National trends of adnexal surgeries at the time of hysterectomy for benign indication, United States, 1998—2011

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OBJECTIVE: We sought to investigate the most recent national trends of bilateral salpingectomy (BS) and bilateral salpingo-oophorectomy (BSO) at the time of hysterectomy performed for benign indications.

STUDY DESIGN: We conducted a national cross-sectional analysis of all inpatient discharges for women aged ≥18 years who underwent a hysterectomy for benign indications from 1998 through 2011 using the largest publicly available all-payer inpatient database in the United States. We scanned *International Classification of Diseases, Ninth Revision* codes for an indication of specific bilateral adnexal surgeries, including BSO and BS. Joinpoint regression was used to characterize and estimate 14-year national trends in performing BSO and BS at the time of hysterectomy for benign indications, overall and in population subgroups.

RESULTS: During the study period, there were approximately 428,523 inpatient hysterectomy procedures performed annually for benign indications. Of these, >53% had no adnexal surgery performed during the same hospitalization, whereas 43.7% and 1.3% of those discharges had BSO and BS procedures, respectively. The rate of BSO was directly correlated with increasing age for patients <65 years.

Conversely, we observed an inverse relationship between BS and patient age, with the BS rate among women aged <25 years twice that of women aged ≥45 years. From 1998 through 2001, there was a 2.2% increase in the rate of BSO per year (95% confidence interval, 0.4—4.0); however, this was followed by a consistent 3.6% (95% confidence interval, −4.0 to −3.3) annual decline in the BSO rate, from 49.7% in 2001 to 33.4% in 2011. National rates of BS among women undergoing hysterectomy for benign indications increased significantly throughout the study period, with an estimated 8% annual increase from 1998 through 2008, followed by a sharp 24% increase annually during the last 4 years of the study period. The BS rate nearly quadrupled in 14 years.

CONCLUSION: The type of adnexal surgery performed concomitantly with hysterectomy for benign indications has undergone a significant shift since 2001. Significantly more BS and less BSO procedures are being performed among gynecologic surgeons in the United States.

Key words: adnexal surgery, benign indication, hysterectomy, trends, United States

Adnexal surgery at the time of hysterectomy performed for benign indications is a crucial component of preoperative patient counseling and decision making. These concurrent surgeries, which include oophorectomy or salpingectomy, are typically performed with the aim of reducing the possibility of ovarian cancer in the future. Ovarian cancer represents a challenging health problem with 225,500 new cases and 140,200 deaths worldwide in 2008.[1] So far there is no effective screening method for ovarian cancer. Despite surgical and medical advances, the prognosis associated with ovarian cancer is poor, with a 5-year overall survival of 45%.[2] Concomitant oophorectomy, while an important consideration for patients undergoing hysterectomy for benign indications, is usually a difficult decision because of other potential health consequences that result from a surgically induced menopause. Compared with

ovarian conservation, bilateral oophorectomy at the time of hysterectomy for benign disease is associated with a decreased risk of breast and ovarian cancer, but an increased risk of all-cause mortality, fatal and nonfatal coronary heart disease, and lung cancer.[3] Recently, studies have confirmed the belief that most pelvic serous carcinomas originate from the distal fallopian tube.[4-6] Therefore, there has been an increasing discussion among gynecologists on the need to prophylactically remove the fallopian tubes at the time of a hysterectomy. Despite the absence of any formal guidelines, this emerging evidence has prompted a change in surgical practice patterns regarding performance of salpingectomy, as opposed to oophorectomy, at the time of simple hysterectomy.[7,8]

Currently, there are no studies evaluating practice pattern changes among gynecologic surgeons in the United States. Therefore, the objective of this study is to investigate the most recent national trends of bilateral salpingectomy (BS) and bilateral salpingo-oophorectomy (BSO) performed at the time of a hysterectomy procedure for benign indications. We hypothesize that there has been a significant change in the rate of oophorectomy and salpingectomy in recent years due to this emerging evidence. Our secondary aim is to describe any differences in the rates and trends stratified by socioeconomic, demographic, and hospital characteristics.

Materials and Methods
Study design and data source
After obtaining exempt status from University of South Florida Institutional Review Board, a cross-sectional analysis of all inpatient hospital discharges from 1998 through 2011 was conducted using the National Inpatient Sample (NIS), the largest publicly available all-payer inpatient database in the United States, made available by the Healthcare and Cost Utilization Project (HCUP).[9] Each year, HCUP stratifies all nonfederal community hospitals from participating states by 5 major hospital characteristics: type of ownership, geographic region, rural/urban setting, number of beds, and

teaching status. HCUP then selects a 20% systematic random sample of hospitals, and all inpatient discharges from selected hospitals are included in the NIS.[9]

Study population and identification of adnexal surgeries
The study population consisted of inpatient discharges for women aged ≥18 years who underwent a hysterectomy for ≥1 of the following benign indications: uterine leiomyoma, carcinoma in situ of cervix uteri, uterine prolapse, hypertrophy of the uterus, endometrial hyperplasia, cervical dysplasia, dysmenorrhea, menstruation disorders, or other specified disorders of uterus. Discharges in which the woman underwent a radical abdominal or vaginal hysterectomy, a pelvic exenteration, or in which there was a diagnosis of a malignant neoplasm of the female reproductive system were excluded. We also excluded discharges in which obstetrical procedure was performed (Figure 1). All clinical diagnoses and surgical procedures were identified using *International Classification of Diseases, Ninth Revision, Clinical Modification (ICD-9-CM)* diagnosis and procedure codes. After identifying the study population, we scanned procedure codes in each woman's discharge record for an indication of specific bilateral adnexal surgeries, including BSO, BS without oophorectomy, and bilateral oophorectomy without salpingectomy. We also considered a small proportion of surgical procedures in which the remaining tube and/or ovary was removed. Unilateral procedures were not considered. Discharges for women without any indication of adnexal surgeries were classified as "no procedure." The complete list of *ICD-9-CM* codes used to characterize each indication and procedure is presented in the Appendix; Supplementary Table 1.

Sociodemographic, clinical, and hospital characteristics
Patient-level sociodemographic factors were extracted from the NIS databases. Patient age in years was classified into 6 categories: 18-24, 25-34, 35-44, 45-54,

55-64, and ≥65. Relative median household income (in quartiles) served as a proxy for each woman's socioeconomic status and was estimated by HCUP using the patient's ZIP code or residence. We grouped the primary payer for hospital admission into 3 categories: government (Medicare/Medicaid), private (commercial carrier, private health maintenance organization, and preferred provider organization), and other sources (eg, self-pay and charity). Clinical characteristics included the type of hysterectomy performed (laparoscopic, vaginal, or abdominal), the benign indication(s) for the hysterectomy, and whether the patient had a genetic susceptibility to or a personal or family history of breast or ovarian cancer. We also considered several hospital characteristics including US region (Northeast, Midwest, South, or West), location (urban vs rural), and teaching status (teaching, or a ratio of full-time equivalent interns and residents to nonnursing home beds ≥0.25, vs nonteaching).

Data analysis
We used descriptive statistics including frequencies, percentages, and rates to describe the national prevalence of hysterectomies due to benign indications, the relative rates of adnexal surgeries among those discharges, and the distribution of sociodemographic, clinical, and hospital characteristics across the study population. To compute national estimates, we weighted all analyses with discharge-level weights provided with the NIS databases.

Joinpoint regression was used to investigate and describe 14-year national trends in performing salpingectomy and oophorectomy at the time of hysterectomy for benign indications. Joinpoint regression first models annual trend data by fitting a straight line (ie, 0 joinpoints).[10] Then, a Monte Carlo permutation test is used to examine whether a model with 1 joinpoint is statistically significantly better than the null. If it is, the joinpoint is incorporated into the model. Additional joinpoints are considered in a similar manner until the optimal fitting model is determined. In