

Original Article

# Trends in Various Types of Surgery for Hysterectomy and Distribution by Patient Age, Surgeon Age, and Hospital Accreditation: 10-Year Population-Based Study in Taiwan

Ming-Ping Wu, MD, PhD, Kuan-Hui Huang, MD, Cheng-Yu Long, MD, PhD, Eing-Mei Tsai, MD, PhD<sup>\*1</sup>, and Chao-Hsiun Tang, PhD<sup>\*1</sup>

*From the the Division of Uroynecology and Pelvic Floor Reconstruction, Department of Obstetrics and Gynecology, Chi Mei Foundation Hospital, Tainan (Dr. Wu), College of Medicine, Taipei Medical University, Taipei (Dr. Wu), the Division of Gynecology, Department of Obstetrics and Gynecology, Chang Gung Memorial Hospital, Kaohsiung Medical Center, Chang Gung University College of Medicine, Kaohsiung (Dr. Huang), the Department of Obstetrics and Gynecology, Kaohsiung Municipal Hsiao-Kang Hospital, Kaohsiung Medical University, Kaohsiung (Dr. Long), the Department of Obstetrics and Gynecology, Kaohsiung Medical University Hospital, Kaohsiung Medical University, Kaohsiung (Dr. Tsai), and the School of Health Care Administration, Taipei Medical University, Taipei, and the Gynecology Research Center, Taipei Medical University Hospital, Taipei (Dr. Tang), Taiwan.*

**ABSTRACT** **Study Objective:** To estimate the trends in various types of hysterectomy (abdominal, vaginal, laparoscopic, and subtotal) and their distribution according to patient age, surgeon age, and hospital accreditation in Taiwan.

**Design:** Retrospective cohort study (Canadian Task Force classification II-2).

**Setting:** Population-based National Health Insurance (NHI) database.

**Patients:** Women with NHI in Taiwan undergoing various types of hysterectomy to treat noncancerous lesions.

**Interventions:** Data for this study were obtained from the Inpatient Expenditures by Admissions files of the NHI research database, released by the NHI program in Taiwan for 1996–2005.

**Measurements and Main Results:** A total of 234 939 women who underwent various types of hysterectomy were identified for analysis. The number of hysterectomies performed annually remained stationary during the 10-year study. Total abdominal hysterectomies decreased significantly (77.33% in 1996 vs 45.68% in 2005), laparoscopic hysterectomies increased significantly (5.20% vs 40.40%), vaginal hysterectomies decreased (14.70% vs 8.86%), and subtotal abdominal hysterectomies increased (2.76% vs 5.06%). Laparoscopic hysterectomy was more commonly performed in middle-aged women; vaginal hysterectomy was more common in older women; and subtotal abdominal hysterectomy was more common in younger women. Laparoscopic hysterectomy was performed more commonly in regional hospitals (33.11%), followed by medical centers (30.17%) and local hospitals (17.78%). Laparoscopic hysterectomy was performed more commonly in not-for-profit hospitals (30.25%), followed by private hospitals (29.32%) and government-owned hospitals (25.91%).

**Conclusion:** There has been considerable change in the types of surgery used for hysterectomy in Taiwan over the past 10 years. As a minimally invasive approach, laparoscopic hysterectomy represents a profound change for both patients and surgeons. *Journal of Minimally Invasive Gynecology* (2010) 17, 612–619 © 2010 AAGL. All rights reserved.

**Keywords:** Abdominal hysterectomy; Laparoscopic hysterectomy; National Health Insurance; National Health Insurance research database; Subtotal abdominal hysterectomy; Total abdominal hysterectomy; Vaginal hysterectomy

<sup>1</sup> Both authors contributed equally to this work.

The authors have no commercial, proprietary, or financial interest in the products or companies described in this article.

Corresponding authors: Chao-Hsiun Tang, PhD, School of Health Care Administration, Taipei Medical University, 250 Wu-Xin St, Taipei 110, Taiwan; Eing-Mei Tsai, MD, PhD, the Department of Obstetrics and Gynecology, Kaohsiung Medical University Hospital, Kaohsiung Medical University, 100 Shih-Chuan Road, San-Ming Dist., Kaohsiung, Taiwan.  
E-mail: chtang@tmu.edu.tw

Submitted February 23, 2010. Accepted for publication April 23, 2010.  
Available at [www.sciencedirect.com](http://www.sciencedirect.com) and [www.jmig.org](http://www.jmig.org)

Hysterectomy is the most common nonpregnancy-related gynecologic procedure performed in the United States and other countries [1]. The procedure is most commonly performed because of leiomyomas, also known as myomas, followed by menstrual disorders, endometriosis, uterine prolapse, and cancer of the cervix, uterus, or ovary [1]. The number of hysterectomies has not decreased despite a large number of medical and procedural alternatives [2]. A stable rate of 5.1 to 5.8 hysterectomies per 1000 civilian women residing in the United States has been reported [3]. The chance

of a woman undergoing hysterectomy by the age of 55 years is 20% in the United Kingdom, and 25% in Australia, and by the age of 60 years is 37% in the United States [4]. In Taiwan, the incidence of hysterectomy was approximately 268 to 303 per 100 000 women from 1996 to 2001 [5]. Elsewhere, the 2002 report from Organization for Economic Co-operation and Development showed that rates ranged from a low of 114 per 100 000 women in Mexico to a high of 526 in Norway [6].

The 3 approaches to hysterectomy in women with benign disease are abdominal hysterectomy (AH), vaginal hysterectomy (VH), and laparoscopic hysterectomy (LH). Abdominal hysterectomy is further subdivided into total abdominal hysterectomy (TAH) and subtotal or supracervical abdominal hysterectomy (SAH), with or without removal of the cervix. The subdivisions or modifications of LH include laparoscopic-assisted vaginal hysterectomy (LAVH), in which VH is assisted using laparoscopic procedures with or without uterine artery ligation; total laparoscopic hysterectomy (TLH), in which there is no vaginal component and the vaginal vault is sutured laparoscopically [7], and laparoscopic supracervical hysterectomy (LSH), in which the cervix and attached ligaments are left intact [8]. The variable laparoscopic preparation and modifications necessitated the definition of LH classification systems, wherein the report from the Classification Committee of the AAGL was of supreme importance [9].

A recent report on hysterectomy rates in the United States demonstrated that in 2003, AH was performed in 66.1% of cases, followed by VH in 21.8% of cases and the laparoscopic route in 11.8% [10]. The ratio of VH to AH varies from 1:3 to 1:4 or less, depending on the country, although this ratio is reversed among surgeons with more experience with vaginal approaches, with the rate of VH of 60% to 90% [4]. With the advance of operative laparoscopy, LH offers a minimally invasive approach for treatment of uterine lesions. It has been accepted worldwide, and has revolutionized the practice, but with some concerns about complications [1,11–14]. SAH was popular during the 1940s and 1950s but lost favor because of the risk of cervical stump cancer [15]. Total abdominal hysterectomy began to supplant SAH during the 1960s, and continued its dominance into the mid-1990s. Beginning in 1997, SAH was resurrected [15]. Preservation of the cervix remained a concern if there were further cancerous lesions or cyclic bleeding.

Traditionally, VH was the standard surgical treatment for uterovaginal prolapse. The adoption of VH varied, especially in the absence of uterine prolapse or the need for concomitant removal of the adenxa [16]. Recently, the concept of uterine preservation during surgery to repair prolapse or the use of adjuvant prostheses has been evolving; however, the effect on VH remains unknown [17,18]. Existing research indicates that both LH and VH have advantages over AH in terms of shorter hospital stay, fewer complications, and better surgical outcome [19]. In addition, a number of nonsurgical treatments or other surgical alternatives have been developed to treat uterine conditions other than cancer such as progesterone-releasing

intrauterine devices, myomectomy, uterine artery embolization, hysteroscopic removal of myomas, and endometrial ablation [2,10].

Previous research evaluating various approaches to hysterectomy has tended to focus on Western countries; to the best of our knowledge, no study has yet been performed in developing countries such as the Asian country of Taiwan. This study used a population-based National Health Insurance (NHI) claims database to estimate the trends in various surgical approaches to hysterectomy in Taiwan during the last 10 years, and examined the distribution of various approaches to hysterectomy according to patient age, surgeon age, and hospital accreditation and ownership.

## Materials and Methods

### *NHI Program in Taiwan*

The NHI program in Taiwan was put into effect in March 1995 and is characterized by its comprehensiveness and universalism. The financing sources of NHI primarily come from payroll taxes, with additional subsidies from general government revenues. The benefit package of the NHI includes preventive medicine, dental care, outpatient and inpatient services, prescription drugs, and Chinese herbal remedies. Of the total population of Taiwan, the NHI covered approximately 93.1% in 1996, and 98.0% in 2005. During 1996 and 2006, approximately 95.8% of Western medical hospitals were contracted with the Bureau of National Health Insurances [20].

### *Data Sources*

The data used in this study were obtained from the National Health Insurance Research Database (NHIRD). The NHIRD was established by the National Health Research Institute in cooperation with the National Health Insurance Bureau, with the objective of promoting research into current and emerging medical issues in Taiwan.

Three types of files from the NHIRD were used in the present study. First, inpatient expenditures by admission contains information on all NHI-reimbursed hospital discharges pertaining to inpatient characteristics; dates of admission and discharge; 1 major and 4 minor diagnosis codes (based on the *International Classification of Diseases, 9th rev, Clinical Modification [ICD-9-CM]*), and 1 major and 4 minor surgery codes; ownership of the medical facilities where the services were delivered; itemized expenditures for physician services, room services, and drugs and prescription services; and anonymous identifiers of the patient, the medical institution, and the physician delivering the services. Second, the registry of contracted medical facilities provides data about each medical institution's accreditation level and geographic location. Third, the registry of medical personnel provides data about each medical professional's date of birth, sex, type of profession, and specialty. Anonymous identifiers of the medical

institutions and the physicians were used to link the hospital discharge data to the registries of physicians and hospitals. Confidentiality assurances were addressed by abiding by the data regulations of the National Health Insurance Bureau, and institutional review board approval was waived.

### Study Participants

The study participants were female patients who underwent hysterectomy in Taiwan between January 1, 1996, and December 31, 2005. A total of 234 939 women who underwent various surgical types of hysterectomy were identified for analysis. These patients were further classified into 4 groups according to the type of surgery received: (1) SAH (*ICD-9-CM* code 68.3); (2) TAH (*ICD-9-CM* code 68.4); (3) LH before 2002 (*ICD-9-CM* codes 54.21 and 68.5; vaginal hysterectomy with laparoscopy) and LH after 2002 (*ICD-9-CM* code 68.51 (LSH could not be differentiated from other types of hysterectomy and, therefore, was categorized as LH); and (4) VH before 2002 (*ICD-9-CM* code 68.5 but not *ICD-9-CM* code 54.21 [laparoscopy]) and after 2002 (*ICD-9-CM* code 68.59).

### Definitions of Variables

Three categories of variables were used in the present study: patient age, hospital accreditation level and ownership, and surgeon age and sex. Patients were divided into ten 5-year age groups, from younger than 30 years to 70 years or older. In Taiwan, hospitals are accredited by the Taiwan Joint Commission on Hospital Accreditation, which is supervised by the Department of Health and classified into 3 levels based on healthcare quality and medical teaching ability, clinical capabilities, and bed capacity (medical centers, 500-bed minimum; regional hospitals, 250-bed minimum; and local hospitals, 20-bed minimum). Hospital ownership was classified as nonprofit hospitals, government-owned hospitals, or private for-profit hospitals. Surgeon age was divided into

eight 5-year age groups, from younger than 30 years to 60 years or older.

### Statistical Analysis

The  $\chi^2$  test was performed to examine differences in the distribution of the 4 types of hysterectomy surgery according to patient, surgeon, and hospital characteristics. Trend tests were performed to examine differences in trend by pairs between 2 surgical groups of the 4 groups. A p value of  $<.05$  was considered significant. All of the analyses were performed using commercially available software (SAS for Windows, version 9.01; SAS Institute, Inc., Cary, NC).

### Results

#### Overall Trends in Types of Surgery

The annual number of hysterectomies remained stable between 1996 and 2005, from a low of 20 080 in 1996 to a high of 26 291 in 2000, and a decrease to 22 106 in 2005 (Table 1). The most frequently performed type of hysterectomy during the 10-year study was TAH, with a total of 135 082 procedures, accounting for 57% of all cases, followed by 67 822 LH procedures (29%) and 24 303 VH procedures (10%).

The trends in various types of hysterectomy surgeries during 1996–2005 in Taiwan are shown in Fig. 1. There was a significant shift in use of various types of hysterectomy surgery during the study. Results from trend tests demonstrated that there were significant differences ( $p <.001$ ) in the trend for each pair of the 4 surgical groups. Use of TAH decreased by 35%, from 15 528 in 1996 to 10 099 in 2005; whereas LH demonstrated the highest increase in the number of procedures, from 1045 in 1996 to 8931 in 2005, indicating an average growth rate of 755%. During this time, the number of VH procedures decreased by 34%, and SAH procedures increased by 101%.

The information was further shown as figures for illuminating purposes, as follows.

Table 1  
Types of surgery for hysterectomy in Taiwan by year, 1996–2005\*

Year	Type of surgery				Total procedures
	TAH	LH	VH	SAH	
1996	15 528 (77.3)	1045 (5.2)	2952 (14.7)	555 (2.8)	20 080 (8.6)
1997	16 887 (77.9)	1246 (5.8)	2857 (13.2)	676 (3.1)	21 652 (9.2)
1998	17 491 (67.4)	5339 (20.6)	2373 (9.2)	740 (2.9)	25 943 (11.0)
1999	15 814 (60.3)	7385 (28.2)	2346 (8.9)	690 (2.6)	26 235 (11.2)
2000	14 252 (54.2)	8905 (33.9)	2518 (9.6)	616 (2.3)	26 291 (11.2)
2001	12 779 (51.4)	8931 (35.9)	2553 (10.3)	620 (2.5)	24 883 (10.6)
2002	11 887 (49.7)	8711 (36.4)	2499 (10.5)	823 (3.4)	23 920 (10.2)
2003	9775 (47.4)	7866 (38.2)	2114 (10.3)	848 (4.1)	20 603 (8.8)
2004	10 584 (45.6)	9463 (40.7)	2133 (9.2)	1046 (4.5)	23 226 (9.9)
2005	10 099 (45.7)	8931 (40.4)	1958 (8.9)	1118 (5.1)	22 106 (9.4)
1996–2005	135 082	67 822	24 303	7732	234 939 (100)

LH = laparoscopic-assisted hysterectomy; SAH = subtotal abdominal hysterectomy; TAH = total abdominal hysterectomy; VH = vaginal hysterectomy.

\* Data are given as No. (%).

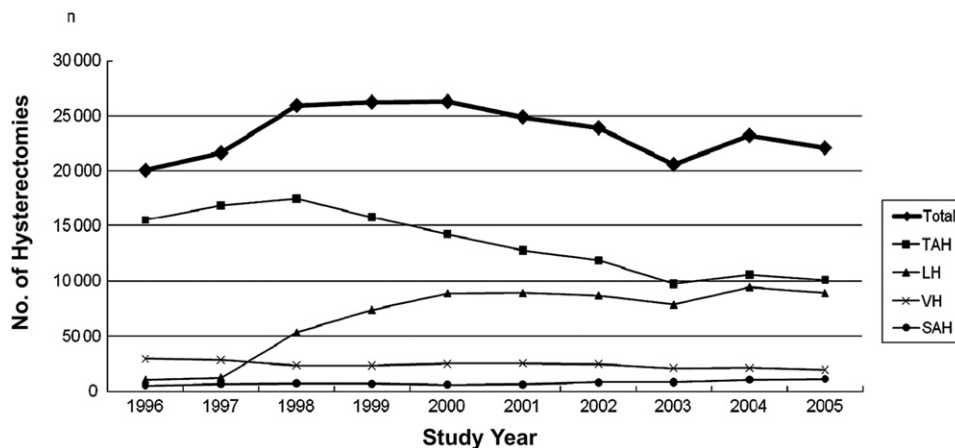


Fig. 1. Trends in various types of surgery for hysterectomy in Taiwan, 1996–2005. LH = laparoscopic hysterectomy; SAH = subtotal abdominal hysterectomy; TAH = total abdominal hysterectomy; VH = vaginal hysterectomy.

#### Types of Surgery in Patients of Different Ages

The incidence of hysterectomy was greatest in women aged 35 to 54 years, accounting for 78.5% of the total cases, with the highest number in the group aged 40 to 44 years (Fig. 2). There were significant differences in the distribution of various types of surgery for hysterectomy in patients of various age groups ( $p < .001$ ). Laparoscopic hysterectomy was more commonly performed in middle-aged women. More VH procedures were performed in patients in the older age groups ( $\geq 55$  years). The percentage of women undergoing SAH and TAH gradually increased with decreasing age, with a jump in the number of SAH surgeries in younger women ( $< 35$  years).

#### Types of Surgery According to Hospital Accreditation Levels and Ownership Type

Significant differences were demonstrated in the distribution of various types of hysterectomy according to hospital accreditation level ( $p < .001$ ) and type of hospital ownership ( $\chi^2$  test, 639.80;  $p < .001$ ) (Fig. 3). Medical centers and regional hospitals were 1.70 times (30.17% vs 17.78%) and 1.86 times (33.11% vs 17.78%) more likely to perform LH, respectively, compared with local hospitals. In contrast, local hospitals tended to perform 2.4 times more SAH procedures (5.5% vs 2.3%), 1.12 times more TAH procedures (64.4% vs 57.4%), and 1.22 times more VH procedures (12.34 vs 10.13%), compared with medical centers, and 1.6 times more SAH procedures (5.5% vs 3.5%), 1.20 times more TAH procedures (64.4% vs 53.8%), and 1.29 times more VH procedures (12.3 vs. 9.6%), compared with regional hospitals. In terms of hospital ownership, TAH and VH were slightly more common in government-owned vs nonprofit and private hospitals, whereas LH was more likely to be performed in nonprofit and private hospitals. The percentages of SAH procedures performed in government-owned and nonprofit hospitals were similar; however, percentages for both were 30% lower than for private hospitals.

#### Types of Surgery According to Surgeon Age

Significant differences were discernible in the distribution of incidences of the 4 types of hysterectomy surgery performed by surgeons in different age groups ( $p < .001$ ) (Fig. 4). Total abdominal hysterectomy and SAH were more commonly used by younger surgeons ( $< 30$  years) and older surgeons ( $> 60$  years) compared with surgeons in other age groups, whereas LH was more commonly performed by middle-aged surgeons. The distribution of VH remained similar among surgeons of different age groups, with a slightly lower percentage performed by surgeons older than 60 years.

#### Discussion

According to our population-based NHI database, this observational study demonstrated that there have been considerable changes in the surgical types of hysterectomy performed in Taiwan during the last 10 years. The annual numbers of hysterectomies remained stationary. The trends of different surgical types were as follows: LH increased by 755%, TAH decreased by 35%, VH decreased by 34%, and SAH increased by 101%. Studies from the United States demonstrated that LH accounted for 0.3% of all hysterectomies in 1990, 9.9% in 1997, and as many as 11.8% in 2003. The use of AH decreased from 73.6% in 1990 to 63% in 1997, and to 66.1% in 2003; VH rates did not change, remaining around 24% [1,10]. In the Danish National Population Register 11-year study ( $N = 67,096$ ), the incidence of hysterectomy performed to treat benign diseases has been stable, with a change in age distribution for all types of hysterectomy [21]. During the study period, the number of TAH procedures decreased by 38%, SAH procedures decreased sharply by 458%, and VH procedures increased by 107% [21]. In addition, a number of conservative alternative treatments have been developed for benign uterine conditions to replace hysterectomy as the first-line therapy; these include the levonorgestrel-releasing intrauterine device, hysteroscopic polyp or myoma removal, and

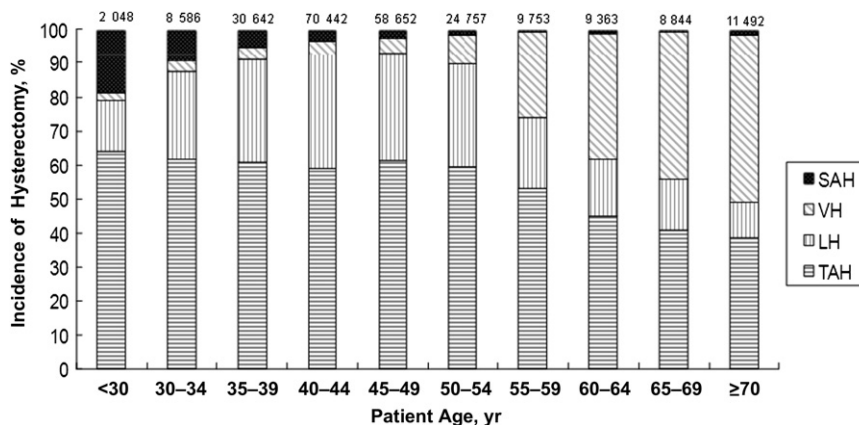


Fig. 2. Types of surgery for hysterectomy in Taiwan according to patient age, 1996–2005. LH = laparoscopic hysterectomy; SAH = subtotal abdominal hysterectomy; TAH = total abdominal hysterectomy; VH = vaginal hysterectomy.

endometrial ablation [2]. However, the influence of these procedures on hysterectomy rates remains uncertain unless long-term research studies are available to identify the effectiveness of various treatment methods [1].

Many factors might influence surgical treatment for uterine lesions and menstrual disorders, some of which are surgeon- or hospital-related, and others are patient-related. Our results indicated that the surgical types differed according to patient age and surgeon age. In the Danish study, the age distribution for all hysterectomies changed, from a maximum in the 36–45-year age group in 1988 to the 46- to 55-year age group in 1998 [21]. The changes in attitudes among patients and surgeons, however, were difficult to quantify. Moreover, information in the popular press about the various treatment methods and patients' rights has increased during the last decade. A change in patient attitudes caused by their reflection on information might also contribute to the change in percentages of the various types of hysterectomy [21]. Although a laparotomy may initially seem advantageous for the surgeon, the large abdominal incision, prolonged hospital stay, increased postoperative analgesic requirements, and increased morbidity are disadvantages for the patients [22]. Thus, such factors also influence the surgical choices of patients

and surgeons [23]. Our population-based study revealed that surgeons in medical centers and regional hospitals were more likely to perform LH than those in local hospitals. The difference in percentages of surgical types by hospital ownership and accreditation may be due to the training system. Several studies highlighted the effects of surgical experience and learning curve of surgeons on both costs and clinical outcomes of LH [24], and the choice of VH [16]. Therefore, the change in attitude and training system of surgeons might be important.

Our results supported the observation of the trend that the increasing use of LH has substituted for traditional TAH. Although the primary reason for performing LH instead of AH is to improve quality of life, only a few studies have used this as an outcome measure. In a review study by Kluivers et al [19], only 7 of 30 randomized clinical trials published between 1994 and 2004 reported on postoperative health or quality of life. Among them, 2 studies reported significantly improved quality of life in the first 6 weeks after LH compared with AH, using various validated quality-of-life questionnaires, whereas no differences were observed 1 year after surgery [25,26]. Therefore, the decision about the approach to hysterectomy should weigh the advantage of

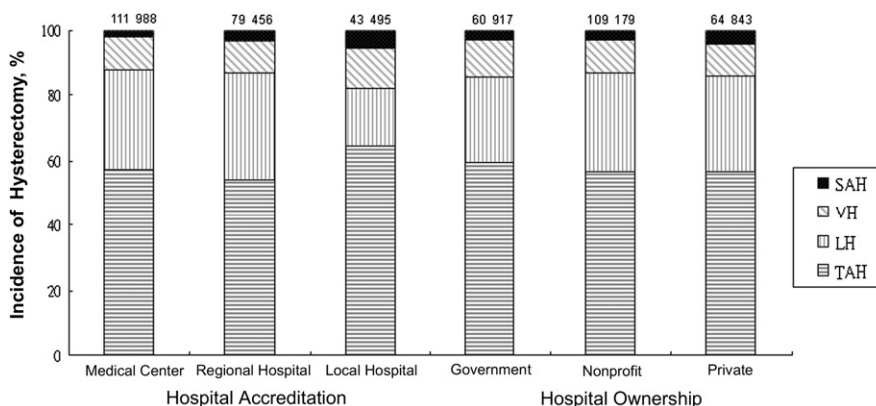


Fig. 3. Types of surgery for hysterectomy in Taiwan according to hospital accreditation and ownership, 1996–2005. LH = laparoscopic hysterectomy; SAH = subtotal abdominal hysterectomy; TAH = total abdominal hysterectomy; VH = vaginal hysterectomy.

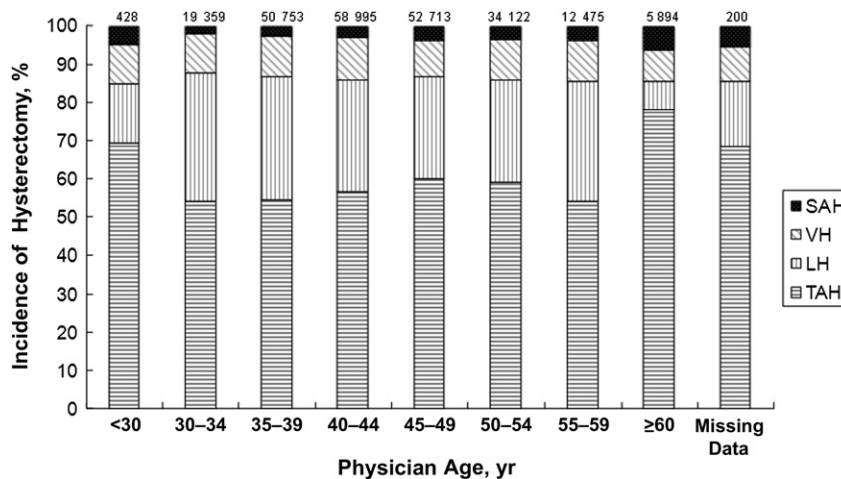


Fig. 4. Types of surgery for hysterectomy in Taiwan according to surgeon age, 1996–2005. LH = laparoscopic hysterectomy; SAH = subtotal abdominal hysterectomy; TAH = total abdominal hysterectomy; VH = vaginal hysterectomy.

improved quality of life and the risk of complications of LH [19].

To compare the advantages and disadvantages between LH and AH, the abdominal trial of the eVALuate Study revealed that LH was associated with a higher rate of major complications (11.1% vs 6.2%;  $p = .02$ ) and longer operating time (84 vs 50 minutes), but less pain (visual analog scale, 3.51 vs 3.88;  $p = .01$ ) and shorter hospital stay (3 vs 4 days), compared with AH [26]. The Cochrane Reviews demonstrated that the benefits of LH vs AH were less intraoperative blood loss and a smaller decrease in hemoglobin concentration, shorter hospital stay, speedier return to normal activities, fewer wound or abdominal wall infections, fewer unspecified infections, and fewer febrile episodes, but longer operating time and more urinary tract injuries [7]. To compare LH with VH, the vaginal trial of the eVALuate Study showed no evidence of differences in major complication rates between LH and VH (9.8% vs 9.5%;  $p = .92$ ) and other differences except for longer operating time (72 vs 39 minutes) and a higher rate of detection of unexpected disease (16.4% vs 4.8%;  $p < .01$ ) [26]. The Cochrane Reviews showed no evidence of benefits of LH vs VH in terms of hospital stay, return to normal activity, infections, and febrile episodes, but longer operating time compared with VH [7].

Despite advanced technology and accumulating experience, laparoscopic complications remain an issue of concern, especially when patients and surgeons enthusiastically accept LH as an efficacious and minimally invasive technique in the treatment of uterine lesions [14,27]. According to a literature review, the complication rate with LAVH was 2.24% (88 of 3928 procedures) in a Finnish nationwide study [11], and 6.59% (983 of 14911 procedures) according to an AAGL membership survey [12]. The present data could not report the nationwide complication rates for the procedures because of limitations of the data retrieval system. The hospital-based experience in Taiwan demonstrated that the major complication rate for LAVH was 1.66% (12 of 722) in Chang Gung

Memorial Hospital [13], and 1.79% (13 of 727) [28] and 0.77% (17 of 2174) [14] in the present series. The decreasing overall tendency toward complications during different intervals demonstrates that laparoscopic surgery is highly dependent on experience. The accumulation of surgical experience and preventive measures reduced the complication rate significantly [14].

Our results demonstrated an increase in SAH (101%), similar to the Danish National Patient Register (2001), which showed a dramatic increase in SAH during an 11-year study in Denmark [21]. The reasons for the increased frequency of SAH are unclear. Our results indicated that surgeons in local hospitals tend to perform more SAH procedures than those in regional hospitals and medical centers. This reflects that surgeon attitudes might be important in the choice of hysterectomy method [29]. There has been considerable discussion internationally in recent decades about the merits of SAH and whether removing the cervix at hysterectomy is necessary [30,31]. Since the 1970s, unsupported claims have been made to prospective patients that orgasm and sexual function would be enhanced with cervical preservation and, in turn, preservation of the nebulous “G spot,” which has never been objectively identified as an anatomical entity [15,17]. A questionnaire survey was conducted regarding surgeon selection of SAH vs TAH as the preferred operation for candidate patients; 19% of surveyed gynecologists always offered their patients a choice between SAH or TAH, 61% rarely or never offered a choice, and 88% considered the risk of cancer in the cervical stump to be small or negligible [29].

To compare the advantages and disadvantages between SAH and TAH, a randomized double-blind study by Thakar et al [32] showed that the SAH group had shorter hospitalization (5.2 vs 6 days) and decreased febrile morbidity (6% vs 19%), compared with TAH. However, 7% of the SAH group continued to have cyclic bleeding, and 2% developed subsequent cervical prolapse [32]. Another randomized comparison

by Learman et al [33] showed no differences in complications, degree of symptom improvement, or activity limitation between SAH and TAH during a 2-year follow-up. However, the SAH group had more hospital readmissions, although not statistically significant different [33]. Nevertheless, Gimbel et al [34] reported that significantly fewer women developed urinary incontinence in the TAH vs SAH group ( $p = .04$ ). In addition, 20% of the women in the SAH group had vaginal bleeding, and 2 required subsequent cervical stump removal [34].

Several recent publications failed to demonstrate the hypothesized advantages of SAH such as shorter operating time, fewer complications, lower institutional charges, enhanced sexual function [35], reduced postoperative incontinence and constipation, and measures of better sexual function [36]. The Cochrane Reviews reported shorter operating time and less blood loss in SAH compared with TAH, but there was no evidence of a difference in the odds of requiring transfusion. Subtotal abdominal hysterectomy was associated with less febrile morbidity (odds ratio [OR], 0.43; 95% confidence interval [CI], 0.25–0.75) but more ongoing cyclical vaginal bleeding 1 year after surgery (OR, 11.3; 95% CI, 4.1–31.2), compared with TAH [36]. There was no evidence of differences in rates of other complications, recovery from surgery, or readmission [36]. In sum, there are few data to suggest any real advantages of SAH over TAH; the basis for selection of SAH vs TAH has little in the way of factual data to support it, and it may actually present some significant disadvantages such as continued vaginal bleeding, cervical mucous discharge, cervical hypertrophy, cervical prolapse, and risk of cervical neoplasia [15].

In concordance with the report by Babalola et al [37], our study found that VH decreased by 34% during the 10 years. We postulate the possible reasons for the decrease in VH may be the decrease in incidence of uterine prolapse, the lack of exposure to vaginal surgery during gynecologic training [16], or the concept of uterine-preserving pelvic reconstructive surgery, such as sacral hysteropexy [18], uterosacral ligament fixation [38], sacrospinous ligament uterine suspension [39], and the tension-free vaginal mesh technique with procedural kits [17,40].

Nevertheless, the vaginal route is a safe, feasible, and patient-friendly method for performing hysterectomy. Limitations of VH include poor visualization of the operative field, concomitant management of adnexal disease, absence of prolapse, nulliparity, and history of endometriosis [16,41]. The Cochrane Reviews demonstrated that the benefits of VH vs AH were shorter duration of hospital stay (weighted mean difference, 1.0 day; 95% CI, 0.7–1.2 days), speedier return to normal activities (weighted mean difference, 9.5 days; 95% CI, 6.4–12.6 days), and fewer unspecified infections or febrile episodes (OR, 0.42; 95% CI, 0.21–0.83) [7]. Proponents and practitioners of VH have widened their indications and decreased the contraindications through liberal use of debulking, and performing oophorectomy, laparoscopic evaluation, and trial VH [41]. The changing trend may reflect the

different decision-making strategies, surgical attitude, and training system [4,16,42].

This observational study demonstrates the considerable shift in use of various types of surgical hysterectomy in Taiwan during the last 10 years. The annual total number of hysterectomies remained stationary. The number of LH procedures increased, primarily at the expense of TAH. Other changes in surgical types were the increase in VH procedures and the decrease in SAH procedures. Despite a large number of potential alternatives to hysterectomy for management of benign disease, hysterectomy rates have remained relatively stable in our study and others [3].

## References

1. Nationwide Inpatient Sample (NIS) of the Healthcare Cost and Utilization Project (HCUP). Available at: [www.hcupnet.ahrq.gov](http://www.hcupnet.ahrq.gov). Accessed date February, 01, 2010.
2. van Dongen H, van de Merwe AG, de Kroon CD, et al. The impact of alternative treatment for abnormal uterine bleeding on hysterectomy rates in a tertiary referral center. *J Minim Invasive Gynecol*. 2009;16:47–51.
3. Falcone T, Walters MD. Hysterectomy for benign disease. *Obstet Gynecol*. 2008;111:753–767.
4. Browne DS, Frazer MI. Hysterectomy revisited. *Aust N Z J Obstet Gynaecol*. 1991;31:148–152.
5. Hsu CY. Analysis on the causes and effects of hysterectomy in Taiwan. Grant report (DOH92-HP-1212) to the Bureau of Health Promotion, Department of Health, Taipei, Taiwan, 2005.
6. Organization for Economic Co-operation and Development. *OECD Health Data*. 2002.
7. Johnson N, Barlow D, Lethaby A, et al. Surgical approach to hysterectomy for benign gynaecological disease. *Cochrane Database Syst Rev*. 2006. CD003677.
8. Jenkins TR. Laparoscopic supracervical hysterectomy. *Am J Obstet Gynecol*. 2004;191:1875–1884.
9. Olive DL, Parker WH, Cooper JM, et al. Classification Committee of the American Association of Gynecologic Laparoscopists. The AAGL classification system for laparoscopic hysterectomy. *J Am Assoc Gynecol Laparosc*. 2000;7:9–15.
10. Wu JM, Wechter ME, Geller EJ, et al. Hysterectomy rates in the United States, 2003. *Obstet Gynecol*. 2007;110:1091–1095.
11. Harkki-Siren P, Sjoberg J, Kurki T. Major complications of laparoscopy: a follow-up Finnish study. *Obstet Gynecol*. 1999;94:94–98.
12. Hulka JF, Levy BS, Parker WH, et al. Laparoscopic-assisted vaginal hysterectomy: American Association of Gynecologic Laparoscopists 1995 membership survey. *J Am Assoc Gynecol Laparosc*. 1997;4:167–171.
13. Lee CL, Lai YM, Soong YK. Management of major complications in laparoscopically assisted vaginal hysterectomy. *J Formos Med Assoc*. 1998;97:139–142.
14. Tian YF, Lin YS, Lu CL, et al. Major complications of operative gynecologic laparoscopy in southern Taiwan: a follow-up study. *J Minim Invasive Gynecol*. 2007;14:284–292.
15. Baggish MS. Total and subtotal abdominal hysterectomy. *Best Pract Res Clin Obstet Gynaecol*. 2005;19:333–356.
16. Miskry T, Magos A. A national survey of senior trainees' surgical experience in hysterectomy and attitudes to the place of vaginal hysterectomy. *BJOG*. 2004;111:877–879.
17. Diwan A, Rardin CR, Kohli N. Uterine preservation during surgery for uterovaginal prolapse: a review. *Int Urogynecol J Pelvic Floor Dysfunct*. 2004;15:286–292.
18. Nygaard IE, McCreery R, Brubaker L, et al. Abdominal sacrocolpopexy: a comprehensive review. *Obstet Gynecol*. 2004;104:805–823.

19. Kluivers KB, Johnson NP, Chien P, et al. Comparison of laparoscopic and abdominal hysterectomy in terms of quality of life: a systematic review. *Eur J Obstet Gynecol Reprod Biol.* 2008;136:3–8.
20. Department of Health. Health and National Health Insurance Annual Statistics Information Services. <http://www.doh.gov.tw/statistic/index.htm>.
21. Gimbel H, Settnes A, Tabor A. Hysterectomy on benign indication in Denmark 1988–1998: a register based trend analysis. *Acta Obstet Gynecol Scand.* 2001;80:267–272.
22. Advincola AP, Song A. The role of robotic surgery in gynecology. *Curr Opin Obstet Gynecol.* 2007;19:331–336.
23. Domenighetti G, Luraschi P, Casabianca A, et al. Effect of information campaign by the mass media on hysterectomy rates. *Lancet.* 1988;2:1470–1473.
24. Chang WC, Li TC, Lin CC. The effect of physician experience on costs and clinical outcomes of laparoscopic-assisted vaginal hysterectomy: a multivariate analysis. *J Am Assoc Gynecol Laparosc.* 2003;10:356–359.
25. Ellstrom M, Ferraz-Nunes J, Hahlin M, et al. A randomized trial with a cost-consequence analysis after laparoscopic and abdominal hysterectomy. *Obstet Gynecol.* 1998;91:30–34.
26. Garry R, Fountain J, Mason S, et al. The eVALuate Study: two parallel randomised trials, one comparing laparoscopic with abdominal hysterectomy, the other comparing laparoscopic with vaginal hysterectomy. *BMJ.* 2004;328:129.
27. Hoffman CP, Kennedy J, Borschel L, et al. Laparoscopic hysterectomy: the Kaiser Permanente San Diego experience. *J Minim Invasive Gynecol.* 2005;12:16–24.
28. Wu MP, Lin YS, Chou CY. Major complications of operative gynecologic laparoscopy in southern Taiwan. *J Am Assoc Gynecol Laparosc.* 2001;8:61–67.
29. Zekam N, Oyelese Y, Goodwin K, et al. Total versus subtotal hysterectomy: a survey of gynecologists. *Obstet Gynecol.* 2003;102:301–305.
30. Gimbel H. Total or subtotal hysterectomy for benign uterine diseases? a meta-analysis. *Acta Obstet Gynecol Scand.* 2007;86:133–144.
31. Thakar R, Ayers S, Srivastava R, et al. Removing the cervix at hysterectomy: an unnecessary intervention? *Obstet Gynecol.* 2008;112:1262–1269.
32. Thakar R, Ayers S, Clarkson P, et al. Outcomes after total versus subtotal abdominal hysterectomy. *N Engl J Med.* 2002;347:1318–1325.
33. Learman LA, Summitt RL Jr, Varner RE, et al. A randomized comparison of total or supracervical hysterectomy: surgical complications and clinical outcomes. *Obstet Gynecol.* 2003;102:453–462.
34. Gimbel H, Zobbe V, Andersen BM, et al. Randomised controlled trial of total compared with subtotal hysterectomy with one-year follow up results. *BJOG.* 2003;110:1088–1098.
35. Scott JR, Sharp HT, Dodson MK, et al. Subtotal hysterectomy in modern gynecology: a decision analysis. *Am J Obstet Gynecol.* 1997;176:1186–1192.
36. Lethaby A, Ivanova V, Johnson NP. Total versus subtotal hysterectomy for benign gynaecological conditions. *Cochrane Database Syst Rev.* 2006. CD004993.
37. Babalola EO, Bharucha AE, Melton LJ III, et al. Utilization of surgical procedures for pelvic organ prolapse: a population-based study in Olmsted County, Minnesota, 1965–2002. *Int Urogynecol J Pelvic Floor Dysfunct.* 2008;19:1243–1250.
38. Diwan A, Rardin CR, Strohsnitter WC, et al. Laparoscopic uterosacral ligament uterine suspension compared with vaginal hysterectomy with vaginal vault suspension for uterovaginal prolapse. *Int Urogynecol J Pelvic Floor Dysfunct.* 2006;17:79–83.
39. Dietz V, de Jong J, Huisman M, et al. The effectiveness of the sacrospinous hysteropexy for the primary treatment of uterovaginal prolapse. *Int Urogynecol J Pelvic Floor Dysfunct.* 2007;18:1271–1276.
40. Wu MP. The use of prostheses in pelvic reconstructive surgery: joy or toy? *Taiwan J Obstet Gynecol.* 2008;47:151–156.
41. Sheth SS. Vaginal hysterectomy. *Best Pract Res Clin Obstet Gynaecol.* 2005;19:307–332.
42. Kovac SR. Decision-directed hysterectomy: a possible approach to improve medical and economic outcomes. *Int J Gynaecol Obstet.* 2000;71:159–169.
43. Advincola AP, Falcone T. Laparoscopic robotic gynecologic surgery. *Obstet Gynecol Clin North Am.* 2004;31:599–609.