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Prevalence and impact on quality of life of lower urinary tract symptoms among a sample of employed women in Taipei: A questionnaire survey

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ABSTRACT

Background: Previous studies about the prevalence and impact of lower urinary tract symptoms (LUTS) were focused on urinary incontinence or overactive bladder in the general population. Little research has been focused on the role that the workplace has in employed women's experiences with LUTS or the impact of LUTS on their health-related quality of life (HRQL).
Objectives: To estimate the prevalence of LUTS among employed female nurses in Taipei and to compare the HRQL for nurses with and without LUTS.
Design: This study was a cross-sectional, questionnaire survey.
Settings: Three medical centers and five regional hospitals in Taipei were selected randomly.
Participants: In the selected hospitals, 1065 female nurses were selected randomly. Data analyses were based on 907 usable surveys. All participants were native Taiwanese; most of the female nurses were 26–35 years of age (mean = 31.02, SD = 6.32), had normal body mass index, and had never given birth. Most nurses' bladder habits were poor or very poor and their personal habits of fluid consumption at work were inadequate.
Methods: Data were collected using the Taiwan Nurse Bladder Survey and the Short Form 36 Taiwan version. Chi-square tests were used to compare the prevalence rates of different LUTS for nurses in different age groups. Student's *t*-tests were conducted to compare the mean scores of HRQL for nurses with and without LUTS.
Results: Based on 907 usable surveys, 590 (65.0%) experienced at least one type of LUTS. The prevalence for different LUTS ranged from 8.0% to 46.5%. Nurses who reported LUTS also reported lower HRQL, more so on physical health than mental health, than nurses who did not report LUTS.
Conclusions: Although most of the nurses in this study were young (≦35 years) and nulliparous, LUTS were common among this group. The high prevalence rate of LUTS leads to concerns about nurses' possible dysfunctional voiding patterns and possible effects of working environment and poor bladder and personal habits on LUTS. Study results showed

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a possible negative impact of LUTS on nurses' physical health. Designing a continence-related education program for this group is essential for delivering information about LUTS prevention and management.

What is already known about the topic?

1. Previous studies examining the prevalence and impact of LUTS were focused on urinary incontinence or overactive bladder.
2. Study results showed that the overall prevalence rates of female LUTS ranged from 28% to 69%. Women with urinary incontinence or overactive bladder reported negative effects on HRQL and some aspects of work.
3. Little research has been focused on the role of the workplace in women's experiences with LUTS or the impact of these symptoms on HRQL.

What this paper adds

1. High prevalence rate of LUTS leads to a concern that working environments, poor bladder habits, or poor personal habits may affect LUTS.
2. Nurses who report LUTS also report lower HRQL, more so on physical health than mental health, than nurses who do not report LUTS.
3. Study results contribute to knowledge about LUTS among an Asian population in Taiwan. About one third of the employed nurses expressed their need for a continence-related education program.

1. Introduction

Lower urinary tract symptoms (LUTS) include three main symptom groups – storage, voiding, and postmicturition. Storage symptoms occur during the filling and storage phase of the bladder and include increased daytime urinary frequency, nocturia, urinary urgency, and urinary incontinence (UI). Voiding symptoms such as slow stream, splitting or spraying, intermittent stream, hesitancy, straining, and terminal dribble occur during the voiding phase. Postmicturition symptoms –feeling of incomplete emptying and postmicturition dribble – occur immediately after micturition (Abrams et al., 2002). Overactive bladder (OAB) is another focus of many ongoing studies and is defined as a symptom complex that includes urinary urgency with or without urgency UI, usually with increased daytime frequency and nocturia (Abrams et al., 2006).

Previous study results showed that the overall prevalence rates of female LUTS ranged from 28% to 69% (Swithinbank et al., 1999; Moller et al., 2000; Irwin et al., 2006a; Irwin et al., 2006b; Herschorn et al., 2008). The prevalence of OAB has not been well studied because it is a recently defined syndrome (Ouslander, 2004). Most studies have been focused on the effects resulting from UI or OAB (Donovan et al., 2005). Very little research has addressed the role that the workplace has in employed women's experiences with LUTS or the impact of LUTS on their health-related quality of life (HRQL). An increasing proportion of women in the global labor force is a striking phenomenon of recent times; thus, more attention will need to be given to the effects of paid employment on women's health.

Taiwan's Executive Yuan statistics showed that about half of adult women are employed and about 70% of women 20–45 years of age are working (Executive Yuan, 2006). Employed women are exposed not only to the general risk factors of LUTS, but also to the risk factors such as inadequacy of bathroom breaks or toilet facilities in their work environments (Fultz et al., 2005). Preliminary study results showed that women employed in occupations that place constraints on urinary elimination have an increased risk of developing UI. Employed women with restrictive bathroom breaks were more likely to develop LUTS than women who were not employed. Examples include women working on production lines, as nurses, as teachers, and in the military (Sampselle et al., 2004).

Women with UI or OAB reported negative impact not only on HRQL (Araki et al., 2005; Chiaffarino et al., 2003; Hägglund et al., 2001) but also on some aspects of work (Fultz et al., 2005; Margalith et al., 2004). Study results showed that women without UI or OAB reported better physical and mental health than women with these symptoms (Chiaffarino et al., 2003; Hägglund et al., 2001; Margalith et al., 2004), that UI had a greater impact on working women's physical health than mental health (Araki et al., 2005), and that severity of UI was associated negatively with HRQL (Chiaffarino et al., 2003; Yu et al., 2003). With respect to work life, women with OAB were shown in one study to be more likely to be unemployed, and those who were employed reported decreased work productivity (Irwin et al., 2006b).

Although LUTS have widespread human and psychosocial implications that negatively affect women's HRQL (Moller et al., 2000; Swithinbank et al., 1999), only one fourth to one third of women with LUTS seek professional help (Irwin et al., 2008; Roberts et al., 1998). Many women with LUTS manage symptoms with self-care strategies, and some of these strategies could have adverse effects. Restricting fluids may lead to dehydration, and frequent voiding combined with a low urine output may result in a reduction of the bladder's functional capacity, urinary tract infections (UTI), and pathogenesis (Anders, 2000; Dowd et al., 1996).

There are few international studies about female LUTS, particularly studies on the prevalence and impact of LUTS for women in Asia. Information is also limited on employed women's experiences of LUTS and the impact of LUTS. Common work environment factors associated with nurses' role stress were high job demand and work overload (Chang et al., 2005), and Bendtsen et al. (1991) reported that 69% of nurses and nursing assistants avoided urinary elimination during their work shifts. In response to the lack of information about LUTS among the Taiwanese

population and Taiwan's nurses, the major objectives of this study were to estimate the prevalence of LUTS among employed female nurses in Taipei and to compare the HRQL for nurses with and without LUTS.

2. Materials and methods

2.1. Sample

The majority of nurses in Taipei (73%) were employed at medical centers or regional hospitals (Taipei City Nurse Association, 2004). Therefore, the target population of this study was defined as all female nurses who were employed at the medical centers or regional hospitals in Taipei. In Taipei, there were over 9000 nurses in seven medical centers and 4000 nurses in 11 regional hospitals (Taipei City Nurse Association, 2004).

A formula ($n_0 = 4pq/d^2$) was used to calculate the required representative 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) (Biemer and Lyberg, 2003).

The working assumptions for computing the required sample size were: (a) the prevalence of LUTS is 50%, (b) the margin of error for an estimate of prevalence is 2.5 percentage points or less (Biemer & Lyberg, 2003), (c) the expected response rate would be 85% (Lai et al., 2003), and (d) approximately 10% of completed questionnaires would not be usable (Lai et al., 2003). Based on the above assumptions, the required sample size was 533 nurses at Taipei's medical centers plus 508 nurses at Taipei's regional hospitals. This required sample size was the most conservative one under the assumption that the prevalence of LUTS is 50% and generated the maximum required sample size.

A two-stage sampling method was used to select the sample of this study. In the first stage, three medical centers and five regional hospitals were selected randomly from the list. If the Director of the Department of Nursing in a selected medical center or hospital refused to participate, another medical center or hospital would be selected randomly from the list as a substitute. In the second stage, a simple random sample of 180 and 105 nurses was selected from the selected medical centers and regional hospitals, respectively. If a selected nurse refused to participate, another nurse would be selected randomly from the same institution. This approach reduced the need for adjusting the sample weights for nonresponse, because characteristics of nurses within the same institution were expected to be correlated.

2.2. Data collection and ethical consideration

2.2.1. Survey and measurement

The Taiwan Nurse Bladder Survey (TNBS) was used to estimate the prevalence of LUTS. Development of the TNBS was based on the content of the Taiwan Teacher Bladder Survey (TTBS). The process of instrument generation and initial psychometric testing for the TTBS has been described previously, and internal consistency for the construct validity, content validity, and test-retest reliability of the TTBS were found to be adequate (Liao et al., 2006).

For generating an instrument suitable for this study, modifications were made on the TTBS. First, the word "school" in the 12 statements related to employment setting was changed to "hospital." Second, six items related to nurses' working experiences were added into the TNBS and two items related to teachers' working experience were eliminated. Third, three items related to nurses' experiences on performing Kegel exercises were added because this experience might be related to the presence of LUTS. The TNBS included 85 items to collect information about LUTS and UTI (40 items), individual characteristics (17 items), personal habits (20 items), and work-related factors (8 items). Some items related to individual characteristics, personal habits, and work-related factors were included to investigate possible factors related to individual LUTS and are beyond the scope of this paper. Five experts (two female nurses, two female head nurses, and one urologist) were invited to review the content validity of the TNBS. The grading system and the criterion for assuring an item has content validity were based on the standard proposed by Lynn (1986). Content validity of the TNBS was confirmed by the five experts.

The presence of LUTS was defined as the self-reported occurrence during the past 12 months of UI, increased daytime urinary frequency, urinary urgency, nocturia, intermittent stream, weak urinary stream, hesitancy, or a feeling of incomplete emptying. These LUTS were chosen because they are prevalent among women (Irwin et al., 2006a; Moller et al., 2000; Perry et al., 2000; Zhang et al., 2005). Most of the definitions for individual LUTS used in this study were based on the standardization report proposed by the International Continence Society (Abrams et al., 2002, 2006) and all of them were reported in a related study (Liao et al., 2007).

Information related to UTI was collected because several LUTS such as UI, urinary frequency, and urinary urgency are associated with UTI. The presence of OAB was not investigated because identification of this symptom was difficult based on participants' self-reports. For nurses with UI, information related to the type and severity of UI was collected. Sandvik's UI severity index was used to represent UI severity (Sandvik et al., 2000). Classification methods used for UI type and severity were reported in a related study (Liao et al., 2007). Classification methods used for categorizing nurses' individual characteristics, personal habits, and work-related factors were the same as the ones used in a recent study (Liao et al., 2008).

The Short Form 36 (SF-36) Health Survey was used to assess nurses' HRQL. The SF-36 has been used widely in the medical literature to measure HRQL and is suitable to measure HRQL for nurses with or without LUTS. The SF-36 includes 36 items to represent self-perceived change in health (one item) and eight specific HRQL aspects: physical functioning (10 items), role limitation due to physical health problems (four items), bodily pain (two items), general health (five items), vitality (four items), social

functioning (two items), role limitation due to emotional problems (three items), and mental health (five items). For each aspect of HRQL, a score ranging from 0 to 100 was obtained; a higher score indicates better health status and higher HRQL. The reliability and validity tests of the SF-36 Taiwan version satisfied most conventional psychometric criteria (Tseng et al., 2003). Approval to use the SF-36 Taiwan version in this study was acquired.

2.2.2. Pilot study

A pilot study was conducted to obtain feedback on possible problem areas on the TNBS. Institutional review board approval was obtained for conducting this pilot study. Thirty female nurses employed at one regional hospital were invited to complete the TNBS and the SF-36 Taiwan version. One item about the time spent on completing the survey was added at the end of the survey. The nurses were encouraged to provide any suggestions or ask questions about the survey. There were no specific criteria for exclusion except that male nurses and female nurses who had worked less than 1 year or worked part-time were not invited.

Informed consent letters, surveys, and incentives (US$10) were distributed by the principal investigator. Nurses were instructed to return completed surveys within 10 days to a sealed box left at the office of Department of Nursing. The principal investigator picked up the box 2 weeks after the surveys were distributed. The average time spent completing the survey was 16 min (range = 9–20). Participants did not report any specific problems in the data collection process. The pilot study confirmed the adequacy of the data collection process and helped to streamline the study procedure.

2.2.3. Main study

Institutional review board approvals from the selected medical centers and regional hospitals were obtained. The sample included 540 nurses at three medical centers and 525 nurses at five regional hospitals in Taipei. The data collection procedure was similar to the one used in the pilot study.

2.3. Data analysis

SPSS for Windows was used to analyze the data. Descriptive statistics were calculated to demonstrate the prevalence of LUTS along with the distributions of nurses' individual characteristics, personal habits, and work-related factors. Chi-square tests were used to compare the prevalence rates of different LUTS for nurses in different age groups. Student's *t*-tests were conducted to compare the mean scores of the eight HRQL aspects in the SF-36 Taiwan version for nurses with and without LUTS. A *p*-value of less than 0.05 was regarded as statistically significant.

3. Results

All the Directors of the Department of Nursing from the selected medical centers and regional hospitals gave approval to participate in this study. A total of 1065 ($180 \times 3 + 105 \times 5 = 1065$) surveys were distributed to the three medical centers and five regional hospitals. Of the 1065 selected female nurses, 92 declined participation, so 92 additional nurses were selected randomly as substitutes. Among the 1065 nurses initially selected, 927 completed the survey, resulting in a response rate of 87.0%. Of the 927 completed surveys, 840 were usable. Of the 92 substitutes, 76 completed the surveys, of which 67

Table 1
Demographic characteristics ($n = 907$).

Variable	N	%
Age (range: 21–59 years, mean = 31.02, SD = 6.32)		
21–25	142	15.8
26–30	382	42.4
31–35	205	22.8
36–40	91	10.1
>40	81	9.0
Missing	6	
Body mass index (BMI) (range: 15.18–33.20, mean = 20.60, SD = 2.59)		
<18.5 underweight	165	18.5
18.5–24.9 normal	677	76.0
≧25 overweight	49	5.5
Missing	16	
Marital status		
Married	263	29.1
Single (separated, divorced, or widowed)	30	3.3
Single, never married	612	67.6
Missing	2	
Parity		
Zero	710	78.6
One	85	9.4
Two	90	10.0
Three and above	18	2.0
Missing	4	
Delivery method		
Never given birth	710	80.4
Vaginal delivery	109	12.3
Cesarean section	55	6.2
Vaginal delivery and Cesarean section	9	1.0
Missing	24	
History of gynecological surgery		
Yes	73	8.2
No	822	91.8
Missing	12	
Working experience		
>1–2 years	102	11.3
>2–4 years	240	26.7
>4–6 years	143	15.9
>6–8 years	120	13.3
>8–10 years	94	10.4
>10–15 years	107	11.9
>15–20 years	56	6.2
>20 years	38	4.2
Missing	7	
Working unit		
Medical-surgical units	297	33.0
Special units (ER, DR, BR and ICU)	363	40.3
Out patient department, hemodialysis room, psychiatric unit	133	14.8
Operation room	62	6.9
Administration department, infection control or TPN services	24	2.7
Community nursing, nursing home	20	2.3
Missing	8	

Note: ER = emergency room; DR = delivery room; BR = baby room; ICU = intensive care unit; TPN = total parenteral nutrition.

Table 2
Personal habits and work-related factors (n = 907).

Personal habits/work-related factors	n	%
Fluid intake (ml/day)		
<1500 ml/day	375	41.6
1500–3000 ml/day	445	49.4
>3000 ml/day	81	9.0
Missing	6	
Caffeine consumption (mg/day)		
0 mg/day	259	28.6
<100 mg/day	165	18.2
100–400 mg/day	416	45.9
>400 mg/day	67	7.3
Bladder habits		
Very good	52	5.7
Good	135	14.9
Poor	326	35.9
Very poor	394	43.5
Delay urinating at work		
Never	92	10.2
Sometimes (1 day a week or less)	195	21.5
Usually (2 or 3 days a week)	377	41.5
Always (everyday or nearly everyday)	243	26.8
Reduce fluid consumption at work		
Never	222	24.6
Sometimes (1 day a week or less)	155	17.1
Usually (2 or 3 days a week)	277	30.6
Always (everyday or nearly everyday)	250	27.7
Missing	3	
Did not drink fluid until you were thirsty at work		
Never	65	7.2
Sometimes (1 day a week or less)	119	13.2
Usually (2 or 3 days a week)	299	33.1
Always (everyday or nearly everyday)	419	46.5
Missing	5	
Too busy to drink fluid at work		
Never	42	4.6
Sometimes (1 day a week or less)	117	12.9
Usually (2 or 3 days a week)	325	35.9
Always (everyday or nearly everyday)	421	46.6
Missing	2	
Adequacy of bathroom breaks		
Very good	196	21.8
Good	255	28.3
Poor	358	39.8
Very poor	91	10.1
Missing	7	
Adequacy of toilet facility		
Very good	89	9.8
Good	549	60.7
Poor	242	26.8
Very poor	24	2.7
Missing	3	

were usable. Of the 1003 completed surveys, 96 surveys completed by nurses who were pregnant or who currently had a UTI, or with numerous missing item responses were excluded from the analyses. Data analyses were based on the 907 usable surveys. Given the high response rate, weighting for nonresponse would have little effect on the estimates and would tend to increase the variance of the estimates. Therefore, weighting for nonresponse was not conducted.

All participants in this study were native Taiwanese and employed full-time as nurses in Taipei. Most of the nurses were 26–35 years of age (mean = 31.02, SD = 6.32), had normal BMI, and had never given birth (Table 1). The distributions of nurses' personal habits and work-related factors are presented in Table 2. Most nurses' (n = 720, 79.4%) bladder habits were poor or very poor. During the regular 8-h shifts, 620 (68.3%) nurses usually or always delayed urinating. At work, most nurses reported that they usually or always reduced fluid consumption (n = 527, 58.3%), did not drink fluid until they felt thirsty (n = 718, 79.6%), and/or were too busy to drink fluid (n = 746, 82.5%). Official bathroom breaks are not scheduled at the hospitals; nurses may go to the restrooms whenever they need to. However, about 50% nurses rated the adequacy of bathroom breaks as poor or very poor (Table 2).

Of the 907 nurses, 590 (65.0%) experienced at least one type of LUTS. Prevalence rates for different LUTS ranged from 8.0% to 46.5% (Table 3). For the majority of the nurses with LUTS, symptoms had lasted from 1 month to 1 year (55–60%) and occurred less than once a month (40–50%) or one or several times a month (35–45%). For any LUTS, UI, and increased daytime urinary frequency, the prevalence rates were significantly different for nurses in different age groups. The prevalence rates for UI increased with age. Nurses who were 21–35 years of age were more likely to experience LUTS and increased daytime urinary frequency than nurses who were more than 35 years of age (Table 3).

For nurses with UI, 25 (30.9%) experienced stress UI; 42 (51.9%) experienced mixed UI; and 14 (17.2%) experienced urge UI. Based on Sandvik's UI severity index (Sandvik et al., 2000), 67 (82.7%), 12 (14.8%), and 2 (2.5%) experienced slight, moderate, and severe UI, respectively. Thirty-four (41.0%) nurses had experienced UI with a duration of more than 1 month and less than 1 year, and 27 (32.5%) with a duration of 1–5 years; 42 (51.9%) nurses experienced UI no more than once a month and 28 (34.6%) nurses experienced UI one or several times a month.

The mean scores of HRQL were significantly different for nurses with and without LUTS only on five HRQL aspects in the SF-36: physical functioning, role limitation due to physical health problems, bodily pain, general health, and social functioning, with nurses without LUTS reporting higher scores than nurses with LUTS (Table 4). Information about the norm of the SF-36 Taiwan version for Taiwanese women ages 12 years and above (Tseng et al., 2003) is listed in Table 4. Nurses' mean HRQL scores were all within 1 SD of the population mean.

In this study, exploring the association between LUTS severity and HRQL was not feasible because of the lack of information on LUTS severity. Although UI severity was investigated in this study, the small sample size of nurses with UI (n = 84) and uneven distribution of UI severity limited the analyses. Another important finding of this study was that among the 901 nurses who answered the item about their need for a continence-related education program, 319 (35.4%) expressed their need for such offering.

Table 3
Prevalence rates of LUTS and chi-square tests of the prevalence rates by different age groups ($n = 907$).

LUTS	Total/age group	Yes *n* (%)	No *n* (%)	χ^2	*p*
Any LUTS	Total	590 (65.0)	317 (35.0)		
	21–25	92 (63.9)	52 (36.1)	10.86	0.03*
	26–30	249 (65.2)	133 (34.8)		
	31–35	149 (72.0)	58 (28.0)		
	36–40	49 (53.8)	42 (46.2)		
	>40	48 (57.8)	35 (42.2)		
UI	Total	84 (9.3)	823 (90.7)		
	21–25	9 (6.2)	135 (93.8)	32.91	<0.001***
	26–30	25 (6.5)	357 (93.5)		
	31–35	19 (9.2)	188 (90.8)		
	36–40	11 (12.1)	80 (87.9)		
	>40	22 (26.5)	61 (73.5)		
Increased daytime urinary frequency	Total	420 (46.5)	484 (53.5)[a]		
	21–25	68 (47.6)	75 (52.4)[a]	14.60	<0.01**
	26–30	175 (45.9)	206 (54.1)[a]		
	31–35	114 (55.3)	92 (44.7)[a]		
	36–40	35 (38.5)	56 (61.5)		
	>40	28 (33.7)	55 (66.3)		
Urgency	Total	137 (15.2)	765 (84.8)[a]		
	21–25	20 (13.9)	124 (86.1)	3.98	0.41
	26–30	61 (16.0)	320 (84.0)[a]		
	31–35	38 (18.4)	168 (81.6)[a]		
	36–40	10 (11.2)	79 (88.8)[a]		
	>40	10 (12.2)	72 (87.8)[a]		
Nocturia	Total	103 (11.4)	803 (88.6)[a]		
	21–25	15 (10.4)	129 (89.6)	9.36	0.05
	26–30	44 (11.5)	338 (88.5)		
	31–35	34 (16.4)	173 (83.6)		
	36–40	4 (4.4)	87 (95.6)		
	>40	9 (11.0)	73 (89.0)[a]		
Intermittent stream	Total	93 (10.3)	811 (89.7)[a]		
	21–25	16 (11.1)	128 (89.9)	0.78	0.94
	26–30	40 (10.5)	340 (89.5)[a]		
	31–35	22 (10.6)	185 (89.4)		
	36–40	7 (7.7)	84 (92.3)		
	>40	10 (12.2)	72 (87.8)[a]		
Hesitancy	Total	72 (8.0)	831 (92.0)[a]		
	21–25	10 (6.9)	134 (93.1)	6.72	0.15
	26–30	39 (10.2)	342 (89.8)[a]		
	31–35	18 (8.8)	187 (91.2)[a]		
	36–40	4 (4.4)	86 (95.6)[a]		
	>40	4 (4.8)	79 (95.2)		
Incomplete emptying	Total	165 (18.3)	739 (81.7)[a]		
	21–25	28 (19.4)	116 (80.6)	2.85	0.58
	26–30	73 (19.2)	308 (80.8)[a]		
	31–35	41 (19.9)	165 (80.1)[a]		
	36–40	14 (15.6)	76 (84.4)[a]		
	>40	11 (13.3)	72 (86.7)		
Weak urinary stream	Total	122 (13.5)	782 (86.5)[a]		
	21–25	17 (11.8)	127 (88.2)	3.38	0.50
	26–30	54 (14.2)	325 (85.8)[a]		
	31–35	34 (16.4)	173 (83.6)		
	36–40	10 (11.0)	81 (89.0)		
	>40	9 (10.8)	74 (89.2)		

Note: LUTS = lower urinary tract symptoms; UI = urinary incontinence.
* $p < 0.05$.
** $p < 0.01$.
*** $p < 0.001$.
[a] 1–5 Missing values.

4. Discussion

The results are interpreted in light of the limitations and the literature on LUTS and OAB. This study is limited by the cross-sectional study design and self-report on many important variables. Because this study was conducted with employed female nurses in Taipei, the results should be generalized with caution and do not infer to a causal

Table 4
Comparison of the HRQL for nurses with and without LUTS ($n = 907$).

Aspects in the SF-36	Female norm of the SF-36 Taiwan version[a] Mean (SD)	Nurses with LUTS ($n = 590$), mean (SD)	Nurses without LUTS ($n = 317$), mean (SD)	Ranges	t	p
Physical functioning	90.52 (17.36)	90.31 (14.38)	93.24 (11.87)	0–100	−2.38	0.02*
Role limitation due to physical health problems	80.91 (35.31)	80.17 (33.77)	85.90 (28.25)	0–100	−1.97	0.04*
Bodily pain	82.14 (20.32)	75.94 (19.07)	80.35 (21.56)	12–100	−2.23	0.03*
General health	67.08 (21.99)	59.67 (18.03)	65.68 (17.59)	10–100	−3.49	0.00***
Vitality	65.64 (19.02)	49.81 (16.96)	52.02 (16.94)	0–95	−1.35	0.18
Social functioning	85.78 (17.46)	70.69 (18.74)	75.36 (19.52)	0–100	−2.53	<0.01**
Role limitation due to emotional problems	77.59 (37.33)	73.33 (38.55)	75.72 (37.55)	0–100	−0.66	0.51
Mental health	70.99 (16.88)	58.16 (14.54)	59.21 (14.88)	0–96	−0.74	0.46

Note: HRQL = health-related quality of life; LUTS = lower urinary tract symptoms; t: comparison of the means between nurses with and without LUTS.
[a] Information was from Tseng et al., 2003 for Taiwanese women aged 12 and above.
* $p < 0.05$.
** $p < 0.01$.
*** $p < 0.001$.

relationship. Another limitation of this study is that information about the age distribution of female nurses and their working experiences in Taipei was not available at the Taipei City Nurse Association. Confirming that a representative sample was selected was not feasible.

A literature search of the PubMed database over the time period 1995–2008 was conducted and summarized. Key words included "prevalence," "lower urinary tract symptom," "urinary symptom," and "women." Ten prevalence studies about LUTS that were conducted among young or middle-aged (<65 years) women were included because the samples of these studies were similar in age to nurses in the current study. The following information about these studies is listed in Table 5: (a) prevalence of any LUTS; (b) prevalence of individual LUTS; (c) data collection method and instrument; (d) sample and setting; and (e) age ranges of subjects. Studies conducted among women with a mean age over 60 years (Homma et al., 2006), studies investigating less than 4 urinary symptoms (Araki et al., 2005; Tikkinen et al., 2008), and studies not reporting the prevalence of individual LUTS (Hansen, 2004; Low et al., 2006) were not included in Table 5.

The prevalence rate of any LUTS (65.0%) in this study is similar to the rates reported by Swithinbank et al. (69.0%) and Liao et al. (65.8%) and higher than the rates (range = 28.5–57.0%) reported in five community studies (Herschorn et al., 2008; Irwin et al., 2006a; Moller et al., 2000; Perry et al., 2000; Pinnock & Marshall, 1997) and three community studies conducted in Asia (Brieger et al., 1996; Chen et al., 2003; Zhang et al., 2005). This finding suggests that employment status may be associated with LUTS because the prevalence of any LUTS for female nurses in this study is similar to the rate for women recruited from clinical practice (Swithinbank et al., 1999) and to another study conducted among Taiwan's employed women (Liao et al., 2007).

Consideration of the concept of dysfunctional voiding is warranted because the prevalence rate of any LUTS in this study was high. Dysfunctional voiding is an abnormality of bladder emptying in neurologically normal individuals in whom there is increased external sphincter activity during voluntary voiding. Contraction of the external sphincter is a normal "guarding" response to control urgent urination and results in a reflex inhibition of the detrusor. When the action becomes a habit over time, abnormal coordination carries over to voluntary voiding. Dysfunctional voiding is a learned behavior and may result in various LUTS including storage symptoms, voiding symptoms, and recurrent UTI. Urinary frequency and urinary urgency were the most common presenting symptoms for dysfunctional voiding (Carlson et al., 2001). Consensus is poor on the diagnostic criteria for female voiding dysfunction. An accurate diagnosis can be made by history taking; frequency and volume charting; and other objective measures such as uroflowmetry, cystometry, ultrasonography, electromyography, and video-urodynamics (Olujide and O'Sullivan, 2005).

Researchers noted that dysfunctional voiding was the most common abnormality of the voiding phase for women with LUTS (Nitti and Fiske, 1999). Bellina et al. (1999) suggested that dysfunctional voiding may result from voluntary withholding of urination in women who worked long hours. Fan et al. (2008) reported that women with dysfunctional voiding experienced a greater degree of depression and anxiety compared to asymptomatic controls, but the cause-and-effect relationship between dysfunctional voiding and psychological abnormalities remains unknown.

Nursing is an occupation subject to a high degree of stress. Associations between nurses' job strain and physiological stress responses such as blood pressure variability and urinary catecholamine excretion have been reported (Brown et al., 2003, 2006). A possible association between psychological malfunction and bladder function has been reported. Klausner and Steers (2004) proposed that corticotrophin-releasing factor is expressed in the areas of the central nervous system that control voiding and response to stress, and the corticotrophin-releasing factor is increased during anxiety, depression, pain, and functional disorders of the pelvic viscera. Based on the information collected in this study, possible effects came from the nurses' working environment, and poor bladder and personal habits were inferred. In this study, information was not collected about job strain, psychological

Table 5
Prevalence rates of female LUTS in different studies.

Author		Brieger et al.	Pinnock et al.	Swithinbank et al.	Moller et al.	Perry et al.	Chen et al.
Year		1996	1997	1999	2000	2000	2003
Country		Hong Kong	Australia	UK	Denmark	UK	Taiwan
Data collection method		Telephone interview	Household interview	Mailed, self-completed survey	Mailed, self-completed survey	Mailed, self-completed survey	Home interview
Questionnaire		Self-developed questionnaire	IPSS	BFLUTS	Self-developed questionnaire	Self-developed questionnaire	BFLUTS
Population and setting		Random sample of women resided in the territory of Hong Kong	A probability sample of the community women in South Australia	Women registered with one group of general practice	Random sample of women resided in Danish civil registration system	Women registered with general practitioners at Leicestershire	A random sample of community women in the general population
Eligible subjects/subjects		819/3248	1686/1734	2075/2641	2860/4000	5544/7659	1253/1581
Participants' age (years)		10–90 (mean = 41.5)	>18	19–97 (mean = 52.0)	40–60	≧40	≧20 (mean = 43.2)
Storage (%)	Mix UI	–	–	–	16.4	20.2	–
	Stress UI	21.0	–	60.0	13.1		35.0
	Urge UI	15.0	–	46.0	7.3		9.1
	Urgency		8.5	61.0	18.1	8.8	12.6
	Daytime frequency	19.0	18.4	15.0	3.5	9.1	21.1
	Nocturia	20.0	17.0	19.0	2.6	20.9	25.5
Voiding (%)	Slow (weak) stream	13.0	4.7	19.0	–	–	–
	Intermittent stream		2.3	26.0	–	–	–
	Hesitancy		–	24.0	1.7	–	–
	Straining		–	8.0	1.0	0.5	–
Post micturition (%)	Incomplete emptying	–	–	43.0	4.3	–	–
	Dribble	–	–	–	2.4	–	–
Overall (%)		46.9	39.3	– (>61.0) 69.0% for UI only	28.5	38.8	– (>35.0)

Author		Zhang et al.		Irwin et al.		Liao et al.		Herschorn et al.	Liao et al.	
Year		2005		2006a		2007		2008	Current study	
Country		China		Canada, Germany, Italy, Sweden And UK		Taiwan		Canada	Taiwan	
Data collection method		Mailed, self-completed survey		Computer-assisted telephone interview (CATI)		Hand-delivered, self-completed survey		Telephone survey	Hand-delivered, self-completed survey	
Questionnaire		BFLUTS		Self-developed questionnaire and IPSS		TTBS		Self-developed questionnaire	TNBS	
Population and setting		A random sample of women registered in Fuzhou, China		A random sample of women in the general population at five countries		A random sample of female school teachers in Taipei		A random sample of women in the general population	A random sample of female nurses in Taipei	
Eligible subjects/subjects		4684/6066		19,165/58,139 (men + women)		445/520		518/≒1300	907/1065	
Participants' age (years)		≧20 (mean = 40.0)		≧18		23–62 (mean = 38.9)		≧18 (mean = 44.5)	21–59 (mean = 31.0)	
Storage (%)	Mix UI	37.3	–	34.2	2.4	26.7	10.6	–	9.3	4.6
	Stress UI		16.6		6.4		13.5	25.5		2.8
	Urge UI		10.0		1.5		1.8	9.3		1.6
	Urgency		10.2		12.8	17.8		14.1	15.2	
	Daytime frequency		16.4		7.4	44.5		14.9	46.5	
	Nocturia		9.9		24.0	16.0		10.2	11.4	
Voiding (%)	Slow (weak) stream	13.4	5.5	19.5	6.4	27.7		–	13.5	
	Intermittent stream		4.8		7.2	18.9		–	10.3	
	Hesitancy		6.8		–	9.9		–	8.0	
	Straining		4.5		4.0	–		–	–	
Post micturition (%)	Incomplete emptying	–		14.2	12.3	26.1		–	18.3	
	Dribble	4.1			3.1	–		–	–	
Overall (%)		– (>37.3)		48.1		65.8		57.0	65.0	

Note: LUTS = lower urinary tract symptoms; UI = urinary incontinence; IPSS: International Prostate Symptom Score; BFLUTS: Bristol Female Lower Urinary Tract Symptoms Questionnaire; TTBS: Taiwan Teacher Bladder Survey; TNBS: Taiwan Nurse Bladder Survey.

profile, frequency and volume chart, and other objective measures of the bladder function. Additional studies are needed to explore the relationships among psychological malfunction, dysfunctional voiding pattern, and LUTS.

The relationship between LUTS and age in this study is puzzling. The prevalence of any LUTS in each age group was high (>50%). In another study, the prevalence of LUTS increased with age ($p < .01$), and factors such as menopause, parity >2, and episiotomy were found to be associated with LUTS (Zhang et al., 2005). However, in this study: (a) above 95% of nurses who were 21–30 years of age were nulliparous, (b) about 72% of nurses who were 31–35 years of age were nulliparous, (c) 60–70% of nurses more than 35 years of age had given birth, and (d) most nurses were 35 years of age or younger. The high prevalence rate of LUTS among nurses younger than 35 years of age is difficult to explain and is not consistent with other studies in which LUTS increase with age. Further studies are needed to examine the factors related to the high prevalence rate for nurses younger than 35 years of age.

4.1. Storage symptoms

4.1.1. Urinary incontinence

In women with UI, a gradual increase of UI prevalence across adulthood occurs up to the age of 50 years and a stabilization or slight decrease occurs until the age of 70 years (Hunskaar et al., 2005). The finding of a steadily increasing prevalence of UI with increasing age in this study was consistent with Hunskaar et al. and with the findings of other studies (Brieger et al., 1996; Zhang et al., 2005). Because older nurses were not available for this study, the small sample size ($n = 14$) of nurses 51 years old or greater may explain the lack of information about a decrease in the prevalence of UI after the age of 50 years.

The prevalence of UI in this study (9.3%) is lower than the results reported in the review of epidemiologic studies (Hunskaar et al., 2005) and the other studies conducted among employed women (Araki et al., 2005; Fultz et al., 2005; Liao et al., 2007). For the prevalence studies conducted in Asia, a higher overall prevalence rate of UI was reported (Chen et al., 2003). However, results of this study are consistent with the findings of several studies in which UI was found to be not common among young women (Hunskaar et al., 2005; Zhang et al., 2005). Multiple factors related to female UI include aging, body mass index, menopause, hysterectomy, pregnancy, and parity (Sampselle et al., 2004). In this study, special individual characteristics including the small proportion of nurses who were over 35 years of age, had given birth, or had a history of gynecological surgery might explain the low prevalence rate of UI.

The findings of this study on UI severity are similar to the findings of previous researchers (Liao et al., 2007; Moller et al., 2000), but findings on the proportions of different types of UI in this study are not consistent with Hunskaar et al. (2005) in which about half of the women with UI experienced stress UI, a smaller proportion experienced mixed UI, and the smallest proportion experienced urge UI. Surveys of young women have reported a predominance of stress UI (Hunskaar et al., 2005). During women's young adulthood, childbirth predisposes women to stress UI and parity is associated strongly with stress UI. Various changes such as levator ani muscle strength decreases and descent of the bladder neck occurs after delivery (Hunskaar et al., 2005). Most nurses in this study were nulliparous, which might explain the low prevalence rate of stress UI. The reason for the high prevalence rate of mixed UI among this group needs to be further examined.

4.1.2. Increased daytime urinary frequency

The prevalence of increased daytime urinary frequency in this study (46.5%) is higher than that found in previous studies (range = 3.5–21.1%) (Table 5). In this study, 78% of the nurses with increased daytime urinary frequency urinated eight or more times during their waking hours. Possible explanations for the high prevalence rate are: (a) nurses' functional bladder capacity might be reduced because their frequent voiding combined with a low urine output (Khullar & Cardozo, 2001), (b) poor personal or bladder habits (e.g., usually or always delay urinating at work) and work-related factors (e.g., inadequacy of bathroom breaks) might result in the dysfunctional voiding pattern (Carlson et al., 2001), and (c) caffeine consumption may be associated with this symptom (Bird et al., 2005), and only 126 (30%) nurses with increased daytime urinary frequency did not consume caffeine daily. Other factors such as inflamed bladder, detrusor instability, and increased bladder sensation in a normal bladder are related to increased urinary frequency (Khullar & Cardozo, 2001). Future studies are needed to collect information about possible factors related to this symptom that were beyond the scope of this study.

4.1.3. Urgency

The prevalence of urgency in this study (15.2%) is similar to the results reported by five studies (Chen et al., 2003; Herschorn et al., 2008; Irwin et al., 2006a; Liao et al., 2007; Moller et al., 2000) and higher than the results reported in four studies (Perry et al., 2000; Pinnock and Marshall, 1997; Tikkinen et al., 2008; Zhang et al., 2005) but lower than the result reported by Swithinbank et al. (1999). In Tikkinen et al.'s study (2008), surgery of stress UI was found to be associated with urgency among 1728 women 18–79 years of age. Above 90% of nurses in this study had not undergone gynecological surgery, which may explain the low prevalence rate partially. However, varied definitions, age distributions, and data collection methods used in different studies make it difficult to draw conclusions about the similar or different findings.

4.1.4. Nocturia

The prevalence of nocturia in this study (11.4%) is similar to the results reported by Herschorn et al. (2008), Tikkinen et al. (13.0%; 2008), and Zhang et al. (2005); lower than the results reported in seven studies (Brieger et al., 1996; Chen et al., 2003; Irwin et al., 2006a; Liao et al., 2007; Perry et al., 2000; Pinnock & Marshall, 1997; Swithinbank et al., 1999); and higher than the results reported by Moller et al. (2000). In Moller et al.'s study, women who usually

experienced nocturia were defined as having nocturia, but women who sometimes experienced nocturia were not defined as having nocturia. This conservative operational definition might explain the low prevalence rate in Moller et al.'s study.

A similar definition of nocturia was used in this study and a majority of the previous studies. The prevalence of nocturia is observed to increase with age and is more common in men (Appell and Sand, 2008). The special age distribution of the sample in this study might explain the low prevalence rate of nocturia. For example, a different age categorization (63.4% of female teachers were more than 35 years of age) could affect the results of a study conducted in Taiwan's employed women (Liao et al., 2007). In Tikkinen et al.'s study (2008), several reproductive factors (parity, postpartum, and postmenopausal status) were found to be associated with nocturia. About 80% of nurses in this study were nulliparous and above 90% of them were under 40 years of age, perhaps explaining the low prevalence rate.

4.2. Voiding and postmicturition symptoms

Prevalence rates for voiding and postmicturition symptoms have been reported in few studies. The varied study results might result from different definitions of symptoms, sample characteristics, or data collection methods and these differences make comparison to the current study results difficult. Voiding symptoms among nurses in this study were less common than the findings reported by Zhang et al. (2005) who found that menopause, parity >2, and episiotomy were associated with voiding symptoms. The findings of Zhang et al. about the possible factors related to voiding symptoms explained why the prevalence of voiding symptoms was less common among this group. Incomplete emptying was prevalent among the nurses in this study. In future studies, acquiring direct information about nurses' pelvic floor function through physical examination or urodynamic studies (Khullar and Cardozo, 2001) might help to understand the reasons of the high prevalence rate.

4.3. Health-related quality of life

Three UI or OAB studies used SF-36 or SF-12 to measure participants' HRQL and reported that women with UI or OAB had significantly lower scores on physical and mental health than women without these symptoms (Chiaffarino et al., 2003; Hägglund et al., 2001; Margalith et al., 2004). In comparison to the age distribution of this study, these studies used samples with wide ranges of age (Chiaffarino et al., 40–88 years of age; Hägglund et al., 18–72 years of age; Margalith et al., 22–65 years of age). Because the sample in this study of nurses was restricted in age range, the impact of LUTS on nurses' mental health was not detected readily, although it may be evident in a different sample. Araki et al. (2005) reported that the impact of UI on physical health was high in working women 20–29 years of age and its impact on mental health increased in the older age groups. This finding may explain why the nurses in this study reported more physical health impairment than mental health impairment.

5. Conclusions

This study contributes to knowledge about LUTS among employed women in Asia and increases the awareness of this health concern. Although most of the nurses in this study were young and nulliparous, LUTS were common among this group. The high prevalence rate of LUTS leads to a concern that the working environment and nurses' poor bladder habits and poor personal habits may affect LUTS.

Nurses' working conditions are associated with the quality and safety of patient care. Study results showed that LUTS might have a negative impact on nurses' physical health. The time and effort devoted to managing LUTS may reduce nurses' performance in their work tasks. A continence-related education program is suggested and may benefit both the employers and the employees (nurses) by decreasing employers' indirect costs in lost productivity and by maximizing employees' well being. Finding that about one third of the nurses expressed the need of a continence-related education program is encouragement to devote efforts toward this goal.

To achieve good bladder health, employed nurses should be aware of and try to modify their poor bladder habits and personal habits. Hospital administrators should pay attention to and try to eliminate the possible negative impact of working environment on nurses' bladder health. Helpful strategies in the working environment such as increasing staffing, providing support personnel, or offering reasonable bathroom breaks during work shifts could be implemented.

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