



# The association of healthcare seeking behavior for anxiety and depression among patients with lower urinary tract symptoms: A nationwide population-based study

Charles Lung-Cheng Huang<sup>a,b</sup>, Chung-Han Ho<sup>c,d</sup>, Shih-Feng Weng<sup>c,d</sup>, Ya-Wen Hsu<sup>d</sup>, Jhi-Joung Wang<sup>c</sup>, Ming-Ping Wu<sup>e,f,\*</sup>

<sup>a</sup> Department of Psychiatry, Chi Mei Hospital, Tainan, Taiwan

<sup>b</sup> Department of Social Worker, Chia Nan University of Pharmacy and Science, Tainan, Taiwan

<sup>c</sup> Department of Medical Research, Chi Mei Hospital, Tainan, Taiwan

<sup>d</sup> Department of Hospital and Health Care Administration, Chia Nan University of Pharmacy and Science, Tainan, Taiwan

<sup>e</sup> Division of Urogynecology and Pelvic Floor Reconstruction, Department of Obstetrics and Gynecology, Chi Mei Hospital, Tainan, Taiwan

<sup>f</sup> Center of General Education, Chia Nan University of Pharmacy and Science, Tainan, Taiwan

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## ABSTRACT

Lower urinary tract symptoms (LUTS) have a negative impact on the quality of life, and may relate to anxiety and depression. The objective of this study was to test the hypothesis that LUTS are associated with anxiety and depression using a nationwide population-based database in Taiwan. Data were obtained from a random population sample of about one million enrollees in the National Health Insurance program from 2001 to 2009, and consisted of 22,980 LUTS patients and 45,960 matched controls. The records of healthcare seeking for anxiety and depression were collected 2 years before and after the diagnosis of LUTS. The results showed that patients with LUTS had a significantly higher prevalence of anxiety or depression than the matched controls (11.45% vs. 5.72%). After controlling for sociodemographic variables and other major systemic diseases, the odds ratios for anxiety, depression, either anxiety or depression, and both anxiety and depression, were 2.05, 2.19, 2.14, and 2.56, respectively. There was an association between LUTS and the stress-related common mental disorders, and there seemed to be an additive effect of anxiety and depression on the association with LUTS. These findings imply a psychological role in the pathogenesis or sequelae of LUTS.

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## 1. Introduction

Lower urinary tract symptoms (LUTS), including storage, voiding, and postmicturition (Abrams et al., 2010), are highly prevalent worldwide, and the healthcare burden is expected to increase (Irwin et al., 2011). LUTS are known to have a negative impact on health-related quality of life (HRQL), sleep, and mental health (Kannan et al., 2009; Malmsten et al., 2010). In a previous study in Taiwan, a total of 53.7% of the women sampled suffered from urinary incontinence and related symptoms (Chen et al., 2003). LUTS tend to progress with regression in only a few cases (Malmsten et al., 2010), and the overall prevalence of LUTS increases with age (Chen et al., 2003). The pathogenesis of LUTS is not completely understood, however it is considered to be

multi-factorial including neurological, vascular, and connective tissue processes (Banakhar et al., 2012). In addition to interactions between the nervous, vascular, immune, and endocrine systems (Bjorling et al., 2011), psychological factors may also play a significant role in the manifestation of LUTS (Cortes et al., 2012).

Anxiety and depression are stress-related common mental disorders and are caused by a combination of multiple genetic and environmental factors affecting certain brain circuits (Nugent et al., 2011). In Taiwan, the 1-week prevalence rate of anxiety and depression has been reported to be approximately 24% (Cheng, 1988). In addition to their overlapping symptomatology and clinical presentation, they are highly comorbid with each other (Johansson et al., 2013). Furthermore, there is accumulating evidence that anxiety and depression are correlated with chronic medical illnesses (Katon et al., 2007). The combination of both anxiety and depression appears to increase comorbid medical conditions, disabilities, quality of life, and healthcare utilization (Katon et al., 2007; Scott et al., 2009; Johansson et al., 2013).

An increasing body of research suggests an association between LUTS, anxiety, and/or depression (Hakkinen et al., 2008; Bogner

\* Correspondence to: Department of Obstetrics and Gynecology, Chi Mei Foundation Hospital, 901 Chung Hwa Road, Yung Kang, Tainan 710, Taiwan.  
Tel.: +886 6 2812811x53411; fax: +886 2 2828928.

E-mail address: [da002p1@mail.chimei.org.tw](mailto:da002p1@mail.chimei.org.tw) (M.-P. Wu).

**Table 1**  
Sociodemographic characteristics and comorbidities in the LUTS and control groups.

	Non-LUTS (N=45,960)	LUTS (N=22,980)	P-value*
Age (mean ± S.D.)	51.83 ± 13.81	51.83 ± 13.81	0.9995
Age group (years) (%)			
< 40	8699 (18.93)	4531 (18.93)	1.0000
40–49	10,863 (23.64)	5432 (23.64)	
50–59	14,385 (31.30)	7192 (31.30)	
60–69	7568 (16.47)	3780 (16.47)	
70–79	3509 (7.63)	1757 (7.63)	
≥ 80	936 (2.04)	468 (2.04)	
Gender (%)			
Female	21,024 (45.74)	10,512 (45.74)	1.0000
Male	24,936 (54.26)	12,468 (54.26)	
Income (NTD)			
< 20,000	20,027 (43.57)	10,410 (45.30)	< 0.0001
20,000–40,000	18,489 (40.23)	8988 (39.11)	
≥ 40,000	7444 (16.20)	3582 (15.59)	
Urbanization level <sup>a</sup>			
1	13,638 (29.67)	8130 (35.38)	< 0.0001
2	16,044 (34.91)	8784 (38.22)	
3	6744 (14.67)	2434 (10.59)	
≥ 4	9534 (20.74)	3632 (15.81)	
Comorbidity			
HTN			
Yes	7130 (15.51)	3565 (15.51)	1.0000
No	38,830 (84.49)	19,415 (84.49)	
DM			
Yes	2236 (4.87)	1118 (4.87)	1.0000
No	43,724 (95.13)	21,862 (95.13)	
CAD			
Yes	522 (1.14)	261 (1.14)	1.0000
No	45,438 (98.86)	19,160 (98.86)	

NTD: New Taiwan Dollars (approximately 30 to 1 US. Dollars); HTN: hypertension, DM: diabetes mellitus, CAD: coronary artery disease, CI: confidence interval.

\* P-values from the Student's *t*-test for continuous variables and Pearson's chi-square test for categorical variables.

<sup>a</sup> Urbanization level 1 most urbanized, level 4: least urbanized.

et al., 2011; Felde et al., 2012; Milsom et al., 2012), although some studies have reported conflicting results (Watson et al., 2000; Takao et al., 2011). Moreover, there appears to be an additive effect of LUTS, anxiety, and depression which has been reported to affect both physical and mental health as well as HRQL (Avery et al., 2013). However, most studies have been based on self-reported surveys using rating scales with regards the anxiety/depression rather than on physician confirmed diagnoses. In addition, only a few studies have examined the relationship of LUTS with a combination of anxiety and depression (Felde et al., 2012; Milsom et al., 2012). Based on a nationwide population-based database containing data on enrollees in the National Health Insurance program in Taiwan, our objective was to test the hypothesis that LUTS are associated with anxiety and depression.

## 2. Material and methods

### 2.1. Data source

Data were obtained from the Longitudinal Health Insurance Database 2000, which includes the claims data of one million people (approximately 5% of the population in Taiwan) randomly sampled from the registry of the National Health Insurance Research Database (NHIRD) in 2000. The diagnostic codes used in the NHIRD are based on the International Classification of Diseases, Ninth Revision, Clinical Modification (ICD-9-CM) codes. Hundreds of papers have been published using the NHIRD, so the validity of the NHIRD has been confirmed (Chen et al., 2011). To avoid ethical concerns, all personal identification data in the NHIRD are encrypted to ensure the confidentiality of individuals according to the data regulations of the Bureau of NHI in Taiwan. We have consulted with the Institutional Review Board of our hospital and obtained a formal written waiver for the need of ethics approval (No. 10202-E07).

### 2.2. The definition of LUTS

The individuals with LUTS were defined as those who had at least three outpatient service claims in one year, or at least one inpatient hospitalization claim during 2001–2009. LUTS symptoms were classified by storage symptoms, voiding symptoms, and benign prostatic hyperplasia (enlargement). The ICD-9-CM codes of LUTS symptoms were: 1. storage symptoms, including hypertonicity of the bladder (596.51), frequency and polyuria (788.4), stress urinary incontinence in females (625.6) and males (788.32), urge incontinence (788.31), nocturnal enuresis (788.36), nocturia (788.43), and mixed incontinence (788.33); 2. voiding symptoms, including retention of urine (788.2), splitting and slowing of the urine stream (788.6), and post-void dribbling (788.35); 3. benign prostatic hyperplasia (enlargement) (600).

### 2.3. Study subjects and comparison group

The study subjects were LUTS patients with anxiety or depression who had at least three outpatient service claims in one year, or at least one inpatient hospitalization claim during 2001–2009. Anxiety was defined as ICD-9-CM codes for: anxiety, dissociative and somatoform disorders (300, excluding 300.4); adjustment disorder with anxiety (309.24). The ICD-9-CM code 300 includes common anxiety disorders such as generalized anxiety disorder, post-traumatic stress disorder, obsessive-compulsive disorder, etc. Depressions was defined as ICD-9-CM codes for: major depressive disorder, single episode (296.2); major depressive disorder, recurrent episode (296.3); bipolar I disorder, most recent episode (or current) of depression (296.5); depressive disorder, not elsewhere classified (311); dysthymic disorder (300.4); atypical depressive disorder (296.82); adjustment disorder with depressed mood (309.0); and prolonged depressive reaction (309.1). The anxiety and depression records were collected for two years before and after the diagnosis of LUTS. The comparison group was comprised of subjects without LUTS, and matched 1:2 by age, gender, hypertension, diabetes, and coronary artery disease with the LUTS patients. Hypertension was defined as ICD-9-CM codes (401–405), hypertensive encephalopathy (437.2), and hypertensive retinopathy (362.11). Diabetes mellitus was defined as ICD-9-CM codes for diabetes mellitus (250), polyneuropathy in diabetes (357.2), diabetic retinopathy (362.0), and diabetic cataracts (366.41). CAD was defined as ICD-9-CM codes for ischemic heart disease (410–414). All of the comorbidities were based on the records one year before the diagnosis of LUTS.

### 2.4. Measure and statistical analysis

Demographic data including age, sex, insurance amount, and urbanization level were obtained directly from the Bureau of National Health Insurance BNHI insured's file. Age was classified into the following categories: 18–39, 40–49, 50–59, 60–69, 70–79, 80 years or older. The insurance amount was classified into one of three categories: less than US\$640 (NTD20 000), US\$640–1280 (NTD20,000–39,999), and US\$1281 (NTD40,000) or more. The urbanization level was estimated by the index variables of population density, ratio of elderly people (65 years and older), ratio of higher educational levels (people with college education or above), ratio of agriculture population, and the number of physicians per 100,000 people (Liu et al., 2006). There were five levels of urbanization, with level 1 indicating the most urbanized.

The Student's *t*-test for continuous variables and Pearson's chi-square test for categorical variables were used to compare the differences between the LUTS and the comparison groups in terms of sociodemographic characteristics and co-morbidities. Conditional logistic regression was used to assess the influence of anxiety, depression, or both combined between the patients with and without LUTS, and odds ratios (OR) with 95% confidence intervals (CI) were calculated for the following four groups: those with anxiety, depression, either anxiety or depression, and both anxiety and depression. A *p*-Value of less than 0.05 was considered to be statistically significant, and Statistical Analysis System software (version 9.3; SAS Institute, Inc., Cary, NC), was used to perform all statistical analyses.

## 3. Results

A total of 22,980 patients with LUTS and 45,960 matched controls were enrolled. The demographic information and medical comorbidities of the two groups are shown in Table 1. There were no significant differences in age, gender, hypertension, diabetes mellitus, and CAD between the two groups; however, there were significant differences in income and urbanization level.

Table 2 presents the associations and ORs for anxiety, depression, either anxiety or depression, and both anxiety and depression, which were all significantly higher in the LUTS group

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