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## Original Article

## Trends in inpatient female urinary incontinence surgery and costs in Taiwan, 1997–2011

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## ABSTRACT

**Objective:** To explore the factors influencing the trends in incidence and cost for female inpatient urinary incontinence (UI) surgery from 1997 to 2011.**Materials and methods:** A dataset of one million individuals was randomly drawn from the nationwide National Health Insurance claim database covering Taiwan's population from 1997 to 2011. The participants consisted of women aged  $\geq 20$  years who underwent UI surgery. We evaluated the trends of inpatient UI incidence, the medical cost of UI surgery, and the number of UI surgeries performed from 1997 to 2011.**Results:** A total of 1517 women underwent inpatient UI surgery from 1997 to 2011. Among these patients, the age-standardized incidence of UI surgery gradually trended upward from 1997 to 2010 but decreased in 2011. The trends were similar for medical costs, including annual inpatient cost, total medical service cost, and surgery fees. The annual inpatient cost had doubled in 2011 compared with that in 1997. However, physician visit fees, ward fees, and anesthesia fees started decreasing from 2005. The length of hospital stay and medication fees decreased during the 15-year study period. Surgeries by doctor specialty, hospital accreditation level, and patient age were stable for the study period.**Conclusion:** The trends of age-standardized incidence of UI surgery, annual inpatient cost, total inpatient cost, and surgery fees increased significantly from 1997 to 2009, and abruptly decreased from 2010 to 2011. Long-term observation evaluating the impact of Diagnosis-Related Group payment system in Taiwan is warranted to verify in the future.© 2017 Taiwan Association of Obstetrics & Gynecology. Publishing services by Elsevier B.V. This is an open access article under the CC BY-NC-ND license (<http://creativecommons.org/licenses/by-nc-nd/4.0/>).

## Introduction

Female urinary incontinence (UI) is a common, costly, and burdensome condition for women [1]. In Taiwan, 18.7% of women aged 20–59 years and 29.8% of women aged  $\geq 60$  years reported of having UI [2,3]. The prevalence of stress urinary incontinence (SUI) is 18.0% based on patient perceptions in Taiwan [4].

In the US, \$16 billion is spent annually for UI treatment, and approximately \$13.2 billion is attributable to SUI [5]. The costs continue to grow [6]. SUI is treated by strengthening the pelvic

muscles, implanting support devices, or surgery. When methods that are more conservative fail, women often choose surgical treatment for UI [1,7].

The costs of the UI management have increased continuously due to increasing numbers of surgeries, increasing prevalence of SUI, and the willingness of patients to improve their quality of life by undergoing surgery [6,8,9]. Anger et al [6] reported that the total medical cost of UI Medicare claims in the US almost doubled from 1992 to 1998. Furthermore, the incidence of inpatient surgery for UI also increased from 1979 to 2007 [1,10]. Few, if any, studies have reported incidence and cost trends of UI surgery in Taiwan. Thus, we determined female inpatient UI surgery and medical cost trends in a cohort of one million individuals randomly selected from a nationwide National Health Insurance claim database of 23 million beneficiaries from 1997 to 2011.

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## Materials and methods

The National Health Research Institute (NHRI) of Taiwan manages the medical benefits claims of the 23 million residents of Taiwan, covering more than 99% of the population. All inpatient and outpatient claims records paid by the National Health Insurance are registered in the National Health Insurance Research Database (NHIRD).

This retrospective, population-based cohort study used a subset of the NHIRD known as the Longitudinal Health Insurance Database (LHID) (current version, 2005), which is a sample of one million insured individuals and is randomly sampled from the NHRI registry in 2005 and contains the complete original medical claims from 1997 to 2011.

The study dataset includes no patient identification information, thereby making it unnecessary to obtain the approval of an institutional review board.

The study focused on the incidence of UI in women aged  $\geq 20$  years who underwent inpatient UI surgery from 1997 to 2011. Table 1 lists the International Classification of Disease, 9th Revision, Clinical Modification codes used to identify adult female UI patients. Women who underwent UI surgery were defined as those who had claims for UI-related surgical procedures (Table 1).

We analyzed demographic variables including the year the surgery was performed, patient age (stratified into three groups: 20–39 years, 40–59 years,  $\geq 60$  years), hospital accreditation level (medical center,  $\geq 500$  general beds, regional hospital, 250–499 beds, and district hospital,  $< 250$  beds), specialties of the doctors who performed the surgery (gynecologist, urologist), and length of hospital stay. The medical cost variables included annual inpatient cost, total inpatient cost, surgery fee, anesthesia fee, medication fee, physician consultation fee, and ward fee. The total inpatient cost included 13 fees covering the surgery, anesthesia, physician visit, ward, examination, radiological procedure, therapeutic management, blood plasma, special material, medication, pharmacy service, injection, and rehabilitation fees.

**Table 1**

ICD-9-CM codes identifying urinary incontinence and related procedure codes based on National Health Insurance claims in Taiwan.

ICD-9-CM code	
596.51	Hypertonicity of bladder
596.52	Low bladder compliance
596.59	Other functional disorder of bladder
599.8	Other specified disorders of urethra and urinary tract
599.81	Urethral hypermobility
599.82	Intrinsic (urethral) sphincter deficiency
599.83	Urethral instability
599.84	Other specified disorders of urethra
625.6	Stress incontinence, female
788.3	Urinary incontinence
788.30	Urinary incontinence unspecified
788.31	Urge incontinence
788.33	Mixed incontinence, male, female
788.34	Incontinence without sensory awareness
788.37	Continuous leakage
Urinary incontinence procedure	
77029B	Abdominal perineal urethral suspension
78028B	Transabdominal urinary incontinence surgery
78029B	Transvaginal urinary incontinence surgery (Kelly plication included)
78030B	Burch colposuspension
78037B	KELLY operation
78047B	(Retroperitoneoscopy) Laparoscopy, Bladder neck suspension
80007B	Colporrhaphy, anterior
80023B	Vesicovaginal fistula repair

ICD-9-CM = International Classification of Diseases, 9th Revision, Clinical Modification.

Gynecologists and urologists performed most of the UI surgeries. Nonetheless, we found three surgeries performed by doctors of other specialties (general surgeon and cardiovascular surgeon). Therefore, we classified the specialties into the two groups of gynecologists and urologists.

The continuous data were expressed as means and standard deviations (SDs), whereas the categorical data were expressed as numbers and percentages. A joinpoint regression analysis of trends was used to assess the trends in surgery incidence and medical costs from 1997 to 2011. All analyses were performed using the SAS software version 9.4 (SAS Institute, Cary, NC, USA).

## Results

We identified 1517 UI inpatient surgeries in the LHID 2005 database during the 15-year study period. The trend analyses showed that the incidence of UI surgery increased significantly during the 15-year study period. The age-standardized incidence of UI surgeries based on the World Health Organization standardized population in 2000 increased significantly from 1997 to 2011 ( $p < 0.001$ ). It increased from 13.82 per 100,000 women in 1997 to 23.68 per 100,000 women in 2010, and finally 20.48 per 100,000 women in 2011. From 1997 to 2009, the inpatient surgery rate increased significantly in the women  $\geq 60$  years age group ( $p = 0.004$ ). Moreover, the number of cases was more than doubled from 32.65 per 100,000 in 1997 to 68.35 per 100,000 in 2009. Since 2000, the inpatient surgery rate in the women  $\geq 60$  years age group surpassed that in the women of 40–59 years age group (Figure 1). The trends for the numbers of UI cases in the women of 20–39 years ( $p = 0.272$ ) and 40–59 years ( $p = 0.084$ ) age groups remained stable during the study period (see Table 2 & Figure 2).

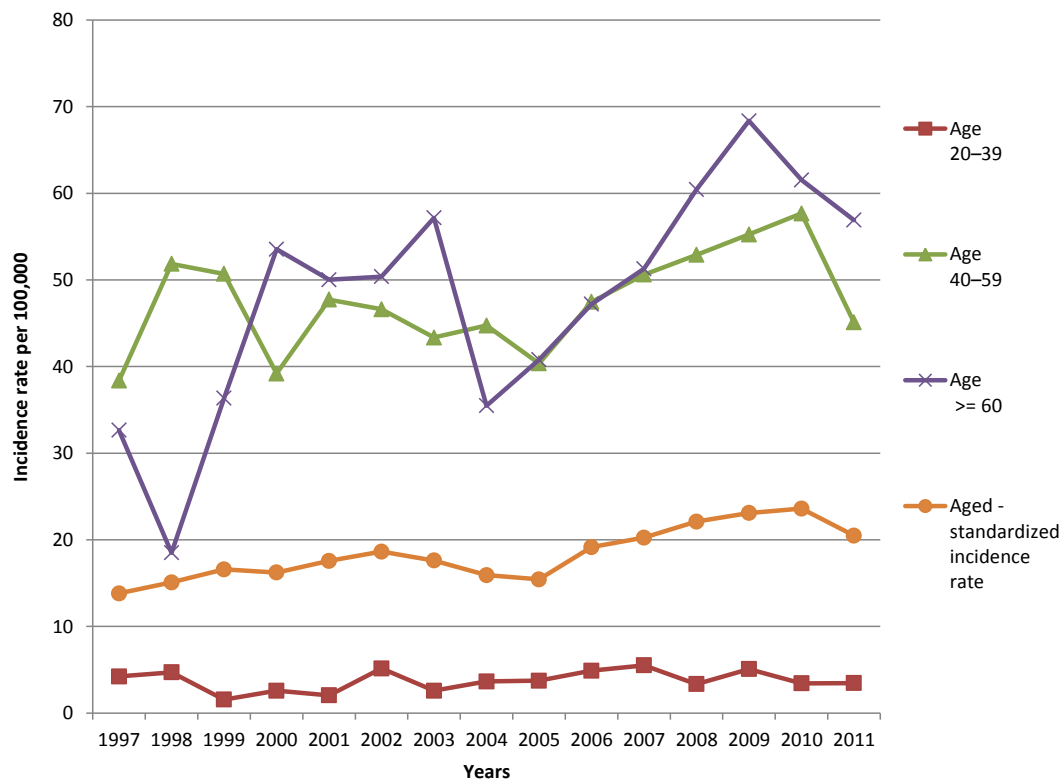
Table 2 compares the patient demographics and hospital characteristics for inpatient UI surgeries for 1997, 2005, 2010, and 2011 and shows the trends for medical fees from 1997 to 2011. The annual number of procedures increased from 60 in 1997 to 124 in 2011 in Taiwan. The overall average age at which UI surgery was performed was 54.39 years, and 946/1517 (62.36%) patients belonged to the 40–59 years age group. We found that the annual inpatient cost, total inpatient cost, and surgery fee increased from 1997 to 2010 but decreased in 2011 (see Table 2 & Figure 2), similar to the age-standardized incidence and the numbers of surgeries. Remarkably, since 1997, the annual inpatient cost increased by more than three times in 2010 and by over two times in 2011 ( $p = 0.026$ ).

In addition, the other medical fees, such as the ward fee ( $p = 0.012$ ), physician visit fee ( $p = 0.012$ ), and anesthesia fee ( $p < 0.001$ ), were stable before 2005 and subsequently decreased through 2011. The data showed a considerable decrease in the length of hospital stay with an average stay of 7.45 days in 1997, decreasing to only 3.47 days in 2011. We found a similar trend for medication fees.

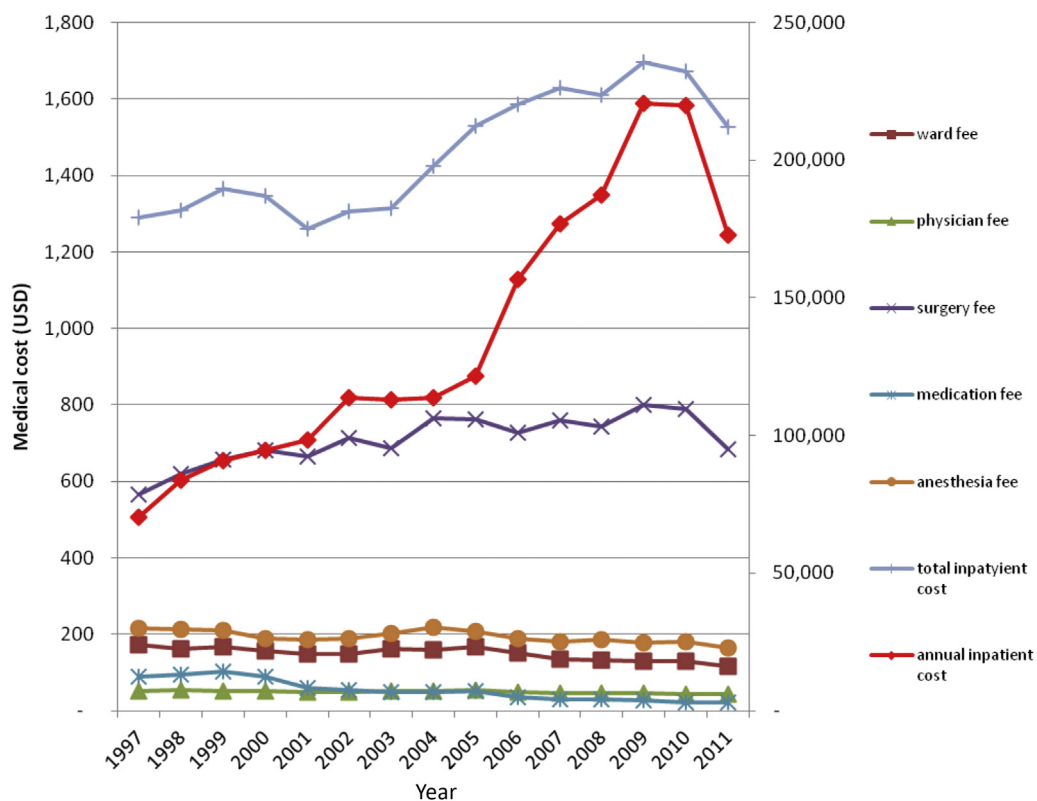
By specialty, gynecologists performed 80.6% (1223/1517) of the UI surgeries i.e., four times higher than those performed by urologists (19.35%, 294/1517) in 2011. These percentages remained stable from 1997 to 2011 ( $p = 0.157$ ). Slightly more than half (58.4%, 886/1517) of the inpatient UI surgeries were performed at medical centers from 1997 to 2011, and this trend was stable among the types of hospitals ( $p$  values for medical center = 0.685, regional hospital = 0.703, and district hospital = 0.351) (Table 2).

## Discussion

The age-standardized incidence of inpatient UI surgery sustainably increased from 13.82 per 100,000 women in 1997 to 20.48 per 100,000 women in 2011. Additionally, the incidence of UI surgery in the women  $\geq 60$  years age group doubled during the 15-year



**Figure 1.** Age-standardized incidence and crude incidence of female inpatient urinary incontinence surgery by age group per 100,000 women from 1997 to 2011 in Taiwan. <sup>a</sup>Trend test of age-standardized incidence rate,  $p < 0.001$ . <sup>b</sup>Trend test of 60 + age group,  $p < 0.001$ ; trend tests of the 20–39 and 40–59-year age groups, both  $p > 0.05$ .



**Figure 2.** Medical cost trends for urinary incontinence care from 1997 to 2011 in Taiwan. USD = US dollars.  $p$  value was obtained by joinpoint regression analysis of the trends. Annual inpatient cost is shown on the right vertical axis. <sup>#</sup> $p < 0.001$  for age-standardized incidence trend.  $p$  value of trend test of medical cost as Table 2.

**Table 2**

Patient demographics and hospital characteristics for inpatient urinary incontinence surgeries, 1997, 2005, 2010, 2011.

Characteristic	1997 n = 60	2005 n = 89	2010 n = 144	2011 n = 124	Total n = 1517	p <sup>a</sup>
Age	50.83 (10.8)	53.70 (11.9)	55.98 (10.9)	56.69 (11.9)	54.39 (11.5)	<0.001
Length of stay	7.45 (3.1)	4.69 (2.8)	3.68 (1.73)	3.48 (1.95)	4.65 (2.63)	<0.001
Age groups						
20–39	9 (15%)	7 (7.9%)	7 (4.9%)	7 (5.5%)	121 (8%)	0.272
40–59	40 (66.7%)	56 (62.9%)	90 (62.5%)	70 (55.5%)	938 (61.8%)	0.084
60 ≤	11 (18.3%)	26 (29.2%)	47 (32.6%)	49 (39.9%)	458 (30.2%)	0.004
Inpatient medical costs (USD)						
Ward fee	171.80 (69.5)	167.95 (166.43)	129.18 (59.9)	115.93 (62.4)	145.11 (86.1)	0.012
Physician visit fee	51.23 (18.9)	52.77 (35.76)	44.27 (16.6)	43.02 (19.0)	48.67 (23.5)	0.012
Medication fee	89.86 (49.9)	50.61 (59.9)	21.51 (15.2)	20.95 (16.9)	48.21 (49.3)	<0.001
Anesthesia fee	215.77 (109.3)	205.34 (120.9)	181.47 (76.2)	164.7 (72.6)	191.40 (99.1)	0.037
Surgical fee	566.55 (224.9)	701.89 (377.6)	789.68 (283.7)	683.89 (256.7)	721.17 (317.8)	<0.001
Total inpatient cost <sup>b</sup>	1288.9 (361.8)	1530.3 (884.7)	1528.20 (443.2)	1527.01 (439.6)	1491.05 (549.2)	0.023
Annual inpatient cost	70164	121483.38	220061	172847.4	2261908.5	0.026
Specialty						
Gynecologist	44 (73.3%)	71 (79.8%)	123 (85.4%)	100 (80.7%)	1192 (78.6%)	0.157
Urologist	16 (26.7%)	18 (20.2%)	21 (14.6%)	24 (19.3%)	325 (21.4%)	0.157
Hospital level						
Medical center	33 (55.0%)	47 (52.8%)	90 (62.5%)	61 (48.4%)	886 (58.4%)	0.658
Regional hospital	19 (31.7%)	35 (39.3%)	35 (24.3%)	49 (38.9%)	487 (32.1%)	0.703
District hospital	8 (13.3%)	7 (7.9%)	19 (13.2%)	16 (12.7%)	144 (9.5%)	0.351

Data are presented as % and standard deviations.

USD = US dollars.

<sup>a</sup> p value of trend test is obtained by joinpoint regression analysis.<sup>b</sup> Total inpatient cost included surgery fee, anesthesia fee, physician consultation fee, ward fee, examination fee, radiological procedure fee, therapeutic management fee, blood plasma fee, special material fee, medication fee, pharmacy service fee, injection fee, and rehabilitation.

study period. This trend is similar to trends reported in two studies in the US that focused on inpatient UI surgeries in women from 1979 to 2007. Wu et al [10] found that the total annual number and incidence of inpatient SUI surgeries performed increased from 1998 to 2007 in the US. Oliphant et al [1] reported trends in female SUI surgery in which the number of SUI inpatient procedures increased significantly from 1979 to 2004. These apparently broad trends could be due to the explosive growth of minimally invasive UI procedures that are easy to perform and the number of doctors who are able to perform them.

We found that the age-standardized incidence of inpatient UI surgery in Taiwan (15.09 per 100,000 women in 1997) was lower than that reported by Wu et al [10] (37.5 per 100,000 women in 1998) and Oliphant et al [1] (85 per 100,000 women) in the US. The incidences in 2004 were similar, with 15.93 per 100,000 women in Taiwan and 95.9 and 85 per 100,000 women in the US [1,10]. The incidences we have reported are much lower than those reported in the two US-based studies even in 2011 (20.48 per 100,000 women) for several possible reasons. First, Thom et al [11] found that the risk of SUI was significantly lower in Asian American (adjusted odds ratio = 0.54) women than in white women [11]. The white women have a higher prevalence of SUI than Asian American women. Additionally, the rates of SUI surgery were 10 per 10,000 women [95% confidence interval (CI)] among white women and 6 per 10,000 women (95% CI) among other races [12]. White women had a higher SUI prevalence and surgery rate than women of other races. Racial disparities in SUI surgery could exist [12]. All of the patients in our study were Taiwanese (yellow race); the percentages of white women in the studies of Wu et al [10] and Oliphant et al [1] in the US were 79.5% and 66.9%, respectively. With a lower SUI prevalence and 100% yellow race, the incidence of surgery in Taiwan was lower than that in the US. Second, the indications for UI surgery in Taiwan and the US might differ. Furthermore, the data source that we used in this study was a population-based, longitudinal cohort dataset of the same cohort. In contrast, the data source used in the US studies was an annual cross-sectional,

hospital-based sample of claim data. As a result, the UI incidence in Taiwan could be lower due to the data source.

The age-stratified proportion of UI procedures for women aged 60 ≤ years was 29.2% (26/89) in 2005 in Taiwan. This result is similar to that reported by Wu et al [10] for US women aged 65 ≤ years (28.5%, 27,074/94,910) in 2007 [10].

In our study, the percentage of UI procedures among women aged 20–59 years was 70.8% (63/89). Most of the procedures were attributable to women in the 40–59 years age group (62.9%, 56/89) in 2005.

The increasing incidence of inpatient UI surgery in women aged ≥60 years likely reflects both an aging population and an increase in women seeking care for incontinence [1]. Although the incidence of UI surgery was high in our study among the women aged ≥60 years and also in the studies reported by Wu et al [10] and Oliphant et al [1], advances in anesthesia and minimally invasive procedures have improved the safety of performing UI surgery in older patients and in medically complex conditions [1].

Oliphant et al [1] noted that there was a considerable decrease in the length of hospital stay from 10.5 ± 4.9 days in 1979 to 4.4 ± 2.2 days in 1991 and 2.3 ± 2.4 days in 2004 in the US. The pressure by insurance companies to reduce healthcare costs by decreasing the length of hospital stay, shifting care from the inpatient to outpatient setting, and the advent of new minimally invasive incontinence procedures have all likely contributed to the trend of decreasing the length of hospital stay [6,13]. Although a similar trend of decreasing length of hospital stay occurred in Taiwan, no shift of surgery from the inpatient to the outpatient setting has occurred. In Taiwan, medical costs are lower than those in the US and are reimbursed by the National Health Insurance Program. Patients pay 10% coinsurance for medical expenses. Thus, a trend to shift inpatient surgeries to the clinic setting has not developed.

Anger et al [6] reported a 15% decrease in per capita costs for UI treatment of women aged ≥ 65 years from 1992 to 1998 in the US, which mitigated the increase in total spending. However, in Taiwan, the trends in inpatient surgery incidence, total inpatient costs, and



surgery fee during the 15-year study period from 1997 to 2011 increased. These trending increases caused the growth in annual medical expenses, even though the trend in the hospital stay decreased.

In Taiwan, 78.6% (1192/1517) of inpatient surgeries were performed by gynecologists and 21.4% (325/1517) by urologists. Similarly, in Spain, Switzerland, and Germany, gynecologists performed a vast majority of UI procedures. In Germany, only 16% of UI surgeries were done by urologists [14,15].

Oliphant et al [1] reported that only 14.1% of UI surgeries were performed in hospitals with >500 beds in 2004. However, in Taiwan, 52.8% (47/89) of UI surgeries were performed in medical centers with  $\geq$ 500 beds in 2005, and this trend remained stable during the 15-year study period. In Taiwan, medical centers provide high-quality health services and UI-related services to women. We suspect that this impression of specialization, quality, and availability influenced patient behavior to seek UI surgery in medical centers in contrast to other hospital types.

From 2010 to 2011, the inpatient UI surgery incidence declined along with total inpatient costs, and surgery fees but with no significant decrease in the joinpoint regression trend. These trends appeared to be associated with the establishment of the Diagnosis-Related Group payment system in Taiwan (Tw-DRG), which was introduced in 2010. It included four DRGs for UI procedures. In a recent study on the effects of Tw-DRGs in a 3-year period (2009–2011) in a medical center-based dataset of type I tympanoplasty patients, the implementation of the DRG payments caused significantly reduced examination fees and slightly decreased medical costs in the most listed expenses [16]. This occurred without a significant difference in total medical costs (inpatient medical costs in our study), physician visit fees, ward fees, or medication fees [16]. A long-term observation evaluating the impact of Tw-DRG is needed to verify the results of these two studies in the broader medical community.

This study of the NHIRD dataset from the National Health Insurance program in Taiwan demonstrated trends in inpatient UI surgeries with an incidence that has increased from 13.82 to 23.68 per 100,000 women. Moreover, an increase in the rate of UI surgery was demonstrated in patients aged  $\geq$ 60 years. Additionally, in 2013, the National Health Insurance authorities added several UI procedures, and the reimbursement reduced out-of-pocket UI expenses potentially enhancing patient willingness to undergo UI surgery. Considering the growing proportion of elderly women in Taiwan, it is important to train sufficient numbers of gynecologists and urologists to care for women of all ages who experience UI.

Certain limitations should be considered in the application of the study results. First, in 2005 in Taiwan, only 22.2% women with UI had visited a doctor according to interviews of elderly women nationwide [2]. Second, with the use of National Health Insurance claim data in this study, the exact number of undiagnosed and untreated patients with UI is unknown, which could result in underestimation of UI incidence and surgery numbers. Third, the medical costs identified in this study do not include the out-of-pocket expenses for inpatient UI surgery, such as uncovered special materials fees and single or double room fees. Therefore, we may have underestimated the true costs and financial burden of inpatient UI surgery.

The main strength of our study is the 15-year longitudinal descriptive analysis of the trends in inpatient female UI surgery and costs in Taiwan in a nationwide cohort. We believe that the claims data is a reliable reflection of the female population because the coverage rate of the National Health Insurance Program extends to almost 99% of the population.

In conclusion, the findings provide nationwide population-based observations that show considerable changes in inpatient female UI surgery over the 15-year study period. The trends of age-standardized incidence of UI surgery, annual inpatient costs, total inpatient costs, and surgery fees increased significantly from 1997 to 2009, and abruptly decreased from 2010 to 2011. The length of hospital stay and medication fees decreased during the 15-year study period. A long-term observation evaluating the impact of Tw-DRG is needed to verify in the future.

## Conflicts of interest

The authors have no conflicts of interest relevant to this article.

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