

Prevalence of lower urinary tract symptoms among female elementary school teachers in Taipei

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Abstract The aim of this study was to estimate the prevalence of lower urinary tract symptoms (LUTS) among female elementary school teachers in Taipei. A total of 520 self-administered surveys were distributed to 26 elementary schools in Taipei City. Data analyses were based on 445 usable surveys. The prevalence rates for different types of

LUTS ranged from 9.9 to 44.5%. The prevalence of urinary incontinence (UI; 26.7%) and nocturia (16.0%) fell within the prevalence estimates of these LUTS in North American and European women. Employed women in this study were more likely to experience LUTS than women in previous epidemiological or community studies. This study extended research on UI into other LUTS among employed women in Asia. Study results suggest that the working environment may affect LUTS in female elementary school teachers. This preliminary study is important for developing future behavioral interventions for female LUTS in the workplace.

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Introduction

For more than 40 years, research on lower urinary tract symptoms (LUTS) has focused on urinary incontinence (UI) for institutionalized adults and women under treatment with overactive bladder and stress UI [1]. In the past 10 years, interest in other LUTS has mounted, and efforts to develop behavioral and pharmacologic interventions for them are evident in the literature [2]. Notably lacking are international studies on LUTS, particularly studies of the prevalence of LUTS and of LUTS in women in Asia.

LUTS can be mainly divided into three main symptom groups—storage (increased daytime urinary frequency, nocturia, urgency, and UI), voiding (slow stream, splitting or spraying, intermittent stream, hesitancy, straining, and terminal dribble), and post micturition (feeling of incomplete emptying and post micturition dribble) [3]. These symptoms have widespread human and social implications

and cause physical discomfort, shame, and loss of self-confidence that negatively affect women's quality of life (QOL) [2, 4, 5].

LUTS are health concerns of particular relevance to women because the prevalence rates are higher than the rates for men [6–8]. Studies conducted to investigate female LUTS showed that the overall prevalence rates ranged from 28 to 69% [4–7, 9, 10]. Study results demonstrated that storage symptoms were more prevalent than voiding or post micturition symptoms [4–7, 9–11].

The literature on LUTS is limited with most focusing on UI or nocturia only. UI has been reported as a prevalent cross-cultural condition among women. The prevalence of UI was estimated to be 20–30% for young adult women, 30–40% for middle-aged women, and 30–50% for elderly women [8]. Typical ranges for nocturia (two or more voidings per night) are 5–15% and 20–30% for women 20–50 and 50–70 years of age, respectively [12].

Very little research has addressed the role that the workplace has in women's experiences with LUTS, including UI, although research from the USA indicates that this is an important area of investigation [13, 14]. A few studies have demonstrated that the prevalence of UI is around 20–40% for employed women; but they are silent on other LUTS [13–15]. Studies investigating the prevalence of other LUTS among employed women were not found.

In Taiwan, about half of the adult women are employed, and about 70% of women 25 to 44 years of age are working [16]. Traditionally, women bear more responsibility and obligation for taking care of the elderly and children in their family than men do [17]. Employed women are performing more than one role at a time, and these multiple roles may reduce the time they allot for personal health promotion. Also, employed women are affected by the work environment, which may include inadequacy of bathroom breaks or toilet facilities [13, 14]. Infrequent voiders—the so-called “nurse's bladder” and “teacher's bladder”—who have developed the habits of holding their urine for prolonged periods of time and voiding only a few times each day are predisposed to stasis, voiding dysfunction, and infection [18].

Lack of knowledge about treatment and low expectations of benefit from treatment is common among women with LUTS [19]. Only one fourth to one third of women with LUTS seek help from health professionals [20, 21]. Instead of seeking professional help, many women manage LUTS with self-care strategies [14]. Some strategies used by women, however, could have adverse effects. For example, restricting fluids may lead to dehydration. Frequent voiding, another strategy, combined with a low urine output may result in a reduction in the bladder's functional capacity, urinary tract infections (UTI), and pathogenesis [22, 23].

The aim of this study was to estimate the prevalence of LUTS among female elementary school teachers in Taipei. Prevalence studies for LUTS conducted outside of Europe and North America are few. Thus, this research is needed before research on behavioral interventions refined in the West can be considered for women in Asia.

Materials and methods

There were more than 9,000 female elementary school teachers in more than 150 elementary schools in Taipei City in 2003 [24]. One unrelated study conducted among the elementary school teachers in Taipei City had a non-response rate of 15% that included less than 5% unusable questionnaires [25]. The study reported here used a representative sample in which a formula ($n_0=4pq/d^2$) was used to calculate the required sample size (n_0). In the formula, the probability of the presence of LUTS (p), the probability of the absence of LUTS ($q=1-p$), and the margin of error (d) were represented. Another formula [$n_1=n_0/1+(n_0/N)$] was used to adjust the value of the required sample size for the finite population (N) [26].

For purposes of computing the sample size, the working assumptions were: (a) the prevalence of LUTS is 40% [6, 7, 10], (b) the margin of error for the estimate of prevalence is 2.5 percentage points or less [26], (c) the expected response rate for this study is 85% [25], and (d) approximately 10% of the completed questionnaires will not be usable [25]. Based on these assumptions, a sample size of 482 teachers was needed to provide the estimate of prevalence of LUTS in these women. A more conservative estimate for the required sample size was 502 teachers, based on the assumption of a 50% prevalence rate of LUTS and the other assumptions remaining the same. When the prevalence rate of LUTS was 60%, the required sample size was the same as the required sample size under the assumption that the prevalence rate of LUTS was 40%.

A systematic sampling method with probability proportional to size (pps) was used to select the sample of elementary schools from all of the elementary schools in Taipei City. In each of the selected elementary schools, a simple random sample of teachers was used to achieve the required sample size of 502 teachers. The first-stage sampling method gave large schools higher probabilities of being selected than small schools. However, the next stage of sampling compensated for this by assigning a smaller probability of selection to teachers employed in larger schools. Thus, the overall probability of selection was the same for all teachers across all schools. This special type of sampling method, equal probability of selection method (epsem), guarantees that specific population elements have an equal selection probability. This sampling

method usually results in estimates of population characteristics with a smaller sampling error than those obtained from unequal probability sampling. The design also leads to self-weighting samples and an efficient estimation of population mean by the sample mean [27].

The development of the Taiwan teacher bladder survey (TTBS)

The Taiwan teacher bladder survey (TTBS), a paper-and-pencil survey, was used to collect data for this study because no instruments designed to assess LUTS for women in employment settings were found. Available generic instruments developed to assess LUTS are not sensitive to factors related to LUTS in work environments [4–6, 11, 28]. Several questionnaires developed to assess LUTS lacked estimates of reliability and validity [4, 6, 11]. Although the Bristol female lower urinary tract symptoms (BFLUTS) questionnaire is a valid instrument, post micturition symptoms and items about the role of the workplace are not included in the BFLUTS questionnaire [28]. The North Carolina teacher bladder survey (NC TBS) was the only instrument that covered the majority of the constructs needed as a basis for developing the TTBS [29].

The NC TBS was developed to estimate the presence of LUTS among public school teachers in North Carolina. The NC TBS was refined in a series of studies of content validity, pilot testing ($n=31$), and test–retest reliability testing ($n=44$). Content validity of the NC TBS was established using the index of content validity (CVI) with a CVI of 0.88 obtained. Modifications to the NC TBS were made based on the suggestions provided by the participants in the pilot study. When the NC TBS was completed by a sample of North Carolina school teachers ($n=44$) on two occasions, separated by 1 week, the overall percent agreement was 85%, which is an adequate test–retest reliability [29].

The content of the TTBS included 80 items to collect information about LUTS plus UTI (40 items), individual characteristics (13 items), personal habits (17 items), work-related factors (8 items), and one item each about teachers' help-seeking behavior and degree of bother resulting from LUTS. One question about teachers' interest in participating in lectures about continence health was placed at the end of the survey [29]. Information related to UTI was collected because several LUTS such as UI, frequency, and urgency are associated with UTI. Items related to individual characteristics, personal habits, and work-related factors were included to investigate multiple factors related to LUTS but are beyond the scope of this paper.

The process of instrument generation and psychometric testing for the TTBS involved seven steps: (a) development of the TTBS; (b) instrument translation; (c) content validity testing; (d) human subjects (ethical) review; (e) pilot

testing; (f) test–retest reliability testing; and (g) testing the internal consistency of the LUTS construct. After instrument generation and translations, content validity of the TTBS was assessed and found to be satisfactory. Institutional review board (IRB) approval from the University of North Carolina at Chapel Hill IRB was obtained for psychometric testing of the TTBS. Modifications were made based on the suggestions provided by the participants in the pilot study ($n=30$). For test–retest reliability testing ($n=30$), correlation values for the majority of the items evaluated exceeded the criterion set at 0.70 and were judged adequate. To achieve a better understanding of the item with a test–retest reliability value less than 0.70 (which was the item about the availability of relief persons at schools), an item about the need for relief persons at schools was added. Internal consistency for the construct LUTS was 0.71 [29].

Measurement

The prevalence rates of the LUTS such as UI, increased daytime urinary frequency, urgency, nocturia, intermittent stream, hesitancy, and a feeling of incomplete emptying were the foci of this study because these symptoms are the prevalent LUTS among women [4–7, 9–11]. Information related to weak urinary stream was collected also because it was reported as a common symptom in one study [5].

The presence of LUTS was defined as the self-reported occurrence during the past 12 months of UI, increased daytime urinary frequency, urgency, nocturia, intermittent stream, weak urinary stream, hesitancy, or a feeling of incomplete emptying. The majority of the definitions for individual LUTS used in this study were based on the standardization report proposed by the International Continence Society [3]; *UI* was defined as any involuntary leakage of urine; *increased daytime urinary frequency* was defined as the complaint of when the woman reports that she thinks she voids too often during the day; *urgency* was defined as the complaint of a sudden compelling desire to pass urine; *intermittent stream* was defined as the term used to describe the individual's urine flow when it stops and starts on one or more occasions during micturition; *weak urinary stream* referred to the individual's perception of reduced urine flow compared to her previous normal flow; and *hesitancy* was defined as the term used to describe a woman's difficulty in initiating micturition after she is ready to pass urine, resulting in a delay in the onset of voiding [3]. Information about teachers' frequency of daytime urination was collected also. In addition to the teachers who reported that they thought they voided too often during the day, teachers who voided eight or more times per day during the past 12 months were also defined as having *increased daytime urinary frequency* because the normal daytime urinary frequency is reported as four to

seven voids/day [30]. *Nocturia* was defined as rising to void two or more times at night, as this definition was commonly used in previous studies [5–7]. *Incomplete emptying* was defined as the sensation that urine is left in the bladder after micturition [30].

For teachers who experienced any type of LUTS, information related to the frequency and duration of the experiences were collected. For teachers who experienced UI, information related to the types of UI, amount, and frequency of urine leakage were also collected. The item that addressed stress UI was “Do you experience urine leakage related to physical activity, coughing, or sneezing?” Teachers who answered “yes” for either or both of the following two questions were defined as having urge UI: (a) “Do you experience urine leakage related to the feeling of urgency? By urgency we mean that you feel a sudden compelling desire to pass urine,” (b) “Do you ever leak urine on the way to the bathroom?” Teachers who answered “yes” for the question about stress UI and one or two questions about urge UI were classified as having mixed UI. Sandvik’s UI severity index was incorporated into the TTBS to represent UI severity. Sandvik’s UI severity index was computed by multiplying the self-reported frequency of UI (four levels) by the amount of urine leakage (three levels). Four levels of UI frequency were: 1=less than once a month, 2=one or several times a month, 3=one or several times a week, and 4=every day and/or night. Three levels of amount of urine leakage were: 1=drops, 2=small splashes, and 3=more. The resulting index values (1–12) were categorized into four levels (1–2=slight, 3–6=moderate, 8–9=severe, and 12=very severe) to demonstrate individual’s UI severity [31].

Procedures

IRB approval for this study was obtained from the University of North Carolina at Chapel Hill IRB.

The systematic sampling method with pps was used to select 26 elementary schools from the 152 elementary schools in Taipei City. Once the approvals for conducting this study were acquired from the selected schools, a second-stage simple random sampling of 20 teachers in each school was conducted. If the principal of a selected school refused the request to participate, the school listed either before or after the originally selected school on the ordered list used for sampling was substituted. If the school with the smallest number (10) of female teachers was selected, the school directly before or after the selected school on the ordered list was also selected. Then, a random sample of 20 teachers was selected from both schools. If a teacher randomly selected from the selected school refused to participate, another teacher was randomly selected from the same school.

After the sample was identified, selected teachers were then invited to complete the self-administered, paper-and-pencil TTBS. There were no criteria for exclusion. Incentives (US\$10) were distributed before the completion of the survey. The informed-consent letter indicated that, by completing the TTBS, the participant was giving permission for her data to be added to the data provided by other participants. A sealed box was left in each school’s academic office, and the teachers were instructed to return their completed surveys to the sealed box within 1 week. The principal investigator (Liao YM) picked up the box 2 weeks after the surveys were distributed to maintain security of the completed surveys.

Method of data analysis

Statistical Analysis System (SAS) for Windows was used to analyze the data. The original data were coded and entered into SAS. Simple frequency distributions and repeated inspection were used to verify the data. Descriptive statistics were used to demonstrate the prevalence of LUTS plus UTI along with the distributions of participants’ individual characteristics and frequency/duration of individual LUTS. The standard errors (SE) for the prevalence rates of LUTS with the consideration of clustering effects were calculated using Survey Data Analysis (SUDAAN) software. Chi-square tests were used to compare the prevalence rates of different types of LUTS for teachers in different age groups.

Results

All the principals of the 26 selected schools gave their approval for this study; no selected school had less than 20 teachers. A total of 520 surveys were distributed to 26 elementary schools in Taipei with 68 teachers refusing to participate. Thus, 68 additional teachers in the schools where the 68 teachers who refused to participate were employed were randomly selected as substitutes. Among the 452 teachers initially selected, 430 completed the TTBS, which resulted in a response rate of 82.7% (430/520). Of the 430 completed surveys, 411 were usable. Of the 68 substitutes, 41 (60.3%) completed the surveys, of which 34 were usable. Twenty-six surveys completed by teachers who currently experienced UTI or with numerous missing item responses were excluded from the analysis. Among the total 471 completed surveys, 445 were usable. Weighting for non-response was considered in some schools where non-response was found. Given the high response rate (82.7%), weighting for the non-response would have little effect on the estimates and would tend to increase the variance of the estimates. Therefore, weighting for non-response was not conducted.

The participants in this study were women employed full time as elementary school teachers in Taipei City. Of the 445 teachers, 389 (87.5%) were 26 to 50 years of age (mean=38.93, SD=8.56), and the majority were married ($n=295$, 66.3%). Although mean body mass index (BMI) was 21.03 (SD=2.57) with a range of 15.62 to 32.89, the majority of teachers had a normal BMI ($n=350$, 78.8%). One hundred and eighty-eight teachers (42.8%) had given birth twice, 185 (43.7%) had experienced vaginal deliveries, and 142 (32.5%) had undergone gynecological surgery (Table 1).

Of the 445 teachers, 293 (65.8%) experienced at least one type of LUTS: 119 (26.7%) reported UI; 192 (44.5%) experienced increased daytime urinary frequency; 79 (17.8%) experienced urgency; 71 (16.0%) got up two or more times at night to urinate; 84 (18.9%) experienced intermittent stream; 44 (9.9%) experienced hesitancy; 116 (26.1%) experienced incomplete emptying; 123 (27.7%) experienced weak urinary stream; and 53 (11.9%) experienced UTI during the preceding 12 months (Table 2). For UI, increased daytime urinary frequency, nocturia, and intermittent stream, the prevalence rates were significantly different ($p<0.05$) for teachers in different age groups. The prevalence rates for UI and nocturia increased by increasing age (Table 3).

For the majority of the teachers with LUTS, symptoms had lasted more than 1 month and less than 5 years and with a frequency of less than once a month or one or several times a month. In 30 to 40% of teachers with LUTS, the symptoms had lasted more than 1 month and less than 12 months. Between 35 and 45% of teachers with LUTS had experienced LUTS more than 1 year and less than 5 years. For teachers with UI ($n=119$), 91 (77.1%) had experienced UI with a duration of more than 1 month and less than 5 years; 68 (57.1%) experienced UI with the frequency of no more than once a month. The majority of teachers with UI experienced urine loss as drops ($n=107$, 89.9%), and 46 (39.0%) of them wore some kind of absorbent products for UI. Sixty (52.2%) teachers experienced the symptom of stress UI, 47 (40.8%) experienced the symptom of mixed UI, and 8 (7.0%) experienced the symptom of urge UI. Based on Sandvik's UI severity index, 100 (84.1%), 16 (13.4%), and 3 (2.5%) experienced slight, moderate, and severe to very severe UI, respectively.

Other important findings of this study included teachers' daytime urinary frequency, help-seeking behavior, and their interest of participating in lectures related to continence health. The mean daytime urinary frequency for teachers who experienced increased daytime urinary frequency (range=3 to 22; mean=9.33, SD=2.70) was significantly higher ($t=14.95$, $p<0.001$) than the frequency for teachers who did not experience the symptom (range=3 to 8; mean=6.29, SD=1.41). Among the 290

Table 1 Demographic characteristics ($n=445$)

| Variable | <i>n</i> | Percent |
|--|----------|---------|
| Age (range, 23–62; mean=38.93; SD=8.56) | | |
| 23–25 | 26 | 5.8 |
| 26–30 | 66 | 14.9 |
| 31–35 | 71 | 15.9 |
| 36–40 | 83 | 18.7 |
| 41–45 | 77 | 17.3 |
| 46–50 | 92 | 20.7 |
| 51–55 | 20 | 4.5 |
| ≥56 | 10 | 2.2 |
| Body mass index (BMI; range, 15.62–32.89; mean=21.03; SD=2.57) | | |
| <18.5 underweight | 57 | 12.8 |
| 18.5–24.9 normal | 350 | 78.8 |
| ≥25 overweight | 37 | 8.4 |
| Missing | 1 | |
| Marital status | | |
| Married | 295 | 66.3 |
| Single (separated, divorced, or widowed) | 19 | 4.3 |
| Single, never married | 131 | 29.4 |
| Teaching experience (mean=14.30, SD=9.39) | | |
| ≤5 years | 116 | 26.3 |
| 6–10 years | 60 | 13.6 |
| 11–15 years | 75 | 17.0 |
| 16–20 years | 52 | 11.8 |
| 21–25 years | 77 | 17.5 |
| ≥26 years | 61 | 13.8 |
| Missing | 4 | |
| Teaching grade | | |
| 1–2 | 125 | 28.3 |
| 3–4 | 122 | 27.6 |
| 5–6 | 73 | 16.5 |
| Administrative position or resource teacher | 108 | 24.4 |
| Teachers for students with special needs | 14 | 3.2 |
| Missing | 3 | |
| Parity | | |
| Zero | 164 | 37.4 |
| One | 53 | 12.1 |
| Two | 188 | 42.8 |
| Three and above | 34 | 7.7 |
| Missing | 6 | |
| Delivery method | | |
| Vaginal delivery | 185 | 43.7 |
| Cesarean section | 58 | 13.7 |
| Vaginal delivery and Cesarean section | 16 | 3.8 |
| Never given birth | 164 | 38.8 |
| Missing | 22 | |
| History of gynecological surgery | | |
| Yes | 142 | 32.5 |
| No | 295 | 67.5 |
| Missing | 8 | |

teachers who answered the item about help-seeking behavior, 244 (84.1%) did not report their symptoms to health care providers. For teachers who answered the item about their interest of participating in lectures about

Table 2 Prevalence rates of LUTS and urinary tract infections ($n=445$)

| LUTS | <i>n</i> | Percent | SE (%) |
|--|----------|---------|--------|
| Any LUTS | | | |
| Yes | 293 | 65.8 | 2.3 |
| No | 152 | 34.2 | 2.3 |
| Urinary incontinence | | | |
| Yes | 119 | 26.7 | 3.3 |
| No | 326 | 73.3 | 3.3 |
| Increased daytime urinary frequency | | | |
| Yes (voided too often during the day or voiding frequency ≥ 8) | 192 | 44.5 | 2.9 |
| No | 239 | 56.5 | 2.9 |
| Missing | 14 | | |
| Yes (voided too often during the day) | 151 | 33.9 | 2.9 |
| No | 294 | 66.1 | 2.9 |
| Yes (voiding frequency ≥ 8) | 112 | 26.5 | 2.6 |
| No | 311 | 73.5 | 2.6 |
| Missing | 22 | | |
| Urgency | | | |
| Yes | 79 | 17.8 | 1.7 |
| No | 366 | 82.2 | 1.7 |
| Nocturia | | | |
| Yes | 71 | 16.0 | 2.2 |
| No | 373 | 84.0 | 2.2 |
| Missing | 1 | | |
| Intermittent stream | | | |
| Yes | 84 | 18.9 | 1.7 |
| No | 361 | 81.1 | 1.7 |
| Hesitancy | | | |
| Yes | 44 | 9.9 | 1.3 |
| No | 400 | 90.1 | 1.3 |
| Missing | 1 | | |
| Incomplete emptying | | | |
| Yes | 116 | 26.1 | 2.6 |
| No | 329 | 73.9 | 2.6 |
| Weak urinary stream | | | |
| Yes | 123 | 27.7 | 2.3 |
| No | 321 | 72.3 | 2.3 |
| Missing | 1 | | |
| Burning during urination for the past 12 months | | | |
| Yes | 75 | 16.9 | 2.0 |
| No | 370 | 83.1 | 2.0 |
| Currently, burning during urination | | | |
| Yes | 4 | 0.9 | 0.4 |
| No | 438 | 99.1 | 0.4 |
| Missing | 3 | | |
| Itching or burning around vaginal area for the past 12 months | | | |
| Yes | 219 | 49.3 | 3.0 |
| No | 226 | 50.7 | 3.0 |
| Currently, itching or burning around vaginal area | | | |
| Yes | 38 | 8.6 | 1.7 |
| No | 407 | 91.4 | 1.7 |
| UTI for the past 12 months | | | |
| Yes | 53 | 11.9 | 1.4 |
| No | 392 | 88.1 | 1.4 |

continence health ($n=409$), 309 (75.6%) expressed their interest in such educational offerings.

Discussion

The prevalence rate for teachers in this study who experienced any LUTS (65.8%) is similar to the rate reported in the study of Swithinbank et al. [5] (69.1%) and higher than the rates reported in two epidemiological studies (range=27.8 to 38.8%) [4, 6]. This finding suggests that women's employment status may be associated with LUTS because the prevalence of LUTS for employed women in this study is similar to the rate for women recruited from clinical practice [5]. The difference between the findings of this study and the two other epidemiological studies [4, 6] might result from the varied definitions of LUTS used. A more rigorous criterion would likely result in a lower prevalence rate. For example, UI was regarded as a clinically significant symptom if it had occurred several times a month or more often in the study of Perry et al. [6]. UI was "urine loss" that is objectively demonstrable and is a social or hygienic problem in the study of Moller et al. [4]. Another possible explanation is that the prevalence of some LUTS such as slow stream and intermittent stream were not investigated in the study of Moller et al. [4] or Perry et al. [6]. Lack of the information on these symptoms might have resulted in lower overall prevalence rates.

The prevalence of LUTS in this study is higher than the rates reported in two community studies conducted in Asia [9, 10]. This finding indicates that women's employment status may be associated with LUTS. Brieger et al. used telephone interviews to collect information about the prevalence of LUTS in Hong Kong. The results of the study were not only based on participants' self-perceptions but also on interviewer's judgment. Therefore, the prevalence of LUTS might be underestimated because of the extra screening process carried out by the telephone interviewers. Some post micturition symptoms were not investigated in the studies of Brieger et al. [9] and Zhang et al. [10], which might result in an underestimation of the overall prevalence rate. The prevalence of LUTS for this study is also higher than the rate reported in a study conducted in Australia [7]. A different data collection method (household interview) and the lack of the information on some symptoms in the study of Pinnock et al. were possible explanations for the difference.

Urinary incontinence

The prevalence of UI in this study (26.7%) is similar to the results reported in the review of epidemiologic studies where the prevalence of UI was 20–30% for young adult

Table 3 Chi-square tests of the prevalence rates for LUTS by age groups ($n=445$)

| LUTS | Age group | n (%) | Yes n (%) | No n (%) | Missing | Chi-square value/Fisher's exact test | Significance |
|-------------------------------------|-----------|-------------|-------------|------------|---------|--------------------------------------|--------------|
| Any LUTS | All ages | 445 (100.0) | 293 (65.8) | 152 (34.2) | | 1.31 | 0.726 |
| | 23–30 | 92 (20.7) | 61 (66.3) | 31 (33.7) | | | |
| | 31–40 | 154 (34.6) | 103 (66.9) | 51 (33.1) | | | |
| | 41–50 | 169 (38.0) | 107 (63.3) | 62 (36.7) | | | |
| | Over 50 | 30 (6.7) | 22 (73.3) | 8 (26.7) | | | |
| UI | All ages | 445 (100.0) | 119 (26.7) | 326 (73.3) | | 19.93 | <0.001*** |
| | 23–30 | 92 (20.7) | 13 (14.1) | 79 (85.9) | | | |
| | 31–40 | 154 (34.6) | 33 (21.4) | 121 (78.6) | | | |
| | 41–50 | 169 (38.0) | 61 (36.1) | 108 (63.9) | | | |
| | Over 50 | 30 (6.7) | 12 (40.0) | 18 (60.0) | | | |
| Increased daytime urinary frequency | All ages | 445 (100.0) | 192 (44.5) | 239 (55.5) | 14 | 13.54 | 0.004** |
| | 23–30 | 92 (20.7) | 52 (57.1) | 39 (42.9) | 1 | | |
| | 31–40 | 154 (34.6) | 52 (35.1) | 96 (64.9) | 6 | | |
| | 41–50 | 169 (38.0) | 71 (43.6) | 92 (56.4) | 6 | | |
| | Over 50 | 30 (6.7) | 17 (58.6) | 12 (41.4) | 1 | | |
| Urgency | All ages | 445 (100.0) | 79 (17.8) | 366 (82.2) | | 2.28 | 0.517 |
| | 23–30 | 92 (20.7) | 18 (19.6) | 74 (80.4) | | | |
| | 31–40 | 154 (34.6) | 22 (14.3) | 132 (85.7) | | | |
| | 41–50 | 169 (38.0) | 32 (18.9) | 137 (81.1) | | | |
| | Over 50 | 30 (6.7) | 7 (23.3) | 23 (76.7) | | | |
| Nocturia | All ages | 445 (100.0) | 71 (16.0) | 373 (84.0) | 1 | 11.47# | 0.009** |
| | 23–30 | 92 (20.7) | 10 (10.9) | 82 (89.1) | | | |
| | 31–40 | 154 (34.6) | 23 (14.9) | 131 (85.1) | | | |
| | 41–50 | 169 (38.0) | 27 (16.1) | 141 (83.9) | 1 | | |
| | Over 50 | 30 (6.7) | 11 (36.7) | 19 (63.3) | | | |
| Intermittent stream | All ages | 445 (100.0) | 84 (18.9) | 361 (81.1) | | 14.90 | 0.002** |
| | 23–30 | 92 (20.7) | 29 (31.5) | 63 (68.5) | | | |
| | 31–40 | 154 (34.6) | 21 (13.6) | 133 (86.4) | | | |
| | 41–50 | 169 (38.0) | 26 (15.4) | 143 (84.6) | | | |
| | Over 50 | 30 (6.7) | 8 (26.7) | 22 (73.3) | | | |
| Hesitancy | All ages | 445 (100.0) | 44 (9.9) | 400 (90.1) | 1 | 2.59# | 0.459 |
| | 23–30 | 92 (20.7) | 13 (14.1) | 79 (85.9) | | | |
| | 31–40 | 154 (34.6) | 13 (8.4) | 141 (91.6) | | | |
| | 41–50 | 169 (38.0) | 16 (9.5) | 152 (90.5) | 1 | | |
| | Over 50 | 30 (6.7) | 2 (6.7) | 28 (93.3) | | | |
| Incomplete emptying | All ages | 445 (100.0) | 116 (26.1) | 329 (73.9) | | 2.87 | 0.412 |
| | 23–30 | 92 (20.7) | 25 (27.2) | 67 (72.8) | | | |
| | 31–40 | 154 (34.6) | 33 (21.4) | 121 (78.6) | | | |
| | 41–50 | 169 (38.0) | 50 (29.6) | 119 (70.4) | | | |
| | Over 50 | 30 (6.7) | 8 (26.7) | 22 (73.3) | | | |
| Weak urinary stream | All ages | 445 (100.0) | 123 (27.7) | 321 (72.3) | 1 | 5.68 | 0.129 |
| | 23–30 | 92 (20.7) | 29 (31.5) | 63 (68.5) | | | |
| | 31–40 | 154 (34.6) | 32 (20.8) | 122 (79.2) | | | |
| | 41–50 | 169 (38.0) | 53 (31.5) | 115 (68.5) | 1 | | |
| | Over 50 | 30 (6.7) | 9 (30.0) | 21 (70.0) | | | |

Fisher's exact test

* $p < 0.05$ ** $p < 0.01$ *** $p < 0.001$

women and 30–40% for middle-aged women [8]. This study is in agreement with two studies conducted among employed women (range=20 to 30%) [13, 15] and lower than the prevalence estimate for employed women in the

US (37%) [14]. Differences in age distribution in this study with elementary school teachers and the women in the study of Fultz et al. might explain the differences. For example, the percentage of employed women more than

40 years of age was 45% in this study and was 70% in the study of Fultz et al. Compared to the results in previous studies that also used self-administered questionnaires, the prevalence estimate of this study is similar to some [15, 32], lower than others [20, 33, 34], and higher than the rest [4, 6]. The age distribution in this study was similar to the age distribution in the studies with similar results. Recruiting subjects from the medical practice or physician's office might be the reason for a higher prevalence rate in Harrison and Memel's study [33]. For the other two studies with higher prevalence rates [20, 34], subjects' age may be a reasonable explanation. The steadily increasing prevalence of any UI with increasing age was noted in several studies [9, 10, 32]. For those studies with lower prevalence rates [4, 6], the narrow age ranges of the samples might explain the differences in the prevalence estimates.

Prevalence studies for UI conducted in Asia are limited. Results of this study are consistent with the result of another study conducted in Taiwan [21]. For the other studies conducted in Asia, higher prevalence rates were reported [9, 11, 34, 35]. A wide age distribution (greater than 20 years of age) could affect the finding of the study conducted in Hong Kong and Taiwan [9, 35]. Similarly high prevalence rates for the studies conducted in Japan [11, 34] may be explained by the samples being 40 years of age and older.

Findings on the proportions of different types of UI in this study are consistent with the findings reported by Hunskar et al. [8]. About half of the women with UI experienced stress UI, a smaller proportion experienced mixed UI, and the smallest proportion experienced urge UI [8]. The results of this study are similar to the findings in several studies that showed stress UI to be the most common type of UI among women [32, 33]. However, the findings of this study are different from those of Yu et al. who reported 76.2% of community women experienced stress UI and less than one tenth of women experienced urge UI or mixed UI [21]. The interviewers in the study of Yu et al. were senior students from the Department of Public Health. No training program for interviewers or the total number of interviewers was reported in the study. The items used to differentiate different types of UI were not presented. Without appropriate training plus lack of clinical experience, the student interviewer's ability to differentiate different types of UI might be limited.

For women with UI, a gradual increase in the prevalence across adulthood occurs up to the age of 50 years, and a stabilization or slight decrease occurs until the age 70 years has been reported in previous studies [32]. In this study, a similar pattern was found in the prevalence of UI for teachers by age. However, the reported decrease in the prevalence after the age of 50 years was not found. Because older teachers were not available for this study as

were the young or middle-aged teachers, the small sample size ($n=30$) of teachers 51 years old or greater may explain the different finding in this study.

Survey research to investigate UI severity was limited in the literature. Most studies operationalized the measure of severity by measuring the frequency or amount of urine loss. Sandvik's UI severity index used in this study, which combined a frequency and a quantity measure, is suitable for use in survey research. It has been noted to be a simple, reliable measure that can be recommended for routine use [36]. Among other methods for assessing UI severity, the pad test has been the most widely used. Studies investigating the associations between pad testing and a standard evaluation (i.e., urodynamic evaluation) were few. Although urodynamic studies are considered to be the most valid approach to the diagnosis of lower urinary tract function, non-significant low correlations between urodynamic studies and pad testing among women with UI has also been reported [37]. It is clear that additional work is needed to develop valid measures of UI severity, especially for survey research.

The findings of this study on UI severity are different from those of Hannestad et al. [32] but similar to the findings of the other two studies [4, 21]. Different definitions of severity, different populations, and different survey procedures might explain the differences in findings. Two studies were conducted in Taiwan on women's UI severity [21, 38]. Pad test [38] and self-reported quantity of urine loss [21] were used in these studies to measure UI severity. UI severity for participants in this study was similar to that of the women in the study by Yu et al. [21] and less severe than that of the women in the study by Huang et al. [38]. This finding is reasonable because subjects in the study of Huang et al. were recruited from clinics and might have experienced more severe UI than the subjects recruited from the community in the study of Yu et al. Teachers with UI in this study experienced less severe UI than the community women in the study of Yu et al. The minor difference between the findings of this study and the study of Yu et al. might result from the different age distribution for the samples in the two studies (participants in this study were younger). Because no "gold standard" for assessing UI severity had been proposed or recommended for survey research, combining different methods to assess UI severity in a study is recommended for future studies.

Increased daytime frequency, urgency, and nocturia

The prevalence of increased daytime urinary frequency in this study (44.5%) is higher than the findings in previous studies (range=3.5 to 21.1%) [4–7, 9, 10, 35] and lower than the rate reported in Japan [11]. The high prevalence

rate reported in Japan [11] may be explained by an older aged sample of women. About 71.3% of the teachers with this symptom urinated equal to or more than eight times during their waking hours. Compared to women recruited from the community, employed women usually need to balance their jobs, family, and social responsibilities at the same time; they may experience more stress than women who are not employed. School teachers tend to have a more restrictive schedule, which may lead to fewer opportunities to go to the bathroom than women from the community. Increased bladder sensation in an otherwise normal bladder, which may result from stress or a restrictive schedule, might explain why the symptom is common among this population.

The prevalence of urgency in this study (17.8%) is similar to the results reported in the study of Moller et al. [4], higher than the results reported in five studies [6, 7, 9, 10, 35], and lower than the result reported by Swithinbank et al. [5]. Researchers used different questionnaires and/or items that measure urgency in their studies. The questionnaire used in the study of Brieger et al. [9] was derived from King's College Urodynamics Questionnaire; the BFLUTS questionnaire was used in the studies conducted by Moller et al. [4], Swithinbank et al. [5], Zhang et al. [10], and Chen et al. [35]; Pinnock and Marshall [7] used the International Prostate Symptom Score as a basis to develop an instrument; and Perry et al. [6] developed their questionnaire based on the American Urological Association symptom index. The definition for urgency was not specified in the study of Brieger et al. [9]. Urgency was defined as (a) a strong need to urinate with little or no warning by Pinnock and Marshall [7], (b) respondents usually experiencing an overwhelming urge to pass urine or having difficulty holding urine most of the time by Perry et al. [6], and (c) a positive answer on question "Do you have to rush to the toilet to urinate?" by Moller et al. [4], Swithinbank et al. [5], and Zhang et al. [10]. Explaining the difference between studies was difficult due to the varied definitions of urgency and data collection methods used. The age distribution for the samples in different studies was another possible reason for the different findings.

The prevalence of nocturia in this study (16.0%) is similar to the results reported in four studies [5–7, 9], lower than the result reported by Chen et al. [35], and higher than the result reported by Moller et al. [4]. The similar prevalence rate may result from the similar definitions for nocturia that were used in studies. A wide age distribution (20 years of age or older) could affect the finding for the study conducted in Taiwan [35]. Moller et al. collected information on the presence of nocturia as well as the frequency of the symptom. Participants who reported frequency as sometimes were not counted as having this symptom [4]. This decision may explain why the preva-

lence rate of nocturia is low in the study of Moller et al. The finding for this study is consistent with the finding in previous research of nocturia being associated with age [12]. This symptom increases with age, especially for teachers in the oldest groups (51 years of age or older).

Voiding and post micturition symptoms

Comparison between the findings of this study and previous studies for the prevalence rates of voiding and post micturition symptoms is limited because only one study [5] reported the prevalence rates for all the voiding and post micturition symptoms. The prevalence of weak urinary stream in this study (27.7%) is higher than the results reported in previous work [5, 7, 9–11]. The prevalence of intermittent stream in this study (18.9%) is higher than the results reported in previous work [7, 9, 10] and lower than the result reported by Swithinbank et al. [5]. For the prevalence rates of hesitancy (9.9%) and incomplete emptying (26.1%), the findings of this study are higher than the findings reported by Moller et al. [4] and much lower than the finding reported by Swithinbank et al. [5]. In general, voiding and post micturition symptoms among the school teachers in this study were common. As voiding and post micturition symptoms are associated with some organic conditions (pelvic organ prolapse or urethral obstruction) [30], the high prevalence rates of these symptoms among this population may result from these conditions. Acquiring direct information about teachers' pelvic floor function through physical examination or urodynamic studies would be helpful in understanding the reasons for the high prevalence rates.

Help-seeking behavior

In this study, less than one sixth of teachers with LUTS reported their symptoms to health care professionals. Seeking professional help is less common for employed women in this study than for the women in previous community studies [20, 21]. Generally, individuals tend to base perceptions of symptom severity on the frequency of symptom occurrence rather than on the duration the symptom has lasted. A possible explanation for teachers' help-seeking behavior is that they were not bothered by the symptom(s)—the majority of them experienced the symptom(s) less than several times a month, further supporting the finding of Yu et al. that women's behaviors in seeking help are associated with their symptom(s) severity [39]. This finding suggests the possible impact of women's employment status on help seeking. Because employed women need to play multiple roles at the same time, the time for them to improve personal health might be limited.

Summary and limitations

LUTS are common among female elementary school teachers in Taipei City (range=9.9 to 44.5%). The prevalence of UI (26.7%) and nocturia (16.0%) fell within the prevalence estimates of these LUTS in North American and European women. Employed women in this study were more likely to experience LUTS than women in previous epidemiological or community studies. The working environment may affect LUTS in female elementary school teachers.

Because this study was conducted in a population of female elementary school teachers in Taipei, the results may be generalized only with caution. One limitation of this study is that teachers were not examined objectively for lower urinary tract function. Ideally, self-report measures should be validated by clinical evaluations. Using bladder records, physical examinations, or urodynamic assessments to validate the classification is recommended for future studies. Another limitation is that the impact of LUTS on QOL was not measured in this study.

Conclusion

There is limited information about LUTS in Asia. Research investigating prevalence and incidence of LUTS should be conducted and individualized to the culture and social environment of the population under study. Making a comparison between studies is challenging because various data collection instruments were used. To conduct an appropriate comparison, a standardized survey tool about LUTS that can be used in epidemiological studies is needed. Such an instrument could be modified for a specific population as needed. This study contributes to knowledge about the prevalence of LUTS among employed women in Taiwan. This study is important to women in Taiwan because it will increase awareness of this common health concern, open channels of communication among women about LUTS, and may lead to the use of well-researched behavioral strategies to manage LUTS. Finding that the majority of teachers had an interest of participating in lectures to continence health leads us to recommended greater efforts toward increasing awareness of these common health concerns, and of the helpful management strategies, which we hope will further lead to the improvement of employed women's QOL.

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