

ORIGINAL ARTICLE

Effect of lower urinary tract symptoms on the quality of life and sexual function of males in China, Taiwan, and South Korea: Subgroup analysis of a cross-sectional, population-based study

Limin Liao¹ | Yao-Chi Chuang²  | Shih-Ping Liu³ | Kyu-Sung Lee⁴  | Tag Keun Yoo⁵ | Romeo Chu⁶ | Budiwan Sumarsono⁶ | Jian-Ye Wang⁷

¹Department of Urology, China Rehabilitation Research Center, Capital Medical University, Beijing, China

²Department of Urology, Kaohsiung Chang Gung Memorial Hospital, Chang Gung University College of Medicine, Kaohsiung, Taiwan

³Department of Urology, National Taiwan University Hospital and College of Medicine, Taipei, Taiwan

⁴Department of Urology, Samsung Medical Center, Sungkyunkwan University School of Medicine, Seoul, South Korea

⁵Department of Urology, Eulji Medical Center, Eulji University School of Medicine, Seoul, South Korea

⁶Astellas Pharma Singapore Pte Ltd, 5 Pemimpin Drive, #19-03 Seasons View, Singapore 576149

⁷Department of Urology, Beijing Hospital, Beijing, China

Correspondence

Jian-Ye Wang, Department of Urology, Beijing Hospital, No. 1, Dahua Road, Beijing, China.
Email: wangjy@bjhmoh.cn

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Objective: Lower urinary tract symptoms (LUTS) in males can reduce patients' quality of life (QoL) and affect sexual function and satisfaction. Although this has been documented in the US, Canada, Germany, Italy, UK, and Sweden, data are limited on the effects of LUTS on QoL and sexual function in Asian men. The present subgroup analysis of an Internet-based survey correlated the incidence of male LUTS by severity and category with self-assessed QoL and sexual function and satisfaction measures.

Methods: Males aged ≥ 40 years were randomly selected from consumer survey panels in China, Taiwan, and South Korea. LUTS were defined using the International Continence Society (ICS) 2002 symptom definitions; symptom severity was assessed by the International Prostate Symptom Score (IPSS). The effect of LUTS on QoL was assessed using Patient Perception of Bladder Condition (PPBC) and IPSS QoL scores. Sexual function and satisfaction were assessed using the International Index of Erectile Function (IIEF).

Results: Men with moderate-to-severe LUTS and overlap of voiding, storage, and post-micturition symptom categories reported dissatisfaction with their QoL and sexual function. LUTS severity was negatively correlated with IIEF scores. Overlap of LUTS categories had a greater effect on QoL and sexual satisfaction than the incidence of just 1 LUTS.

Conclusion: The findings of the present study suggest that LUTS is prevalent in $>60\%$ of Asian males aged ≥ 40 years and is associated with reduced QoL and sexual function, particularly in those with overlap of LUTS categories and greater symptom severity.

KEYWORDS

Asia, lower urinary tract symptoms, male, quality of life, sexual satisfaction

1 | INTRODUCTION

"Lower urinary tract symptoms" (LUTS) is a term describing storage (urgency, urgency incontinence, frequency, nocturia), voiding (slow and/or interrupted stream, terminal dribble hesitancy, straining), and post-micturition (post-micturition dribble or incontinence, sensation of incomplete emptying) symptoms associated with urination.¹ The prevalence of LUTS among adult men has been reported to range from 63%

to 83%^{2,3} depending on the country and age of the surveyed population; the incidence of LUTS increases with age.⁴ LUTS overlap (i.e. the presence of 2 or more symptom categories) has been shown to occur in 47% of males aged ≥ 40 years, with 24% of men experiencing symptoms from all 3 storage, voiding, and post-micturition symptom categories.⁵

Understanding the etiology of LUTS in males is important to optimize treatment outcomes. In men, the origin of LUTS can be traced to bladder symptoms, prostate symptoms, or both.⁶ Specifically, LUTS

in males is often associated with bladder outlet obstruction (BOO) associated with benign prostatic hyperplasia (BPH).⁷ Although not life-threatening, LUTS can affect the quality of life (QoL) of males by lowering social and emotional well being and work productivity; these effects are consistent among different cultural settings.⁸ Furthermore, the effect of LUTS on QoL can be greater in the elderly population who have concomitant medical conditions.⁹ The multiple etiologies of male LUTS have been shown to complicate treatment decisions and symptom alleviation in this population.¹⁰

Epidemiologic studies have demonstrated an association between male LUTS and reduced sexual satisfaction due, in part, to erectile and ejaculatory dysfunction.^{11,12} Various mechanisms have been proposed for the association of male LUTS with sexual dysfunction, including autonomic hyperactivity, changes to the Rho pathway, endothelial dysfunction, pelvic ischemia, and age-related hormone imbalances.¹³ In addition, medical and surgical treatments of LUTS and/or BPH have been shown to be associated with sexual side effects.^{14,15} Although several previous studies have documented the incidence of male LUTS in different countries,^{2,5} few studies have investigated the effect of LUTS on QoL and sexual function in Asian men. Survey results from male police officers who participated in a voluntary health examination in South Korea revealed that increasing severity of LUTS was significantly correlated with erectile dysfunction (ED) and premature ejaculation.^{16,17} Increasing severity of ED and the voiding subscore of the International Prostate Symptom Score (IPSS) was also shown to be associated with maximum intima-media thickness of the common carotid artery.¹⁸ The objective of the present subgroup analysis was to correlate LUTS severity and categories with self-assessed QoL and sexual function and satisfaction in Asian male subjects.

2 | MATERIALS

2.1 | Study design and population

The study on which the present subgroup analysis is based (ClinicalTrials.gov ID NCT02618421) was a cross-sectional population-representative Internet-based self-administered survey conducted in China, Taiwan, and South Korea between 2 June 2015 and 20 July 2015. The primary objective of the original study was to determine the prevalence of LUTS in the male and female population age ≥ 40 years in the surveyed countries. The secondary objectives of the original study were to examine the sexual satisfaction, QoL, and treatment-seeking behavior of the study population. Subjects who were able to read the local language, had access to the Internet, and were able to use a computer were randomly selected through consumer survey panels and were included in the analysis. Subjects diagnosed with a urinary tract infection 1 month before enrollment were excluded from the study. Because the present study was an Internet-based survey, it was not considered necessary to seek approval for the study from an institutional review board. However, information about confidentiality and the voluntary nature of participation was included in the introduction to the survey, and all subjects provided informed consent to participate in the study. The present study follows the principles set forth in the Declaration of Helsinki and was performed in compliance with the ESOMAR Guideline for Online Research¹⁹ and Good Clinical Practice. Full methodology and results of the original study have been published previously.²⁰ The

subanalysis reported herein is focused on the male subpopulation and analyzed the associations and correlations of LUTS category and severity with QoL and sexual function and satisfaction.

2.2 | Main outcome measures

LUTS category (i.e. voiding, storage, or post-micturition) was defined using the International Continence Society (ICS) 2002 symptom questionnaire,¹ which contains questions regarding the frequency of individual storage, voiding, and post-micturition symptoms that were scored using a 6-point scale from 0 ("not at all") to 5 ("almost always"). LUTS severity was assessed using the 8-item IPSS questionnaire,²¹ which contains questions regarding the frequency of incomplete emptying, urinary frequency, intermittency, urgency, weak stream, straining, nocturia, and their effects on QoL and was scored on a 6-point scale from 0 ("not at all") to 5 ("almost always"). The prevalence of LUTS was assessed using both the ICS questionnaire (presence of ≥ 1 voiding, storage, or post-micturition symptoms; i.e. a rating of ≥ 2 for any individual symptom) and IPSS questionnaire (score ≥ 1). The bother experienced by subjects due to LUTS, as measured by ICS symptoms, was assessed using the short form of the Overactive Bladder Questionnaire²² (OAB-q SF), which contains questions regarding the bother of select bladder symptoms and is scored on a 6-point scale from 0 ("not at all") to 5 ("a very great deal"). The effect of LUTS on QoL was assessed using the Patient Perception of Bladder Condition (PPBC) questionnaire,²³ with the level of problem caused by a respondent's bladder condition assessed on a 6-point scale from 0 ("causes no problem at all") to 5 ("causes many severe problems"), and the IPSS-QoL questionnaire, which asks respondents to grade their feelings if the condition were to persist for the rest of their life using a 7-point scale from 0 ("delighted") to 6 ("terrible"). Male sexual function and satisfaction were assessed using the International Index of Erectile Function (IIEF) questionnaire,²⁴ which collects information regarding functional domains across erectile function, orgasmic function, sexual desire, intercourse satisfaction, and overall sexual satisfaction using a 6-point scale from 1 ("almost never or never") to 5 ("almost always or always"), with a score of 0 indicating "no sexual activity".

2.3 | Statistical analysis

The association of LUTS severity and category with QoL scores and erectile function was assessed using descriptive statistics. The correlation between sexual function and satisfaction with LUTS severity was analyzed using logistic regression (Pearson correlation coefficients). Linear regression analysis was performed for predictors of sexual dissatisfaction and erectile function; the same analysis was performed to correlate LUTS category with symptoms of bother.

3 | RESULTS

3.1 | Overall prevalence of male LUTS and symptoms of bother in Asia

In all, 495 578 subjects were invited to participate in the study and 34 802 (7.0%) responses were received; of these, 26 613

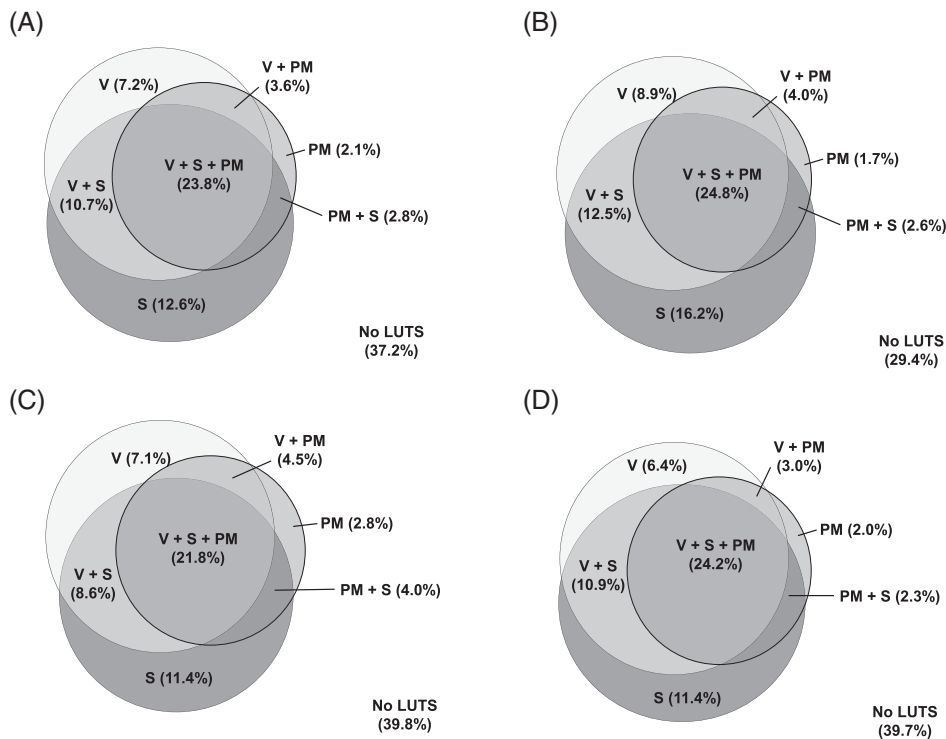


FIGURE 1 Venn diagrams showing the prevalence and overlap of lower urinary tract symptoms (LUTS) by International Continence Society 2002 symptom category in Asian males in all regions (A) and in South Korea (B), Taiwan (C), and China (D) separately. PM, post-micturition; S, storage; V, voiding

respondents provided informed consent (13 819 in China, 5918 in Taiwan, 6876 in South Korea). Of the 8284 male and female survey respondents who completed the survey (4136 from China, 2068 from Taiwan, 2080 from South Korea), 4075 were men (2080 from China, 1005 from Taiwan, 990 from South Korea; 49.2% overall; mean [\pm SD] age 53.7 ± 20.6 years) and were included in the present analyses. The overall prevalence of male LUTS differed when assessed by LUTS category (ICS 2002) versus severity (IPSS). The overall prevalence of male LUTS in the Asian population as measured by the ICS 2002 definition was 62.8%, with most subjects reporting an overlap of voiding, storage, and post-micturition symptoms (Figure 1). Most subjects reported “somewhat or greater bother” for all individual ICS voiding, storage, and post-micturition symptoms (Figure 2). However, when measured by the IPSS, mild-to-severe LUTS was prevalent in 87.7% of the male population, with most subjects (51.4%) reporting mild LUTS (Figure 3).

3.2 | Effect of LUTS category and severity on QoL of Asian males

The QoL of the surveyed Asian males was assessed using 2 QoL questionnaires, the PPBC and IPSS-QoL. Overall, the presence of LUTS by category (i.e. storage, voiding, post-micturition) and severity was associated with reduced QoL.

The effect of LUTS category on QoL was assessed through the association of ICS 2002 LUTS category with PPBC and IPSS-QoL scores. Respondents with overlapping LUTS categories reported being more dissatisfied with their QoL on the IPSS-QoL than those reporting storage, voiding, or post-micturition LUTS alone. Similarly, those with overlapping LUTS categories also reported more severe PPBC-associated problems (Table 1). Furthermore, a logistic regression analysis found an association between individual LUTS

categories with problems recorded by the PPBC questionnaire. The following were all associated with moderate or greater bladder problems reported by PPBC: voiding symptom of straining ($P < .001$), storage symptoms of perceived frequency ($P < .001$), nocturia ($P < .01$), and urgency, urgency with fear of leaking, and stress incontinence due to laughing or coughing (all $P < .05$), and post-micturition symptoms of incontinence (or dribble) and incomplete emptying ($P < .001$).

The effect of male LUTS severity on QoL was assessed through the association of the IPSS score with PPBC and IPSS-QoL scores. Greater symptom severity as assessed using the IPSS was associated with worse PPBC; 58.6% of subjects with severe LUTS reported moderate or greater problems with their bladder condition (Table 2). The severity of LUTS as assessed using the IPSS was associated with dissatisfaction with QoL on the IPSS-QoL; most subjects (82.3%) with severe LUTS reported dissatisfaction with their QoL (Table 2).

3.3 | Prevalence of erectile and ejaculatory dysfunction by LUTS severity and category

In the sexually active population in the present study, 75.4% of subjects suffered from ED, with 8.2% of those with ED reporting severe symptoms. When the occurrence of ED was stratified by IPSS LUTS severity, the prevalence of moderate and severe ED increased with increasing severity of LUTS from mild (9% and 2%, respectively), to moderate (24% and 7%, respectively) to severe (37% and 17%, respectively; see Figure S1, available as Supplementary Material to this paper).

Of the subjects with LUTS who were sexually active, 33% reported ejaculatory dysfunction (EjD), defined as the inability to ejaculate half the time or more when engaging in sexual intercourse. When the occurrence of EjD was stratified by the prevalence of LUTS categories, the highest prevalence of EjD was observed in subjects experiencing overlap of symptoms from storage, voiding, and

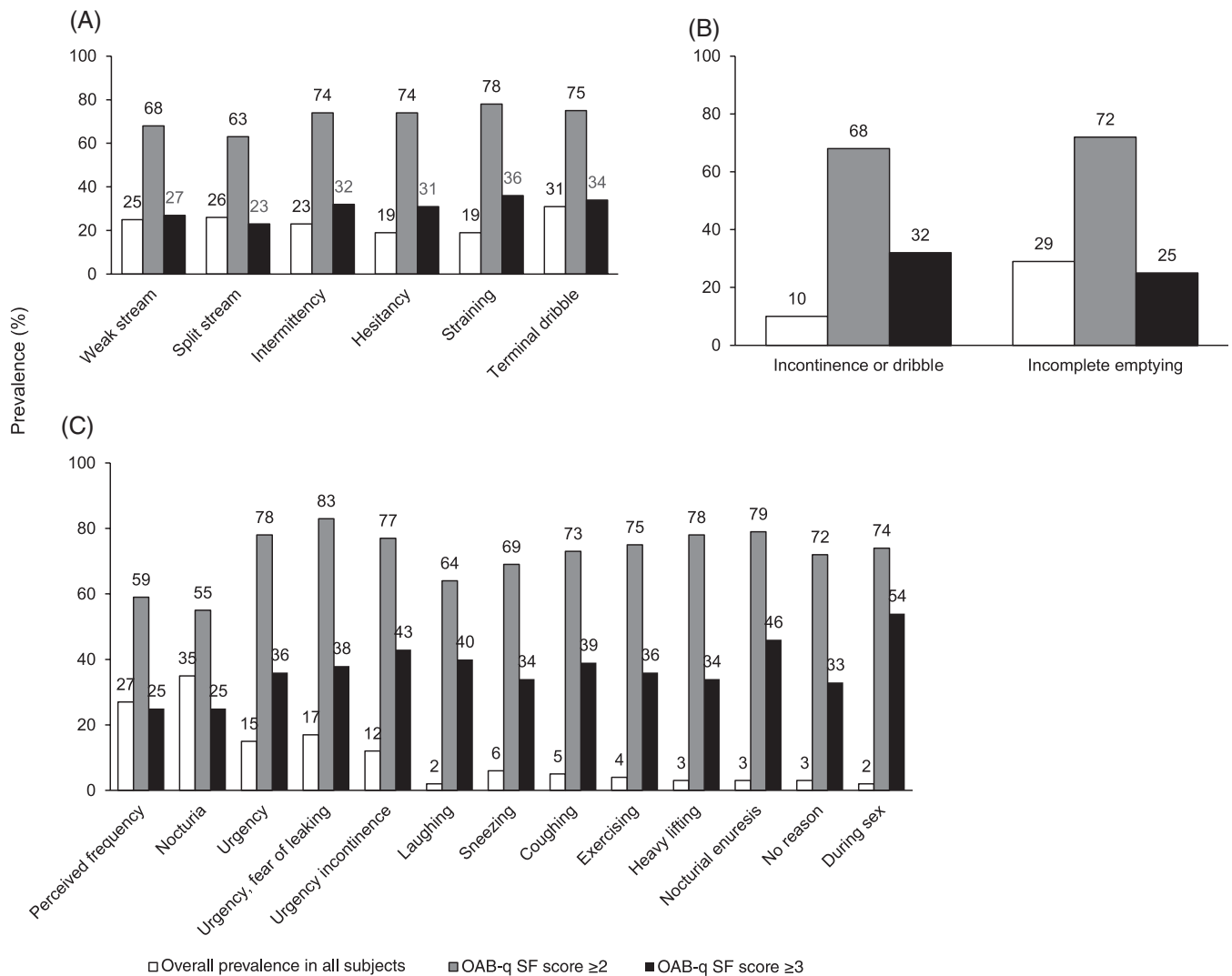


FIGURE 2 Prevalence of bother according to International Continence Society 2002 lower urinary tract symptoms category in Asian males. A, Voiding symptoms; B, post-micturition symptoms; C, storage symptoms. OAB-q SF, short form of the Overactive Bladder Questionnaire (OAB-q)

post-micturition categories (48%) or an overlap of voiding and storage categories (34%; Figure S2). The lowest prevalence of EjD was observed in respondents with voiding symptoms only (12%; Figure S2).

3.4 | Correlation of LUTS category and severity with male sexual satisfaction

The sexual health of surveyed Asian men was analyzed using the IIEF questionnaire. The IIEF scores were stratified by LUTS severity and category to obtain an association between the prevalence of LUTS and sexual satisfaction. Overall, 24% of surveyed subjects reported a reduced enjoyment of sexual activity. Across all IIEF domains, the severity and category of LUTS were associated with reduced sexual satisfaction.

The individual IIEF scores were correlated with IPSS LUTS severity through a Pearson correlation. All IIEF scores were negatively correlated with IPSS LUTS severity scores (erectile function, $\gamma = -0.461$; orgasmic function, $\gamma = -0.426$; sexual desire, $\gamma = -0.357$; intercourse satisfaction, $\gamma = -0.399$; overall satisfaction, $\gamma = -0.387$; all $P < .00001$).

LUTS category was also associated with sexual function and satisfaction. Compared with respondents who reported only a single LUTS category, those with LUTS overlap reported lower scores on the IIEF erectile function, orgasmic function, sexual desire, and

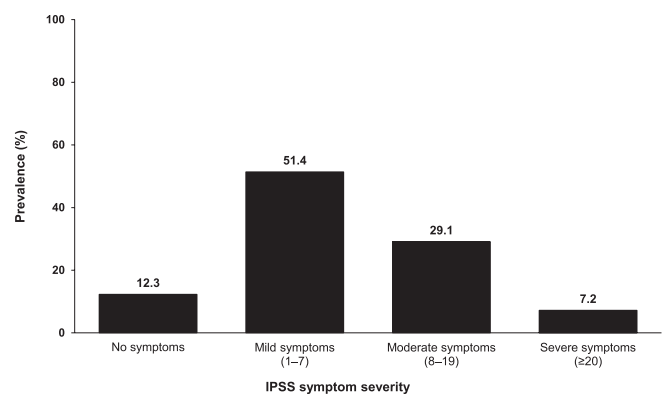


FIGURE 3 Prevalence of lower urinary tract symptoms according to severity in Asian males as determined by the International Prostate Symptom Score (IPSS)

TABLE 1 Association between International Continence Society symptom category and quality of life International Prostate Symptom Score and Patient Perception of Bladder Condition scores

Score and ICS symptom category	No. respondents	Mean (± SD) score	Mean difference in IPSS-QoL or PPBC score
IPSS-QoL score			
Overlap of LUTS	1667	3.54 ± 1.36	PM only 1.270* Storage only 1.080* Voiding only 1.058*
PM LUTS only	87	2.26 ± 1.32	Overlap of LUTS -1.270* Storage only -0.191 Voiding only -0.212
Storage LUTS only	506	2.46 ± 1.53	Overlap of LUTS -1.080* PM only 0.191 Voiding only -0.022
Voiding LUTS only	293	2.48 ± 1.35	Overlap of LUTS -1.058* PM only 0.212 Storage only 0.022
PPBC score			
Overlap of LUTS	1667	1.63 ± 1.17	PM only 1.104* Storage only 1.062* Voiding only 1.074*
PM LUTS only	87	0.53 ± 0.64	Overlap of LUTS -1.104* Storage only -0.041 Voiding only -0.029
Storage LUTS only	512	0.57 ± 0.72	Overlap of LUTS -1.062* PM only 0.041 Voiding only 0.012
Voiding LUTS only	293	0.56 ± 0.72	Overlap of LUTS -1.074* PM only 0.029 Storage only -0.012

* $P < .05$. ICS, International Continence Society; IPSS-QoL, quality of life on the International Prostate Symptom Score; LUTS, lower urinary tract symptoms; PM, post-micturition; PPBC, Patient Perception of Bladder Condition.

intercourse satisfaction domains ($P < .05$). The overall sexual satisfaction of surveyed subjects was markedly affected by the overlap of LUTS categories, as indicated by lower scores on the IIEF overall sexual satisfaction domains compared with respondents who reported only single LUTS categories ($P < .05$; Table 3).

3.5 | Predictors of sexual dysfunction and dissatisfaction

Statistically significant logistic regressions of individual voiding, storage, and post-micturition symptoms with sexual satisfaction scores were used as predictors of male sexual dissatisfaction. Individual

TABLE 2 Association between severity of International Prostate Symptom Score male lower urinary tract symptoms and quality of life as measured by the Patient Perception of Bladder Condition and International Prostate Symptom Score in Asian males

	IPSS LUTS severity			
	No LUTS	Mild	Moderate	Severe
PPBC*				
No. respondents	501	2094	1187	295
Minor problems or worse	8 (1.6)	127 (6.1)	541 (45.6)	248 (84.1)
Moderate problems or worse	3 (0.6)	21 (1.0)	167 (14.1)	173 (58.6)
Severe problems or worse	1 (0.2)	7 (0.3)	40 (3.4)	71 (24.1)
IPSS-QoL*				
No. respondents	113	2093	1189	295
Mostly dissatisfied or worse	18 (15.9)	394 (18.8)	562 (47.3)	243 (82.3)
Unhappy or worse	14 (12.4)	173 (8.3)	232 (19.5)	164 (55.6)

Unless indicated otherwise, data are given as n (%). * $P < .05$ (χ^2 test for proportions). IPSS, International Prostate Symptom Score; IPSS-QoL, quality of life on the International Prostate Symptom Score; LUTS, lower urinary tract symptoms; PPBC, Patient Perception of Bladder Condition.

LUTS were also associated with ED and EjD to predict male sexual dysfunction.

For sexual dissatisfaction, the storage symptoms of urgency with fear of leaking ($P < .05$) and stress incontinence related to coughing ($P < .05$) and exercising ($P < .001$) were predictors of sexual dissatisfaction. Furthermore, the post-micturition symptom of incomplete emptying ($P < .001$) was also a predictor of sexual dissatisfaction. None of the individual voiding symptoms was a predictor of sexual dissatisfaction.

The prediction of sexual dysfunction was focused on ED and EjD. Predictors of ED included voiding symptoms of weak stream and straining ($P < .001$ and $P < .05$, respectively), storage symptoms of urgency with fear of leaking ($P < .001$), stress incontinence related to coughing and exercising, and nocturnal enuresis (all $P < .05$). None of the individual post-micturition symptoms was a predictor of ED. Predictors of EjD included voiding symptoms of straining ($P < .01$) and terminal dribble ($P < .001$), storage symptoms of urgency with fear of leaking ($P < .001$), stress incontinence related to coughing ($P < .05$) and exercising ($P < .01$), and incontinence during sexual activity ($P < .05$). As for ED, no post-micturition symptoms were predictors of EjD.

4 | DISCUSSION

LUTS is globally prevalent among males, and its severity is associated with reduced QoL and sexual satisfaction. Previous studies have focused on determining the prevalence of male LUTS in Europe and the US,² with limited data available for Asian countries. The present study determined the prevalence of LUTS in Asian males in China, Taiwan, and South Korea, and associated the severity and category of LUTS with QoL and sexual satisfaction and function measures. The

TABLE 3 Overall International Index of Erectile Function sexual satisfaction and International Continence Society 2002 lower urinary tract symptoms category

ICS symptom category	Mean difference in IIEF score	
Overlap of LUTS	PM only	-1.051*
	Storage only	-0.948*
	Voiding only	-0.562*
PM only	Overlap of LUTS	1.051*
	Storage only	0.103
	Voiding only	0.489
Storage only	Overlap of LUTS	0.948*
	PM only	-0.103
	Voiding only	0.385
Voiding only	Overlap of LUTS	0.562*
	PM only	-0.489
	Storage only	-0.385

* $P < .05$. ICS, International Continence Society; IIEF, International Index of Erectile Function; LUTS, lower urinary tract symptoms; PM, post-micturition.

results of the present study are similar to previous reports of male LUTS in other countries;²⁵ yet, to our knowledge, the present study is the first to correlate LUTS with QoL and sexual satisfaction in multiple Asian countries.

Previous reports in Asian countries have reported a prevalence of male LUTS between 23%²⁶ and 57%²⁷; these studies focused on IPSS LUTS severity in individual Asian countries and did not address LUTS category using the ICS definition. In the present study, LUTS were found to be highly prevalent among the Asian male population in China, Taiwan, and South Korea, and prevalence rates varied based on the tool used to define LUTS (i.e. IPSS vs. ICS). This disparity may be explained by differences in the questionnaire design; on the IPSS, a score ≥ 1 defines the presence of LUTS, whereas on the ICS a respondent is required to score ≥ 2 in individual questions to be considered to have a specific LUTS. Most subjects in the present study reported an overlap of symptoms from all voiding, storage, and post-micturition categories of mild severity, and "somewhat or greater bother" with individual storage, voiding, and post-micturition symptoms.

Similar to other studies, the present study found that LUTS was associated with decreased self-assessed QoL as measured by the PPBC and IPSS-QoL questionnaire scores. Although these measures assess the respondent's perception of their bladder (PPBC) and urinary (IPSS-QoL) condition, the subjectivity of these measures may be a reflection of problems not only specific to the bladder, but also to the lower urinary tract as a whole. The decrease in QoL due to LUTS severity and overlap has previously been associated with greater limitations in daily activities, and decreases in physical and mental well being.⁴ In the present study, LUTS severity was also associated with a high incidence of ED (75.4%) and EjD (33%), and respondents with overlap of voiding, storage, and post-micturition LUTS were more likely to experience EjD. Similarly, survey results from South Korean police officers revealed a significant correlation between increased LUTS severity, as measured by the IPSS, and ED and premature ejaculation.^{16,17} A previous report of non-Asian males with LUTS reported a lower prevalence of ED (26%) and EjD (10.6%);²⁸ however, these

prevalence rates were estimated in a sample including individuals with no LUTS, whereas the prevalence rates reported in the present study were estimated in a sample in which all respondents had LUTS.²⁸

There was a negative correlation between sexual satisfaction and the IPSS score of surveyed males, indicating that sexual satisfaction decreased with increasing severity of LUTS. The correlation between male sexual satisfaction and LUTS has been observed previously in other regions;¹² however, the present study is the first report of detailed male self-assessed sexual satisfaction criteria according to the IIEF of Asian subjects in their cultural background.

The present study relied on self-assessed measures of LUTS, QoL, and sexual satisfaction, generating cost-efficient and valuable information directly from respondents who are in the best position to describe their symptoms and the effects on their lives. The use of self-assessed reporting of outcome measures is superior to face-to-face interviews in that self-assessed reporting allows for more efficient capture of the patient experience at a lower cost. However, the present study was an online survey, which restricts it to the "Internet population" and the "self-selection" of participants. Considering that only those who have Internet access and who agreed to participate in the surveys were eligible for the study, the respondents may not be representative of the true population. Furthermore, the scope of these results is limited due to subjectivity in the self-assessed measures used in the present study, and the lack of clinical measures for LUTS diagnosis, such as maximum urinary flow rate and post-void residual volume. Another limitation of the present study is that an analysis by age was not conducted, therefore subject age represents a confounder in the relationship between ED and LUTS. Finally, the present study is also limited due to its cross-sectional nature because it does not provide information regarding changes in LUTS and their relationship with QoL and sexual satisfaction over time.

In conclusion, the present subanalysis found that LUTS is prevalent among the male population of China, Taiwan, and South Korea, and may increase ED and EjD and reduce QoL and sexual satisfaction. An overlap of storage, voiding, and post-micturition symptoms was widely reported in the surveyed population, and was associated with marked decreases in QoL and sexual satisfaction. The potential for improvement of QoL and sexual satisfaction in Asian male patients with LUTS is an important consideration in medical assessment and treatment.

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CONFLICT OF INTEREST

TKY has received grants and personal fees from Astellas Pharma Inc. to act as a consultant, researcher, and speaker. LL, Y-CC, S-PL, K-SL, and J-YW have acted as consultants for Astellas Pharma Inc. RC and BS are Astellas Pharma employees.

ORCID

Yao-Chi Chuang  <https://orcid.org/0000-0002-1468-3792>

Kyu-Sung Lee  <https://orcid.org/0000-0003-0891-2488>

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SUPPORTING INFORMATION

Additional Supporting Information may be found online in the supporting information tab for this article.

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