

The Predictive Factors of Nocturia in Young Asian Adult Males – An Online Survey

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Abstract

The present study investigated the association between the severity of depressive mood and nocturia in young Asian adult men. Participants were 3,127 adult male Facebook users aged 20–40 years who could read and write traditional Chinese. Participants completed an online questionnaire about their demographic characteristics, the frequency of getting up to urinate during the night (International Prostate Symptoms Score [IPSS]), and the frequency of experiencing depressive symptoms (Taiwanese Depression Questionnaire [TDQ]). The severity of lower urinary tract symptoms (LUTS) and those who had nocturia were classified using the IPSS. Student's t test and Pearson's chi square test were used to compare participants with and without nocturia. Univariate and multivariate logistic regression were used to evaluate the predictive factors for nocturia. Two hundred fifty-one (8.0%) participants had nocturia, and 21.9% were suspected to have depression. Age over 30 years, body mass index over 25 kg/m², the presence of moderate/severe LUTS, and higher TDQ scores were predictive of nocturia. Depression was associated with nocturia in young Asian adult males. Young men with nocturia who are at risk of developing depression should be identified with a culturally relevant questionnaire. Early referral for psychiatric assessment and intervention may be warranted.

Introduction

Nocturia is highly prevalent in the general population. It disturbs one's sleep and exerts a profound impact on quality of life. It is not only the main lower urinary tract symptom of older adults, but is also common in young adults¹. According to the Boston Area Community Health Study, 19.9% of the residents aged between 30 and 39 years complained of nocturia². Medical comorbidities, such as benign prostate hyperplasia and heart failure, would induce or exacerbate nocturia. Nevertheless, these medical conditions are infrequent in young adults. On the other hand, psychological stress and psychiatric problems, particularly depression, would be the main risk factor for nocturia in younger patients³. A systematic review including seven studies suggests that there is a strong connection between depression and the incidence of nocturia, especially in men⁴. However, none of the studies have investigated the association between nocturia and depression in Asian populations. Given the possible differences in the expression of depression in different cultures⁵, it would be important to investigate whether the relationship exists in Asian populations. Therefore, we conducted an online survey to investigate the association between the severity of depressive mood and nocturia in young Asian adult men.

Ethics Statement

All procedures were in accordance with the ethics committee and with the principles of the Declaration of Helsinki. The informed consent was obtained from all participants included in our study.

Materials And Methods

Questionnaire

We designed an online questionnaire in traditional Chinese to investigate the relationship between nocturia and the degree of depressive symptoms. The first part comprised questions about the demographics of the participants, including age, body height, and body weight. In the second part, we used the 7-item International Prostate Symptoms Score (IPSS) to evaluate the severity of lower urinary tract symptoms (LUTS). The IPSS can range from 0–35, and scores are categorized as mild (0–7), moderate (8–19), and severe (20–35). Subscores can be calculated for voiding (4 items, range = 0–20) and storage (3 items, range = 0–15). The number of times the participant woke up to urinate during nighttime sleep was obtained from the question, "Over the past month, how many times did you most typically

get up to urinate from the time you went to bed at night until the time you got up in the morning?" Those who needed to get up for urination more than one time were classified as having nocturia, according to the definition of the International Continence Society⁶. The third part was the Taiwanese Depression Questionnaire (TDQ), which was used to assess level of depression. The TDQ is a culturally-relevant questionnaire composed of 18 questions regarding the frequency of somatic symptoms and emotional distress within the past week. The response scale is as follows: 0 = fewer than one day per week, 1 = 1–2 days per week, 2 = 3–4 days per week, and 3 = 5–7 days per week. The total score ranges from 0 to 54. The questionnaire has been validated with a sensitivity of 0.89 and specificity of 0.92 at a cutoff score of 19⁷. The scores on the TDQ can be used to classify individuals into four groups: normal (score 0–8), normal-low (score 9–14), normal-high (score 15–18), and depression (score ≥ 19)⁸. The 18 items are either affective/cognitive questions or somatic questions; therefore, we calculated an affective/cognitive symptoms subscore and a somatic symptoms subscore for further analysis⁸.

Study Design

The study was approved by the Institutional Review Board of Taipei City Hospital (TCHIRB-10911002-E). The online questionnaire was set up on SurveyCake, a commercialized software website for creating customized survey questionnaires. We invited adult male Facebook users aged between 20 and 40 years who could read and write traditional Chinese to participate in the study by providing a hyperlink on Facebook to the questionnaire. The online questionnaire was available from February 1st to the 28th of 2021. Repeat filling in of the questionnaire was prevented by a check question at the beginning of the questionnaire and by Internet protocol address filtering.

Statistical Analysis

Statistical analysis was performed using IBM SPSS Statistics for Mac, ver. 24 (IBM Corp., Armonk, NY, USA). All data were expressed as the percentage or mean \pm standard deviation. Student's t test and Pearson's chi square test were used to compare the differences between participants with nocturia and those without nocturia, depending on continuous or categorical parameters. Univariate and then multivariate logistic regression were used to evaluate the predictive factors for nocturia. A p value less than .05 was considered statistically significant.

Results

A total of 3,127 Asian adult males completed the questionnaire online. Table 1 shows the characteristics of the participants. Two hundred and fifty-one (8.0%) participants fulfilled the criteria for nocturia. The mean urination times at night for those with nocturia was 2.3 ± 0.7 . The mean IPSS of all participants was 5.2 ± 5.2 . Most of the participants (75.6%) were classified as having mild LUTS, and 22.0% and 2.4% had moderate and severe LUTS, respectively. The mean TDQ score was 11.9 ± 10.1 . Of all the participants, 21.9% were suspected to have depression (TDQ score ≥ 19).

Table 1
Characteristics of Total Participants and Participants with Nocturia and Without Nocturia

Characteristic	Total		No Nocturia		With Nocturia		<i>p</i> value
	<i>N</i> = 3127		<i>N</i> = 2876		<i>N</i> = 251		
Age: years (<i>SD</i>)	30.7	(5.5)	30.5	(5.5)	32.3	(5.2)	< .001
BMI: kg/m ² (<i>SD</i>)	25	(4.6)	24.8	(4.5)	26.6	(5.5)	< .001
IPSS (<i>SD</i>)	5.2	(5.2)	4.7	(4.7)	11.4	(7)	< .001
Voiding score (<i>SD</i>)	2.6	(3.4)	2.3	(3.1)	5.2	(4.9)	< .001
Storage score (<i>SD</i>)	2.7	(2.4)	2.4	(2.1)	6.2	(2.7)	< .001
IPSS							< .001
Mild LUTS: no. (%)	2365	(75.6%)	2257	(79.1%)	90	(35.9%)	
Moderate LUTS: no. (%)	687	(22.0%)	561	(19.5%)	126	(50.2%)	
Severe LUTS: no. (%)	75	(2.4%)	40	(1.4%)	35	(13.9%)	
Nocturia times (<i>SD</i>)	0.6	(0.7)	0.4	(0.5)	2.3	(0.7)	< .001
TDQ Score (<i>SD</i>)	11.9	(10.1)	11.5	(9.9)	16.6	(11.5)	< .001
Affective/cognitive score (<i>SD</i>)	7.4	(6.7)	7.1	(6.6)	10.1	(7.6)	< .001
Somatic score (<i>SD</i>)	4.5	(3.9)	4.4	(3.8)	6.5	(4.4)	< .001
TDQ category							< .001
Normal: no. (%)	1432	(45.8)	1365	(47.5)	67	(26.7)	
Normal-low: no. (%)	680	(21.7)	623	(21.7)	57	(22.7)	
Normal-high: no. (%)	331	(10.6)	295	(10.3)	36	(14.3)	
Depression: no. (%)	684	(21.9)	593	(20.6)	91	(36.3)	

BMI = body mass index; IPSS = International Prostate Symptoms Score; LUTS = lower urinary tract symptoms;

TDQ = Taiwanese Depression Questionnaire.

Participants with nocturia were older (32.3 ± 5.2 years vs. 30.5 ± 5.5 years, $p < .001$), more overweight (BMI: 26.6 ± 5.5 kg/m² vs. 24.8 ± 4.5 kg/m², $p < .001$), and had a higher IPSS (11.4 ± 7.0 vs. 4.7 ± 4.7 , $p < .001$), as well as higher voiding and storage subscores (Table 1). They also had higher mean total TDQ scores (16.6 ± 11.5 vs. 11.5 ± 9.9 , $p < .001$) and affective/cognitive and somatic subscores.

In the univariate analysis, all the parameters were significantly associated with nocturia (Table 2). We used three multivariate analysis models with different parameters to evaluate the effect of depression on nocturia. Age over 30 years, BMI over 25 kg/m², and presence of moderate to severe LUTS were predictive factors for nocturia in all three models. With regard to depressive symptoms, in the first model, total TDQ score predicted nocturia. In the second model, only TDQ somatic subscores (odds ratio 1.086, 95% confidence interval [1.026, 1.049], $p = .005$) predicted nocturia. In

the third model, normal-low mood, normal-high mood, and depression were significant predictors of nocturia compared to a normal mood.

Table 2
Results of the Univariate Analysis and Three Multivariate Analyses

Characteristic	Univariate Analysis		Multivariate Analysis		Multivariate Analysis		Multivariate Analysis	
			Model I		Model II		Model III	
	Odds ratio (95% CI)	p value						
Age								
< 30	1 (ref)		1 (ref)		1 (ref)		1 (ref)	
> 30	1.756 (1.346, 2.291)	< .001	1.421 (1.071, 1.886)	.015	1.406 (1.059, 1.866)	.019	1.416 (1.067, 1.880)	.016
BMI								
< 25	1 (ref)		1 (ref)		1 (ref)		1 (ref)	
> 25	1.966 (1.516, 2.551)	< .001	1.951 (1.479, 2.574)	< .001	1.997 (1.512, 2.637)	< .001	1.963 (1.488, 2.589)	< .001
TDQ score	1.043 (1.032, 1.055)	< .001	1.014 (1.001, 1.027)	.040				
Affective/cognitive	1.057 (1.039, 1.075)	< .001			0.997 (0.945, 1.009)		.160	
Somatic	1.130 (1.098, 1.163)	< .001			1.086 (1.026, 1.149)		.005	
TDQ category								
Normal	1 (ref)						1 (ref)	
Normal-low	1.864 (1.293, 2.687)	.001					1.515 (1.033, 2.222)	.033
Normal-high	2.486 (1.627, 3.800)	< .001					1.595 (1.012, 2.514)	.044
Depression	3.126 (2.248, 4.348)	< .001					1.543 (1.072, 2.222)	.020
IPSS risk category								
Mild	1 (ref)		1 (ref)		1 (ref)		1 (ref)	

BMI = body mass index; TDQ = Taiwanese Depression Questionnaire; IPSS = International Prostate Symptoms Score;

CI = confidence interval.

Characteristic	Univariate Analysis		Multivariate Analysis		Multivariate Analysis		Multivariate Analysis	
			Model I		Model II		Model III	
Moderate	5.677 (4.266, 7.556)	< .001	5.146 (3.804, 6.963)	< .001	5.021 (3.707, 6.801)	< .001	5.034 (3.721, 6.812)	< .001
Severe	22.118 (13.413, 36.472)	< .001	17.888 (10.487, 30.512)	< .001	17.075 (9.995, 29.171)	< .001	18.562 (10.973, 31.398)	< .001

BMI = body mass index; TDQ = Taiwanese Depression Questionnaire; IPSS = International Prostate Symptoms Score;
CI = confidence interval.

Discussion

Most previous studies on nocturia have focused on men older than 50 years. In the present study, we recruited younger men because they have rarely been investigated in the literature. Moreover, we could avoid causes of nocturia from organic diseases of the lower urinary tract, such as benign prostate hyperplasia, which are infrequent among younger men. Based on the results of the online questionnaire survey, we found that the prevalence of nocturia in Asian adult males younger than 40 years of age was 8%. This finding is consistent with other studies. The reported prevalence rate of 2 or more voids per night ranged from 2–16.6%⁹. Thus, our study sample recruited from Facebook could be representative of younger men in the general population.

Other studies including younger and older adults have revealed that increased age and BMI were both risk factors for nocturia. Madhu et al.¹⁰ conducted a secondary analysis of the EpiLUTS data using participants with nocturia. Age, BMI, anxiety, depression, and a history of bed-wetting were significantly associated with nocturia. Fitzgerald et al.² found that the odds ratio of nocturia increased with age and BMI in a multivariate model. Other studies also reported that nocturia was significantly associated with obesity^{11,12}. Similarly, in the present study, age older than 30 years, BMI over 25 kg/m², and presence of moderate to severe LUTS were predictive factors for nocturia in our sample of young Asian men. Goessaert et al.¹³ found that reduced functional bladder capacity was associated with nocturia in younger participants, which would deteriorate with aging. Obesity would increase the intra-abdominal pressure and lead to nocturia¹⁴. In addition, those with obesity would have a higher chance of obstructive sleep apnea, resulting in nocturnal polyuria and detrusor instability^{15,16}. One supportive evidence in our study is that the participants with nocturia had a higher IPSS, especially storage scores. This relationship has been found to be more profound in men¹⁷ and younger patients^{18,19}, similar to our study population.

One of the key findings of the present study was the association between nocturia and the level of depression in young men. Our findings are compatible with previous findings. Asplund et al.²⁰ found that major depression was associated with a six-fold increase in nocturia in men. A cohort study by Johnson et al.²¹ showed depressed and nondepressed patients reported a mean of 2.7 and 1.9 episodes of nocturia per night, respectively. Patients with 5 or more episodes of nocturia per night experienced a 6.5-fold increased risk of depression. Häkkinen et al.³ noted a unidirectional effect of depressive symptoms on the incidence of moderate or severe nocturia. A systematic review concluded a bidirectional association between depression and nocturia: nocturia increased the odds ratio of depression (OR 1.2–20.24), while depression similarly increased the odds ratio of nocturia (OR 1.2–7.73)⁴. Our findings not only support the association between depressive symptoms and nocturia, but also indicate the association is likely a severity-dependent tendency,

because the more severe the depressive symptoms, the greater the odds ratio to have nocturia, as indicated by the univariate analysis. Furthermore, we provide evidence in the multivariate model II analysis that the association of depressive symptoms with nocturia was because of depression-associated somatic symptoms. The association between levels of depression-related somatic symptoms and nocturia provides clinicians insight into the possible underlying correlates for the relationship of depression with nocturia.

There are several potential mechanisms underlying the relationship between depression and nocturia. One possibility is through poor sleep quality. Nocturia has been shown to have close relationships with early wake-ups and decreased total sleep time²². In a cohort of patients treated for depression, depression severity significantly correlated with sleep quality²³. Przydacz et al.²⁴ even argued that it is not depression severity, rather it is sleep quality that correlates with nocturia. Second, depression has been shown to have a negative effect on perception, development, and prolongation of LUTS, including nocturia²⁵. Third, depression may involve both increased nocturnal diuresis via a disturbed 24-hour rhythm of antidiuretic hormone secretion, and a decrease in nocturnal bladder capacity through a central and/or peripheral serotonergic effect²⁰. Fourth, in a previous study²⁶, patients being treated with selective serotonin-reuptake inhibitors for depression had twice the incidence of nocturia. Another study²⁷ also showed that the incidence and severity of overactive bladder, whose symptoms include nocturia, increased in men using antidepressants.

In the present study, we found that TDQ score was independently associated with nocturia. Moreover, it was somatic rather than affective/cognitive symptoms that related to nocturia. One possible explanation is the different expression of depression in different cultures. For example, Vietnamese patients were prone to endorse higher levels of somatic symptoms than German patients despite similar levels of depression severity²⁸. Similarly, somatic complaints predicted depression in Vietnamese and Vietnamese American adolescents, whereas no relationship was found in European American adolescents²⁹. Furthermore, those with normal-high TDQ scores had the highest odds ratio to develop nocturia. Thus, the complaints of nocturia in young Asian males could be a red flag signaling a depressive mood, which could progress to major depressive disorder without early intervention. Therefore, by utilizing a culturally-relevant depression screening instrument, such as the Taiwanese Depression Questionnaire, with young male patients complaining of nocturia in urology clinics, it would be possible to identify early on those who are at risk of developing a depressive disorder.

There are several limitations to this study that should be mentioned. First, this study recruited participants from a social media site (i.e., Facebook) as opposed to a community-based population. As such, selection bias may exist. Second, we did not investigate comorbidities, medical history, diet, physical activity, or psychiatric history of the participants, which may also have an influence on the occurrence of nocturia. Third, the information from a 24-hour voiding diary is nearly impossible to get from an online survey, which could help determine the etiology of nocturia. Nevertheless, there are some advantages of the present study. We recruited more than 3,000 young men; a population that has been less investigated for LUTS including nocturia. We focused on young men instead of older adult men because they would have less comorbidities and less medications related to nocturia, and therefore, less confounding factors. We also evaluated the associations between depression and nocturia with a culturally-relevant questionnaire. The findings of the present study have practical implications for urologists when treating young men with nocturia. Early assessment of depressive symptoms can be preventative by making a referral for psychological evaluation and treatment of psychological symptoms.

Conclusion

This study demonstrated that about 8% of men between the ages of 20 and 40 had nocturia. Age over 30 years, BMI over 25 kg/m², and concomitant moderate to severe LUTS were independently predictive of nocturia. Those with scores

higher than 8 on the Taiwanese Depression Questionnaire, especially scores between 15 and 18, were at risk of having nocturia. Because the expression of depression in people from Eastern cultures may be predominantly somatic in nature, it would be imperative to use a culturally-relevant questionnaire to uncover the potential psychosomatic connection between nocturia and depression in young men. Early referral of young men with nocturia for psychiatric assessment may be warranted.

Declarations

Author Contributions

Weiming Cheng, Yu-Hwa Fan, Ying-Jay Liou and Yi-Ting Hsu wrote the main manuscript text and prepared tables 1 and 2. All authors reviewed the manuscript.

Competing Interests

The authors declare no competing interests.

Conflicts of Interest and Source of Funding: None declared.

References

1. Blwise, D. L., Wagg, A. & Sand, P. K. Nocturia: A highly prevalent disorder with multifaceted consequences. *Urology*, **133**, 3–13 (2019).
2. Fitzgerald, M. P., Litman, H. J., Link, C. L. & McKinlay, J. B. The association of nocturia with cardiac disease, diabetes, body mass index, age and diuretic use: Results from the BACH survey. *J. Urol.*, **177**, 1385–1389 (2007).
3. Häkkinen, J. T. *et al.* Depressive symptoms increase the incidence of nocturia: Tampere Aging Male Urologic Study (TAMUS). *J. Urol.*, **179**, 1897–1901 (2008).
4. Breyer, B. N. *et al.* The association of depression, anxiety and nocturia: A systematic review. *J. Urol.*, **190**, 953–957 (2013).
5. Goodmann, D. R. *et al.* Factor analysis of depression symptoms across five broad cultural groups. *J. Affect. Disord.*, **282**, 227–235 (2021).
6. Abrams, P. *et al.* The standardisation of terminology of lower urinary tract function: Report from the Standardisation Sub-committee of the International Continence Society. *Neurourol. Urodyn.*, **21**, 167–178 (2002).
7. Lee, Y., Yang, M. J., Lai, T. J., Chiu, N. M. & Chau, T. T. Development of the Taiwanese Depression Questionnaire. *Chang Gung Med. J.*, **23**, 688–694 (2000).
8. Cheng, H. T., Ho, M. C. & Hung, K. Y. Affective and cognitive rather than somatic symptoms of depression predict 3-year mortality in patients on chronic hemodialysis. *Sci. Rep.*, **8**, 5868 (2018).
9. Bosch, J. L. & Weiss, J. P. The prevalence and causes of nocturia. *J. Urol.*, **184**, 440–446 (2010).
10. Madhu, C. *et al.* Nocturia: Risk factors and associated comorbidities; findings from the EpiLUTS study. *Int. J. Clin. Pract.*, **69**, 1508–1516 (2015).
11. Kim, J. S. *et al.* Analyzing the factors associated with nocturia in older people in the United States. *Ann. Geriatr. Med. Res.*, **22**, 184–188 (2018).
12. Moon, S. *et al.* The association between obesity and the nocturia in the U.S. population. *Int. Neurourol. J.*, **23**, 169–176 (2019).

13. Goessaert, A. S., Krott, L., Walle, J. V. & Everaert, K. Exploring nocturia: Gender, age, and causes. *Neurourol. Urodyn.*, **34**, 561–565 (2015).
14. Lee, S. H. *et al.* Effects of obesity on lower urinary tract symptoms in Korean BPH patients. *Asian J. Androl.*, **11**, 663–668 (2009).
15. Witthaus, M. W. *et al.* Bladder oxidative stress in sleep apnea contributes to detrusor instability and nocturia. *J. Urol.*, **193**, 1692–1699 (2015).
16. Yilmaz, Z., Voyvoda, B. & Sirinocak, P. B. Overactive bladder syndrome and bladder wall thickness in patients with obstructive sleep apnea syndrome. *Int. Braz. J. Urol.*, **44**, 330–337 (2018).
17. Zhou, J., Xia, S., Li, T. & Liu, R. Association between obstructive sleep apnea syndrome and nocturia: A meta-analysis. *Sleep Breath*, **24**, 1293–1298 (2020).
18. Miyauchi, Y. *et al.* Obstructive sleep apnea syndrome as a potential cause of nocturia in younger adults. *Urology*, **143**, 42–47 (2020).
19. Maeda, T. *et al.* Obstructive sleep apnea syndrome should be considered as a cause of nocturia in younger patients without other voiding symptoms. *Can. Urol. Assoc. J.*, **10**, E241–E245 (2016).
20. Asplund, R., Henriksson, S., Johansson, S. & Isacsson, G. Nocturia and depression. *BJU Int.*, **93**, 1253–1256 (2004).
21. Johnson, T. V. *et al.* Nocturia associated with depressive symptoms. *Urology*, **77**, 183–186 (2011).
22. Torimoto, K. *et al.* A large survey of nocturia related to sleep quality and daytime quality of life in a young Japanese population: NOCTURNE study. *Neurourol. Urodyn.*, **40**, 340–347 (2021).
23. Przydacz, M. *et al.* Association between lower urinary tract symptoms and sleep quality of patients with depression. *J. Psychosom. Res.*, **57**, 394 (2021).
24. Przydacz, M. *et al.* Nocturia has no impact on depression severity in patients suffering from depression but correlates with sleep quality. *Psychiatr. Pol.*, **52**, 835–842 (2018).
25. Golabek, T. *et al.* Lower urinary tract symptoms, nocturia and overactive bladder in patients with depression and anxiety. *Psychiatr. Pol.*, **50**, 417–430 (2016).
26. Asplund, R., Johansson, S., Henriksson, S. & Isacsson, G. Nocturia, depression and antidepressant medication. *BJU Int.*, **95**, 820–823 (2005).
27. Solmaz, V. *et al.* Evaluation of overactive bladder in male antidepressant users: A prospective study. *Int. Neurourol. J.*, **21**, 62–67 (2017).
28. Dreher, A. *et al.* Cultural differences in symptom representation for depression and somatization measured by the PHQ between Vietnamese and German psychiatric outpatients. *J. Psychosom. Res.*, **102**, 71–77 (2017).
29. Kim, J. H. J. *et al.* Cultural variation in temporal associations among somatic complaints, anxiety, and depressive symptoms in adolescence. *J. Psychosom. Res.*, **124**, 109763 (2019).