

Factors Related to Lower Urinary Tract Symptoms Among a Sample of Employed Women in Taipei

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Aim: To identify factors associated with lower urinary tract symptoms (LUTS) among female elementary school teachers in Taipei. **Methods:** This study is a cross-sectional, descriptive study. A total of 520 surveys were distributed to 26 elementary schools in Taipei. Logistic regression was used to identify possible factors related to individual LUTS. **Results:** Study results were based on the information provided by 445 participants. Of the 445 teachers, 293 (65.8%) experienced at least one type of LUTS. Factors associated with urinary incontinence were body mass index (BMI), vaginal delivery, obstetric and/or gynecological surgery, bladder habits, and job control. Increased daytime urinary frequency was associated with chronic cough and chronic constipation. Bladder habits, straining to lift heavy objects at work and chronic constipation were associated with urgency. Nocturia was associated with age and caffeine consumption while intermittent stream was associated with the presence of a family history of LUTS and chronic constipation. Bladder habits and regular exercise were associated with weak urinary stream. Incomplete emptying was more likely to occur in teachers with chronic constipation and in those who did not exercise regularly. **Conclusion:** All the LUTS under logistic regression analyses were associated with 1–3 modifiable factors. Identification of these modifiable contributing factors may be useful to health care providers. Education of women may include the importance of maintaining normal body weight, good bladder/bowel habits, and regular exercise, treating chronic cough, decreasing daily caffeine consumption, and implementing feasible environmental modifications in employment settings. *Neurourol. Urodynam.* 27:52–59, 2008. © 2007 Wiley-Liss, Inc.

Key words: employed women; female school teachers; lower urinary tract symptoms; occupation; urinary incontinence

INTRODUCTION

Lower urinary tract symptoms (LUTS) are health concerns of particular relevance to women because the prevalence rates are higher than the rates for men.^{1–3} Prevalence rates of LUTS for women ranged from 28% to 69%.^{2–7} LUTS are symptoms with widespread human and social implications, causing physical discomfort, shame and loss of self-confidence that negatively affect women's quality of life.^{6,8} Research findings have shown that only one fourth to one third of women with LUTS seek medical help.^{8,9} The majority of women with LUTS endure its impact without professional help. Understanding the factors related to LUTS could assist with identifying women at risk and could facilitate beneficial interventions related to modifiable variables such as weight loss, smoking cessation, and changing personal habits of fluid intake (i.e., decreasing caffeine consumption).¹⁰

LUTS can be divided into three main symptom groups—storage (urinary incontinence (UI), increased daytime urinary frequency, urgency, and nocturia), voiding (slow stream, splitting or spraying, intermittent stream, hesitancy, straining, and terminal dribble), and post-micturition (feeling of incomplete emptying and post-micturition dribble).¹¹ Studies investigating factors related to UI in the United States (US) and Europe are abundant¹; however, studies of factors related to other LUTS are less numerous. Studies conducted in Asia on factors related to LUTS are limited with most focusing on

factors related to UI.^{4,7–9} The possible contributing factors for LUTS in employment settings such as adequacy of bathroom breaks or toilet facilities and the availability of relief persons were proposed by Palmer et al.¹² Wall et al.¹³ also proposed the possible effects of individuals' occupations on their bladder health. Infrequent voiders—the so called “nurse's bladder” and “teacher's bladder”—who have developed the habit 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. However, the associations

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between the presence of LUTS and work-related factors have seldom been investigated¹⁴. Work identifying factors associated not only with UI but also with the other LUTS is essential.

The major aim of this study was to identify factors associated with female LUTS. The results of this study will contribute to knowledge about factors associated with individual LUTS, which may lead to interventions to address modifiable variables (i.e., body weight, personal habits, and work-related factors), and to appropriate strategies to manage LUTS.

MATERIALS AND METHODS

The development of the conceptual framework for this study was based on the concepts in Palmer's Continence Promotion Model¹⁵ and evidence in the literature. The conceptual framework is comprised of four constructs: (a) individual characteristics, (b) personal habits, (c) work-related factors, and (d) LUTS. Three constructs (individual characteristics, personal habits, and work-related factors) are conceptualized as explaining the presence of LUTS, the fourth construct. The dependent variable, the construct LUTS, refers to the LUTS that women experienced during the past 12 months. Independent variables, some of which may or may not be modifiable, include individual characteristics, personal habits, and work-related factors as listed in Figure 1.¹⁶

Sample

There were over 9,000 female elementary school teachers in over 150 elementary schools in Taipei city in 2003.¹⁷ The

theoretical rationale and statistics for the sampling plan of the study reported here is more fully covered in a recent publication.¹⁸ A systematic sampling method with probability proportional to size (pps) was used to select 26 elementary schools from all of the elementary schools in Taipei city. In each of the 26 selected elementary schools, a simple random sample of 20 teachers was used to achieve the required sample size of 502 teachers.¹⁸ The two-stage sampling method led to the same overall probability of selection 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.¹⁹

Survey

The development of the Taiwan teacher bladder survey (TTBS). As available generic instruments developed to assess LUTS are not sensitive to factors associated with LUTS in work environments,^{2,5,6,20} the TTBS was used. The process of instrument generation and psychometric testing for the TTBS has been previously described.¹⁶ Based on the initial psychometric testing, the TTBS is appropriate for use with women in Taiwan.

The TTBS includes 80 items to collect information about LUTS plus urinary tract infections (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.¹⁶ Information related to UTI was collected because

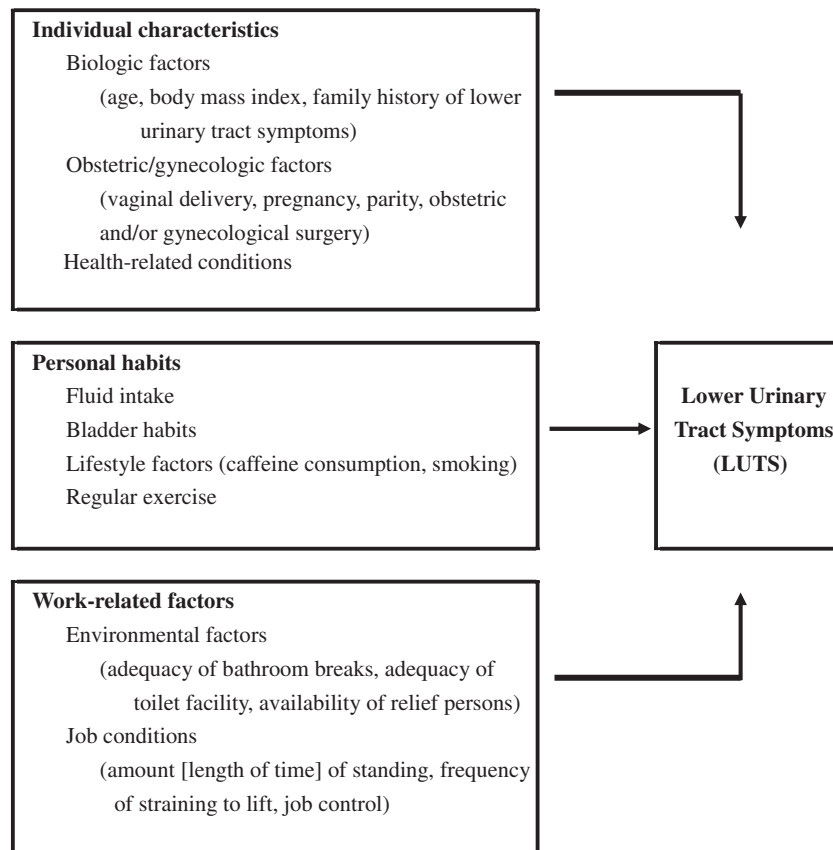


Fig. 1. Conceptual framework for investigating factors related to the presence of LUTS among employed women.

several LUTS such as UI, frequency, and urgency are associated with UTI.²¹

Measurement

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.¹¹ Definitions for all the LUTS used in this study were reported in a related publication.¹⁸

For the construct individual characteristics, teachers' age, body height and body weight, family history of LUTS, obstetric history, and surgery histories were collected. Teachers were divided into six age groups (≤ 30 , 31–35, 36–40, 41–45, 46–50, and ≥ 51). Based on the information (body weight and body height) reported by teachers, body mass index ($\text{BMI} = \text{kg}/\text{m}^2$) was calculated. A low BMI less than 18.5 may indicate underweight; a BMI of 18.5–24.9 is considered to be ideal; and a BMI of 25 or greater may indicate overweight or obesity.²² For family history, only the history for a family member among individuals' first-degree female relatives (i.e., mothers, sisters, daughters) was included. Teachers' obstetric history such as pregnancy, previous history of vaginal delivery, and parity as well as surgery history in the obstetric or gynecological systems was collected. In addition to surgery related to the ovary and uterus, caesarean section was defined as having a history of obstetric and/or gynecological surgery also. Age, BMI, and parity were treated as ordinal variables; and the others (family history of LUTS, pregnancy, histories of vaginal delivery and obstetric and/or gynecological surgery) were treated as dichotomous variables.

Information related to teacher's daily fluid intake, daily caffeine consumption, bladder habits, and smoking habits were collected to demonstrate the construct personal habits. Teachers were asked to estimate the type and amount of fluid intake in milliliters or cup(s) during one 24-hr period. Based on the information provided by teachers, three groups were developed, less than 1,500 ml, 1,500–3,000 ml, and more than 3,000 ml.²³ Total caffeine consumption was calculated by summing the amount of caffeine intake for all beverage categories on women's 24-hr estimations. For conducting a meaningful comparison, the classification method for daily caffeine consumption used in this study was the same as the method used in Arya et al.'s²⁴ study: none (0 mg/day), minimal (<100 mg/day), moderate (100–400 mg/day), and high (>400 mg/day) intake. Teachers' bladder habits were categorized into two different levels (poor and good) based on responses to the items related to delaying urination and restricting hydration. Teachers who frequently (2 or 3 days a week, or every day, or nearly every day) performed these behaviors were conceptualized as individuals with poor bladder habits. Responses to the question on smoking were categorized into two groups, smokers and non-smokers, based on reported smoking habits. Fluid intake, smoking, and bladder habits were treated as nominal variables; caffeine consumption was treated as ordinal variables.

Within the construct work-related factors, information related to environmental factors was collected. Based on teachers' responses on the items related to adequacy of bathroom breaks and toilet facilities at schools, four groups (very poor, poor, good, and very good) for both conditions were developed. For availability of relief persons, teachers' were

divided into four groups: never, sometimes (1 day a week or less), usually (2 or 3 days a week), and always (everyday or nearly everyday). Data for the amount of standing and frequency of straining to lift heavy objects at work and the amount of control over jobs were collected also. Responses on the average amount (length of time) of standing at work were categorized into four groups: less than 1 hr, more than 1 hr and less than 3 hrs, more than 3 hrs and less than 5 hrs, and more than 5 hrs. The frequency of straining to lift heavy objects at work was categorized into four groups: never, sometimes (1 day a week or less), usually (2 or 3 days a week), and always (everyday or nearly everyday). Job control is conceptualized as high when the teacher has the opportunity to toilet whenever she chooses. Teachers were asked "How much control do you have over your job? By control we mean how much freedom you have to toilet when you wish." with four response options: very low, low, high, and very high. Based on teachers' responses, they were divided into two groups: high and low. All the work-related variables were treated as ordinal variables.

In addition to the above information, data related to some health-related conditions (neurologic conditions, chronic cough, and chronic constipation) and habit of performing regular exercise were collected because associations between these conditions and LUTS are reported in literature.^{1,5,13,25,26}

Procedures

Institutional review board (IRB) approval was obtained from the University of North Carolina at Chapel Hill IRB for this study and the procedures are more fully described in a recent publication.¹⁸ Twenty six elementary schools were selected from the 152 elementary schools in Taipei by using the systematic sampling method with pps and a second stage simple random sampling of 20 female teachers in each school was conducted. A total of 520 surveys were distributed to 26 elementary schools in Taipei. Because 68 out of the 520 selected teachers declined participation, 68 teachers were randomly selected as substitutes in the schools where the 68 original selected teachers were employed.¹⁸

Informed consent letters, surveys, and incentives (\$ 10 US dollars) were distributed by the principal investigator to the selected teachers. The teachers were instructed to return their completed surveys to a sealed box located in each school's academic office within 1 week and the principal investigator personally collected the sealed box from each school 1 week after the surveys were distributed.¹⁸

Data Analysis

Basic features of the data analysis, which employed Statistical Analysis System (SAS) for Windows, are described in a recent publication.¹⁸ Descriptive statistics were used to demonstrate the prevalence of individual LUTS as well as the distributions of individual characteristics, personal habits, and work-related factors. Logistic regression was used to identify factors associated with individual LUTS. Teachers who reported that they currently experienced burning during urination or any neurologic disorders (i.e., stroke, hemiparesis, Parkinson's disease) were excluded from the analysis.

The variable selection procedure, based on the process proposed by Hosmer and Lemeshow,²⁷ began with univariate analyses of each independent variable. Instead of using the logistic procedure, the GENMOD procedure, logit model in SAS was used to test the significance of each independent variable because the standard errors could be adjusted for the clustering within schools.²⁸ Any variable whose univariable

Type III Chi-Square test had a *P*-value less than 0.25 was a candidate for the multivariable model. The reason for using 0.25 as the screening criterion was that using a traditional level (i.e., 0.05) often fails to identify variables known to be important.²⁷ This full multivariable model was then used to examine the effects of the variables by using the type III generalized estimating equation (GEE) analysis.

For the full multivariable model, the backward elimination model selection method was used to identify the model that best fit the data. When all significant predictors for different LUTS were identified, effects of the first-order interactions were examined. Backward elimination model selection was conducted again. Finally, estimated odds ratio and associated 95% confidence intervals (CI) for the presence of individual LUTS for each independent variable, while controlling for the other independent variables in the model, were obtained.

RESULTS

Among the 452 originally selected teachers, 430 completed the surveys which resulted in a response rate of 82.7% for this study. Of the 430 completed surveys, 411 were usable. Of the 68 substitutes, 41 (60.3%) completed the surveys, of which 34 were usable. 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; it was considered and not conducted.¹⁸

The 445 participants of this study were employed, full-time elementary school teachers in Taipei city. While *mean* age was 38.9 years (*SD* = 8.6), 389 (87.5%) of women were 26–50 years of age. The majority of women were married (*n* = 295, 66.3%). While *mean* BMI was 21.0 (*SD* = 2.6) with a range of 15.6–32.9, the majority of women had a normal BMI (*n* = 350, 78.8%). One hundred and eighty eight (42.8%) had given birth twice, 185 (43.7%) had experienced vaginal deliveries, and 142 (32.5%) had undergone obstetric and/or gynecological surgery.¹⁸ A family history of LUTS was noted in 109 (75.5%) women, 37 (8.3%), and 99 (22.3%) experienced chronic cough and chronic constipation, respectively.

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 each 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.¹⁸ The distribution of personal habits and work-related factors are demonstrated in Tables I and II, respectively.

Chi-square tests were not conducted to compare the prevalence rates for teachers with different characteristics on hesitancy or on UTI because the total number of teachers with hesitancy (*n* = 44) or UTI (*n* = 53) would generate counts less than five in the cell(s). The effects of first-order interactions were examined after all the significant predictors for the seven LUTS (UI, increased daytime urinary frequency, urgency, nocturia, intermittent stream, weak urinary stream, and a feeling of incomplete emptying) were identified. No interaction effects were found for the seven final models.

Storage Symptoms

Variables that provided unique contributions to the prediction of the presence of UI were BMI, vaginal delivery, obstetric and/or gynecological surgery, bladder habits, and job control. Teachers with higher BMI were more likely to

TABLE I. Personal Habits (*n* = 445)

Personal habits	n	%
Fluid intake (ml/day)		
<1,500 ml/day	139	31.3
1,500–3,000 ml/day	264	59.5
>3,000 ml/day	41	9.2
Missing	1	
Caffeine consumption (mg/day)		
0 mg/day	186	41.9
<100 mg/day	80	18.0
100–400 mg/day	150	33.8
>400 mg/day	28	6.3
Missing	1	
Bladder habits		
Poor	202	45.6
Good	241	54.4
Missing	2	
Smoking		
Yes	0	0.0
No	445	100.0
Regular exercise		
Yes	110	24.8
No	333	75.2
Missing	2	

TABLE II. Work-Related Factors (*n* = 445)

Work-related factors	n	%
Environmental factors		
Adequacy of bathroom breaks		
Very poor	19	4.3
Poor	144	32.5
Good	137	30.9
Very good	143	32.3
Missing	2	
Adequacy of toilet facility		
Very poor	0	0.0
Poor	25	5.6
Good	276	62.0
Very good	144	32.4
Need of relief persons		
No need	252	59.2
Sometimes	154	36.2
Usually	12	2.8
Always	8	1.8
Missing	19	
Availability of relief persons		
Never	350	80.1
Sometimes	35	8.0
Usually	14	3.2
Always	38	8.7
Missing	8	
Job conditions		
Amount of standing at work		
< 1 hr	15	3.4
> 1 hr, ≤ 3 hr	106	23.9
> 3 hr, ≤ 5 hr	227	51.1
> 5 hr	96	21.6
Missing	1	
Frequency of straining to lift at work		
Never	67	15.1
Sometimes	306	68.8
Usually	57	12.8
Always	15	3.3
Job control		
High	303	68.4
Low	140	31.6
Missing	2	

experience *UI* than teachers with lower BMI. Teachers who had a history of vaginal delivery or obstetric and/or gynecological surgery were more likely to experience *UI* than those without the history. Teachers who had poor bladder habits and low control over job were more likely to experience *UI* than teachers with good bladder habits and high control over job (Table III).

Teachers who experienced chronic cough or chronic constipation were more likely to experience *increased daytime urinary frequency* than those without these conditions

(Table III). Teachers who had poor bladder habits and chronic constipation were more likely to experience *urgency* than those with good bladder habits and without chronic constipation. Teachers who sometimes, usually, and always strained to lift heavy objects at work were more likely to experience *urgency* than those who never carried out this task at work (Table III). Age and caffeine consumption provided unique contributions to the prediction of the presence of *nocturia*. Teachers in an older group were more likely to experience nocturia than those in a younger group.

TABLE III. Results of Logistic Regression Analyses for Individual Lower Urinary Tract Symptoms

Source	Category	DF	Chi-square value	Odds ratio	95% CI
Urinary incontinence					
Body mass index (BMI)	<18.5	2	8.51 ^a	Reference	
	18.5–24.9			2.86	1.26–6.50
	≥25			9.41	2.73–32.49
Vaginal delivery	No	1	8.93 ^b	Reference	
	Yes			3.34	1.80–6.19
Obstetric and/or gynecological surgery	No	1	4.92 ^a	Reference	
	Yes			2.18	1.18–4.04
Bladder habits	Good	1	7.93 ^b	Reference	
	Poor			2.20	1.37–3.52
Job control	High	1	3.78 ^a	Reference	
	Low			1.82	1.10–3.00
Increased daytime urinary frequency					
Chronic cough	No	1	3.99 ^a	Reference	
	Yes			2.38	1.11–5.10
Chronic constipation	No	1	3.72 ^a	Reference	
	Yes			1.79	1.03–3.09
Urgency					
Bladder habits	Good	1	4.90 ^a	Reference	
	Poor			1.99	1.19–3.32
Straining to lift heavy objects at work	Never	3	8.69 ^a	Reference	
	Sometimes			3.57	0.94–13.50
	Usually			5.14	1.57–16.83
	Always			8.96	2.51–32.03
Chronic constipation	No	1	4.48 ^a	Reference	
	Yes			1.96	1.21–3.18
Nocturia					
Age	23–30	5	11.04 ^a	Reference	
	31–35			3.09	1.59–6.00
	36–40			2.26	1.14–4.46
	41–45			4.26	1.85–9.84
	46–50			2.08	0.93–4.67
	51–62			4.14	1.59–10.73
Caffeine consumption (mg/day)	0	3	8.27 ^a	—	—
	<100			Reference	
	100–400			2.17	0.90–5.26
	>400			4.00	1.79–8.95
Intermittent stream					
Family history of LUTS	No	1	3.87 ^a	Reference	
	Yes			1.86	1.07–3.24
Chronic constipation	No	1	8.79 ^b	Reference	
	Yes			2.71	1.66–4.40
Weak urinary stream					
Bladder habits	Good	1	6.83 ^b	Reference	
	Poor			1.87	1.22–2.86
Regular exercise	Yes	1	4.21 ^a	Reference	
	No			1.68	0.99–2.83
Incomplete emptying					
Chronic constipation	No	1	7.13 ^b	Reference	
	Yes			2.58	1.53–4.37
Regular exercise	Yes	1	11.48 ^c	Reference	
	No			3.49	1.94–6.29

^a $P < 0.05$.

^b $P < 0.01$.

^c $P < 0.001$.

Teachers who daily consumed more caffeine were more likely to experience *nocturia* than those who consumed less caffeine per day (Table III).

Voiding and Post-Micturition Symptoms

Teachers with a family history of LUTS and the condition of chronic constipation were more likely to experience *intermittent stream* than those without such a history or condition (Table III). Teachers who had poor bladder habits or who did not exercise regularly were more likely to experience *weak urinary stream* than those who had good bladder habits or who exercised regularly (Table III). *Incomplete emptying* was more likely to occur in teachers with chronic constipation and in those who did not exercise regularly (Table III).

DISCUSSION

The results obtained from this study are discussed as they relate to the current literature on LUTS. Different grouping of LUTS variables precludes direct comparison between this work and that of Zhang et al. because LUTS were grouped as LUTS, storage symptoms, and voiding symptoms in Zhang et al.'s study.⁷

Storage Symptoms

Many studies have demonstrated that high BMI was associated with UI.^{12,14,29} Logistic regression analysis confirmed the contribution of BMI to the presence of UI in this study. Because weight loss in obese women had been shown to improve UI,³⁰ maintaining a normal BMI may be helpful in preventing UI. In this study, teachers with low BMI (<18.5) seem to have a threefold protection over being normal weight. Low intra-abdominal pressure might be the explanation for this finding. More studies are needed to explore this association.

As reported by others,^{8,9,26,31} the finding of this study confirmed that vaginal delivery is a significant predictor for UI. Also, in agreement with the findings of previous work that obstetric and/or gynecological surgery are significantly associated with UI,^{8,28,31} teachers who had obstetric and/or gynecological surgery were more than twice as likely to experience UI as those without in this study. Vaginal delivery has been demonstrated to induce stretch injury to pelvic floor muscles, nerves, and connective tissues.³² Operative trauma may weaken the structures supporting the urethra after obstetric and/or gynecological surgery.³³ Both vaginal delivery and obstetric and/or gynecological surgery may result in weakened pelvic floor structures and contribute to UI.

Although the majority of teachers with UI ($n = 73$, 61.9%) consumed normal daily fluid volumes (1,500–3,000 ml/day), 8 (6.8%), 58 (48.7%), and 18 (15.1%) teachers reported they never delayed urinating at work, reduced fluid consumption, and waited until they were thirsty to drink fluid, respectively. The adjustment of personal habits at schools for teachers in this study might result in a negative effect on their bladder health as suggested by Wall and colleagues.¹³

A work-related factor, job control, was significantly associated with UI. While the finding that bathroom breaks and straining to lift heavy subjects might be associated with UI was reported in one study, significant associations were found in the univariate analyses but not in the logistic regression analyses.¹⁴ Findings of this study imply that health care

professionals should pay attention to UI-associated factors in women who are employed in jobs where women lack control over going to the bathroom when they wish. Attention could also be paid to other factors in the work environment such as adequacy of bathroom breaks and straining to lift heavy subjects because these factors may be related to UI as suggested by Fitzgerald et al.¹⁴

Few studies had been conducted to investigate the factors associated with increased daytime urinary frequency and comparison to such studies proves challenging. The findings of this study (chronic cough and chronic constipation) are not consistent with previous work. Moller et al. reported that factors related to daytime urinary frequency were hysterectomy and abortion.⁵ Postpartum urinary frequency was associated with parity, maternal age, vaginal delivery, and anterior vaginal prolapse.³⁴ Although chronic cough is often related to smoking habits, no teachers in this study reported smoking tobacco products. The cause of chronic cough for the sample in this study deems further exploration.

Variables related to urgency in this study were not consistent with the findings of limited previous work. Moller et al.⁵ reported that factors related to urgency were the use of diuretics, hysterectomy, parity, and BMI. Parity, menopause, BMI, and smoking were associated with urgency among a sample of women who were scheduled for hysterectomy.³⁵ Based on the findings of the work presented here, maintaining good bladder habits and avoiding chronic constipation are steps that could improve urgency, and should be introduced to this population. For teachers who need to carry out the task of straining to lift heavy objects, reminding teachers to try to minimize heavy lifting might be helpful.

Published investigations of factors associated with nocturia are few. Factors previously reported to be related to nocturia included BMI, hysterectomy, post-menopausal age,⁵ caffeine consumption,²⁵ and factors such as hypertension, poor health status, and the use of medication.^{36,37} The findings of this study are consistent with the findings in previous work that nocturia is associated with age.^{36,37} In this study, the prevalence rates of nocturia increased with increasing daily caffeine consumption. However, the prevalence of nocturia for teachers who did not consume caffeine was also high ($n = 38$, 20.5%). The great variety of caffeine consumption habits in teachers who did not consume caffeine daily made the interpretation of the high prevalence of nocturia difficult among this group.

Voiding and Post-Micturition Symptoms

Moller et al.⁵ reported that factors related to incomplete emptying included use of diuretics, hysterectomy, and abortion. Women with abnormal bladder sensation and pelvic organ prolapse (cystocele or rectocele) may also experience this symptom.³⁸ The findings of this study suggest that healthy life styles, normal bowel habits, and regular exercise may be helpful for improving the symptom incomplete emptying. Further study on factors related to incomplete emptying including clinical assessment of pelvic organ prolapse or abnormal bladder sensation are needed.

Literature review reveals a lack of prior studies conducted to investigate factors related to symptoms of intermittent stream and weak urinary stream. In this study, family history of LUTS and chronic constipation were significantly associated with intermittent stream while healthy life styles, good bladder habits, and regular exercise were associated with weak urinary stream. Given the lack of data prior to this work, conclusions and suggestions on how to improve these

symptoms will require more evidence from future clinical studies also.

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 would be validated by clinical evaluations. Using bladder records, physical examinations, or urodynamic assessments to validate the classification is recommended for future studies.

CONCLUSIONS

Findings on the factors associated with individual LUTS in this study suggest an association but do not demonstrate a causal relationship. In this study, all the LUTS under logistic regression analyses were associated with 1–3 modifiable variables (body weight, chronic cough, chronic constipation, bladder habits, caffeine consumption, regular exercise, straining to lift heavy objects at work, job control). Identification of these modifiable contributing factors is valuable for improving LUTS.

With the identification of several factors related to LUTS by this work, educational programs for improving teachers' symptoms and strategies for prevention and treatment could be implemented. Educational programs could offer participants information about the possible contributing factors of LUTS, preventive interventions, and appropriate management strategies. The importance of maintaining normal body weight, good bladder/bowel habits and regular exercise, treating chronic cough, and decreasing daily caffeine consumption could be emphasized in such programs. Environmental modification in employment settings is another important issue at the individual and organizational levels. Administrators should pay attention to the work-related contributing factors and try to eliminate the effects of these factors on teachers' bladder health. Strategies could include assistive devices to eliminate the need for teachers to perform heavy lifting, maintenance of hygienic, and convenient toilet facilities, and offering teachers a reasonable degree of control over their work. Teachers need to be aware of these work-related contributing factors and provide prompt suggestions when they notice that the toilet facility is not adequate or the school policy does not facilitate the bladder health.

Evidence about the effects of personal habits and work-related factors on LUTS is limited; further randomized controlled trials are needed to confirm these associations. Studies could be conducted with different groups of employed women who work in a variety of work environments (i.e., nurses, pharmacists) to further examine the factors contributing to LUTS in the work environment found here.

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