those done for endometriosis, AUB or chronic pelvic pain failed to meet ACOG criteria.⁸ Systems-based quality improvement measures to decrease inappropriate hysterectomy rates are effective. A recent study by Hullfish et al⁹ showed that after institutional implementation of a preoperative hysterectomy checklist for benign indications for hysterectomy, rates fell significantly and there was a 50% decrease in unsupportive pathology. Implementation of a checklist type of systems-based quality improvement for hysterectomy could help standardize treatment and ensure appropriate uterine-sparing management has been offered. The use of electronic medical records systems could potentially facilitate this type of standardization with relative ease.

The use of the levonorgestrel IUD is another area deserving of further study. The levonorgestrel IUD, a highly effective, cost-saving intervention for women with AUB and pelvic pain, was considered by only 12% and only one third of these women actually trialed the treatment. The levonorgestrel IUD can effectively manage AUB for most women and has been shown to improve control of back pain.^{12,13} Among women for whom the levonorgestrel IUD is effective in controlling bleeding, the improvements observed in health-related quality-of-life outcomes do not differ from hysterectomy.¹³ Furthermore, even though 42% of those treated with a levonorgestrel IUD will eventually undergo hysterectomy, 58% will not. Additionally, placement of a levonorgestrel IUD as a first step in management of AUB results in significant cost savings. Mean direct and indirect costs among women treated initially with the levonorgestrel IUD were \$3423 vs \$4937 for those treated initially with hysterectomy.^{12,13} Barriers to use in Michigan may be related to patient and/or physician reluctance, especially due to difficulties with coverage for patients or reimbursement for physicians. Identifying barriers to utilization will be critical if appropriate use of the levonorgestrel IUD is to become a viable,

TABLE 4

Multivariable model to identify predictors of unsupportive pathology

Model variable	Odds ratio	5% CI	95% CI	P value
Age				
<40 y	1.00			
40-50 y	0.28	0.23	0.35	< .001
>50 y	0.17	0.12	0.23	< .001
Indication				
Fibroids/abnormal uterine bleeding	1.00			
Endometriosis/chronic pelvic pain	1.65	1.21	2.26	.001
Endometriosis/chronic pelvic pain AND fibroids/abnormal uterine bleeding	1.04	0.84	1.29	.711
Specimen weight (referent: each gram)	0.99	0.99	0.99	< .001

CI, confidence interval.

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practical option for AUB. Nonetheless, the underutilization of the levonorgestrel IUD represents an important area for quality improvement and cost savings.

There are limitations and strengths to consider with this study. The information collected on alternative treatments prior to hysterectomy is abstracted from a patient's hospital record. This includes the preoperative history and physical, the operative note, and the discharge summary but does not always include information from clinic records. It is possible that there is additional information regarding alternative treatments that is not included in the hospital record, thereby underestimating the frequency with which some treatments are used. Nonetheless, this analysis provides evidence regarding clinical practice that is otherwise unavailable. The MSQC also provides a sample of the hysterectomies done at each institution, and there is potential for selection bias. To avoid this, the collaborative collects a robust number of cases from a large number of institutions and uses an algorithm to avoid bias. In addition, data regarding uterine artery embolization as an alternative to hysterectomy were not collected during the initial phase of the hysterectomy initiative within the collaborative. Access to preoperative imaging was not available. Thus, we are unable to stratify women based on size or location of fibroids, a factor that may have played some role in decision-making regarding appropriateness of hysterectomy. There are also hospital level factors (eg, electronic medical records vs paper charts) that

impact the presence or absence of documentation. At this point we are unable to provide an analysis of these factors. A great strength of this study is the chart abstraction process championed by surgical clinical quality reviewers who meet regularly for training and data quality review and who are routinely evaluated on interrater reliability.

In summary, the most common indication for hysterectomy in the MSQC, similar to that observed in national data, was AUB. The fact that 18% of women did not have pathology supportive of the need for hysterectomy and that the majority of women consider at most 1 alternative treatment prior to hysterectomy indicates that there are opportunities to decrease the utilization of hysterectomy. The levonorgestrel IUD, which is one of the most effective alternative treatments for AUB and pelvic pain, may be vastly underutilized. These are prime targets for quality improvement and cost savings by avoiding hysterectomy. ■

REFERENCES

1. Agency for Healthcare Research and Quality. Health services research on hysterectomy and alternatives. Available at: <http://archive.ahrq.gov/research/hysterec.htm>. Accessed Dec. 7, 2013.
2. Wright J, Herzog T, Tsui J, et al. Nationwide trends in the performance of inpatient hysterectomy in the United States. *Obstet Gynecol* 2013;122:233-41.
3. Wu JM, Wechter ME, Geller EJ, Nguyen TV, Visco AG. Hysterectomy rates in the United States. *Obstet Gynecol* 2007;110:1091-5.
4. ACOG Committee on Practice Bulletins-Gynecology. Management of abnormal uterine bleeding associated with ovulatory dysfunction. *ACOG Practice bulletin no. 136. Obstet Gynecol* 2013;122:176-85.
5. ACOG Committee on Practice Bulletins-Gynecology. Diagnosis of abnormal uterine bleeding in reproductive-aged women. *ACOG Practice bulletin no. 128. Obstet Gynecol* 2012;120:197-206.
6. American College of Obstetricians and Gynecologists. Management of endometriosis. *ACOG Practice bulletin no. 114. Obstet Gynecol* 2010;116:223-36.
7. American College of Obstetricians and Gynecologists. Alternatives to hysterectomy in the management of leiomyomas. *ACOG Practice bulletin. Obstet Gynecol* 2008;112:387-400.
8. Broder MS, Kanouse DE, Mittman BS, Bernstein SJ. The appropriateness of recommendations for hysterectomy. *Obstet Gynecol* 2000;95:199-205.
9. Hullfish KL, Henry E, Ferguson JE II. The effect of preoperative checklists on final histology and rates of hysterectomy for benign conditions. *Female Pelvic Med Reconstr Surg* 2012;18:143-7.
10. Lawson EH, Gibbons MM, Ingraham AM, Shekelle PG, Ko CY. Appropriateness criteria to assess variations in surgical procedure use in the United States. *Arch Surg* 2011;146:1433-40.
11. Campbell DA Jr, Kubus JJ, Henke PK, Hutton M, Engelsbe MJ. The Michigan Surgical Quality Collaborative: a legacy of Shukri Khuri. *Am J Surg* 2009;198(Suppl):S49-55.
12. Hurskainen R, Teperi J, Rissanen P, et al. Clinical outcomes and costs with the levonorgestrel-releasing intrauterine system or hysterectomy for treatment of menorrhagia. *JAMA* 2004;291:1456-63.
13. Heliövaara-Peippo S, Hurskainen R, Teperi J, et al. Quality of life and costs of levonorgestrel-releasing intrauterine system or hysterectomy in the treatment of menorrhagia: a 10-year randomized controlled trial. *Am J Obstet Gynecol* 2013;209:535.e1-14.