

Screening of overactive bladder syndrome and its relation with insomnia: A public health experience

Salah Bakry, Anmar Nassir¹, Suhayb Bakry, Bassam Abdullah Saati, Mohammed Bandar Alotaibi, Mohammed Mohammed Alomairi

Medical Graduates and Medical Student, ¹Department of Surgery, Faculty of Medicine, Umm Al-Qura University, Makkah, Saudi Arabia

Abstract

Background: Overactive bladder (OAB) syndromes are a vital global issue linked to sleep disturbances and insomnia. This survey explores the relationship between these health burden issues and their risk factors.

Methodology: A survey-based study was conducted among Makkah city citizens' in April 2023. A standardized tool of OAB symptom score and Insomnia Severity Index was used to screen participants. The collected data were statistically analyzed using SPSS.

Results: Overall, 529 participants were enrolled in this survey with mean = 37.3 and standard deviation = 13.7. Most participants had mild OAB 74.67%, while insomnia represents no clinically significant subtype among the majority 55.39%. About 25.33% of participants had clinical OAB (moderate and severe), while approximately 44.61% had insomnia. Similarly, participants with the mild subtype of OAB show a significant correlation with no clinically significant subtype of insomnia ($P > 0.001$). Furthermore, participants with moderate OAB were statistically associated with subthreshold insomnia ($P > 0.001$).

Conclusion: Medical attention and public awareness are mandatory for the early detection of OAB and insomnia.

Keywords: Insomnia, overactive bladder, Saudi Arabia, screening

Address for correspondence: Dr. Salah Bakry, Faculty of Medicine, Umm Al-Qura University, Makkah, Saudi Arabia.

E-mail: salah.m.bakry@gmail.com

Received: 02.07.2023, **Accepted:** 20.03.2024, **Published:** 03.07.2024.

INTRODUCTION

Overactive bladder (OAB) is a prevalent and unpleasant condition that has a negative impact on the inflicted individuals' health-related quality of life (HRQoL).^[1,2] In accordance with the International Continence Society, OAB is a symptomatic health condition characterized by abnormal urinary urgency, which is frequently accompanied by nocturia and/or daytime frequency, with or without urgent urinary incontinence in the absence of any apparent urinary tract infections, and/or other underlying

pathologies.^[1,3,4] Previous epidemiological studies found that the prevalence of OAB in the general population ranged from 3% to 43%.^[1,5-8]

Previous research has identified various factors that may contribute to urinary incontinence and OAB, including occupational stress, delayed voiding, tea, carbonated drinks, and smoking.^[1,9-12] However, little is known about the prevalence of OAB symptoms in young adults and their impact on HRQoL.^[1,9,11,12] Furthermore, little is known about the factors associated with OAB symptoms in young adults.^[1,11]

Access this article online	
Quick Response Code:	Website: www.urologyannals.com
	DOI: 10.4103/ua.ua_71_23

This is an open access journal, and articles are distributed under the terms of the Creative Commons Attribution-NonCommercial-ShareAlike 4.0 License, which allows others to remix, tweak, and build upon the work non-commercially, as long as appropriate credit is given and the new creations are licensed under the identical terms.

For reprints contact: WKHLRPMedknow_reprints@wolterskluwer.com

How to cite this article: Bakry S, Nassir A, Bakry S, Saati BA, Alotaibi MB, Alomairi MM. Screening of overactive bladder syndrome and its relation with insomnia: A public health experience. *Urol Ann* 2024;16:203-9.

Sleep disruption is one potential side effect of OAB,^[6,13,14] with many women reporting nocturnal bladder symptoms such as urgency, voiding, or incontinence associated with waking up at night.^[13,15,16] The primary cause of poor sleep quality or interrupted sleep in women with OAB is frequently assumed to be nocturnal bladder symptoms.^[13] A study investigated obstructive sleep apnea among male individuals, which they found that nocturia did not influence the negative relationship between sleep efficiency and urgency.^[13,15] Furthermore, in a national survey study, it showed that people with and without OAB symptoms experience worse sleep when their nocturia increases.^[13,17]

This study will examine and screen individuals with overacting bladder syndrome and insomnia through valid surveys to test its relationship and correlation among the general population in Makkah City, Saudi Arabia.

METHODOLOGY

Study design and selecting criteria

An electronic, self-structured survey was utilized in this survey-based cross-sectional study. Citizens from Makkah city aged 15–65 were included in the study, while those who were physically ill, incapable of communicating, unwilling, or unfit to previous criteria were excluded from the study.

Sample size

The General Authority for Statistics in Saudi Arabia estimates that 1,908,000 individuals lived in Makkah in 2017. We used the OpenEpi software (www.OpenEpi.com) to determine the sample size using convenience sampling techniques.^[18] We need 486 participants to achieve 95% confidence, a 5% acceptable error margin, a study design impact of 2, and a 10% additional sample to account for incomplete participation for the Makkah city population. However, 529 samples were obtained during the data collecting process.

Study procedure and questionnaire design

We distributed the survey through social media platforms such as WhatsApp, Snapchat, Instagram, and Facebook in June 2023.

This survey utilized a standardized tool to estimate OAB syndrome and insomnia severity. We classified our study into three sections. We begin to gather participants' social-demographical information such as age, gender, nationality, social status, residential area, educational level, and smoking status. Followed by questions aimed at estimating related symptoms of OAB syndrome using a standardized tool of OAB symptom score (OABSS) translated into Arabic.^[19,20]

Finally, a standardized tool detecting insomnia severity using the Insomnia Severity Index.^[21–23]

Ethical consideration

An Institutional Review Board approval was granted by the Umm Al-Qura University Ethics Committee with the code: (HAPO-02-K-012-2023-04-1575) according to the principles of the Declaration of Helsinki. Furthermore, to preserve anonymity and confidentiality, participant names, phone numbers, and identity card numbers were not provided. Before participating in the survey, each respondent gave their free, informed consent online after being made aware of the study's voluntary nature, confidentiality, and only-ever academic intent.

Statistical analysis and scoring system

Data were calculated using the Google platform and stored in separate Microsoft Excel sheets for checking data-related typographical errors along with coding it. We transferred data into the Statistical Package for the Social Studies version. 23 spreadsheets (IBM, Armonk, NY, USA). Descriptive analyses were expressed as frequency and percentages for continuous variables. Categorical variables were compared using an independent Chi-square test to determine the significance level. $P \leq 5\%$ was considered statistically significant.

The second part of the survey was calculated according to the OABSS.^[19,20] This was further classified into three subcategories: those who scored ≤ 5 were considered mild levels, 6–11 were considered moderate or severe, and those with 12 or greater were classified as severe levels.

The last part of the survey was calculated in accordance with the Insomnia Severity Index, in which the final score was categorized into four subtypes of insomnia level severity as follows: 0–7 = No clinically significant insomnia, 8–14 = Subthreshold insomnia, 15–21 = Clinical insomnia (moderate severity), and 22–28 = Clinical insomnia (severe).

RESULTS

This survey-based study interviewed an overall 529 citizens in Makkah City, Saudi Arabia. Their age mean was 37.3 (standard deviation = 13.7), and most of the responses were from participants with ages ranging from 21 to 30 years old ($n = 162$, 30.6%), followed by participants with ages ranging from 41 to 50 years old ($n = 146$, 27.6%) [Table 1].

Most participants were males shows ($n = 329$, 62.2%), while Saudis represented the majority of responses ($n = 482$,

Table 1: Demographic data

Variable	Category	Frequency, n (%)
Age groups	<18	16 (3.0)
	18-20	32 (6.0)
	21-30	162 (30.6)
	31-40	80 (15.1)
	41-50	146 (27.6)
	51-60	75 (14.2)
	>60	18 (3.4)
Gender	Male	329 (62.2)
	Female	200 (37.8)
Nationality	Saudi	482 (91.1)
	Non-Saudi	47 (8.9)
Social status	Single	215 (40.6)
	Married	314 (59.4)
Resident's area	Rural	7 (1.3)
	Urban	522 (98.7)
Educational level	High school/less than university	112 (21.2)
	University	390 (73.7)
	Others	27 (5.1)
Smoking status	Smokers	108 (20.4)
	Nonsmokers	421 (79.6)
Age, mean (SD)	37.3 (13.7)	

SD: Standard deviation

91.1%). According to social status, most participants were married ($n = 314, 59.4\%$). Most participants lived in urban areas accounting for ($n = 522, 98.7\%$), while most participants had university degrees as the highest educational level represent ($n = 390, 73.7\%$). Regarding smoking status, most of the participants are nonsmokers ($n = 421, 79.6\%$), while smokers represent 20.4% [Table 1].

Table 2 shows participants' profiles of OAB syndrome-related history and symptoms. When participants were asked about previous awareness of the OAB syndrome term, most were unaware of represents ($n = 341, 64.5\%$). Moreover, most of the participants had a negative past medical and family history of OAB syndrome ($[n = 512, 96.8\%]$, $[n = 480, 90.7\%]$, respectively) [Table 2].

According to OAB syndrome-related symptoms, most participants showed an average of urination from waking in the morning until sleeping at night seven or less ($n = 360, 68.1\%$). Most participants had once woken up to urinate from sleeping at night until waking in the morning, accounting for ($n = 209, 39.5\%$). Moreover, most of the participants had no sudden desire to urinate or leak urine ($[n = 194, 36.7\%]$, $[n = 362, 68.4\%]$, respectively) [Table 2].

When the participant was asked whether they needed a professional opinion or advice from physicians concerning solving OAB issues, most participants had negative responses ($n = 452, 85.44\%$) [Figure 1].

After score calculation, according to OABSS, most participants had mild levels of OAB syndrome ($n = 395,$

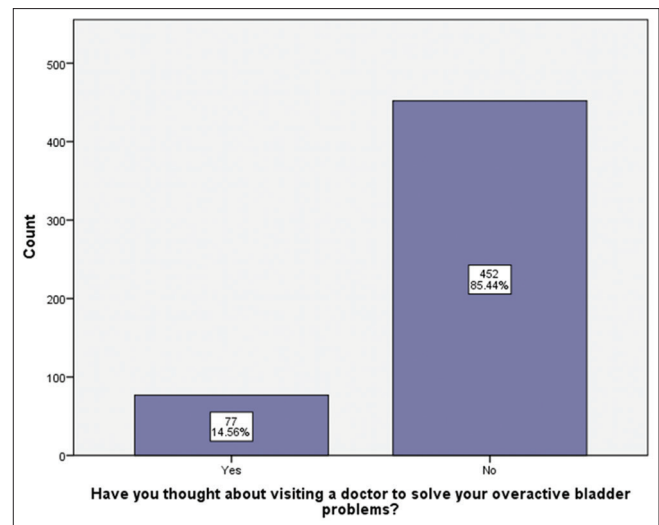


Figure 1: Participants beliefs regarding visiting a physician to solve overactive bladder issue

74.67%), followed by moderate severity ($n = 120, 22.68\%$) [Figure 2].

Table 3 demonstrates the insomnia-related profile and symptoms' frequency. Most participants were aware of insomnia term shows ($n = 436, 82.4\%$), while about 17.6% were unaware. Both past medical and family history were unremarkable among the majority regard insomnia ($[n = 480, 90.7\%]$, $[n = 440, 83.2\%]$, respectively). However, about 9.3% had a past history of insomnia, and 16.8% had a previous family history of insomnia [Table 3].

Most participants had an almost equal representation regarding 2-3 times and once daily tea intake (29.3% and 29.1%, respectively). While most participants had one coffee drink daily, 30.6% [Table 3].

When the participant was asked whether they needed a professional opinion or advice from physicians regarding solving sleep issues, the majority of participants had negative responses ($n = 453, 85.63\%$) [Figure 3].

By utilizing the Insomnia Severity Index, most participants had no clinically significant insomnia ($n = 293, 55.39\%$). About ($n = 193, 36.48\%$) had subthreshold insomnia level, followed by moderate severity clinical insomnia 7.37% and severe clinical insomnia 0.76% [Figure 4].

We determine the level of significance using the Chi-square test regarding the association between the severity of OAB syndrome and the severity of insomnia, as described in Table 4. Participants with mild levels of OAB syndrome corresponded significantly with no clinically significant insomnia ($n = 245$) ($P > 0.001$).

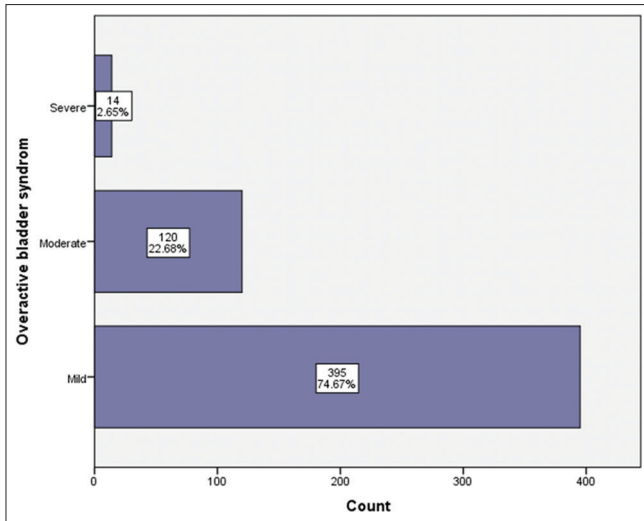


Figure 2: The overactive bladder syndromes' score

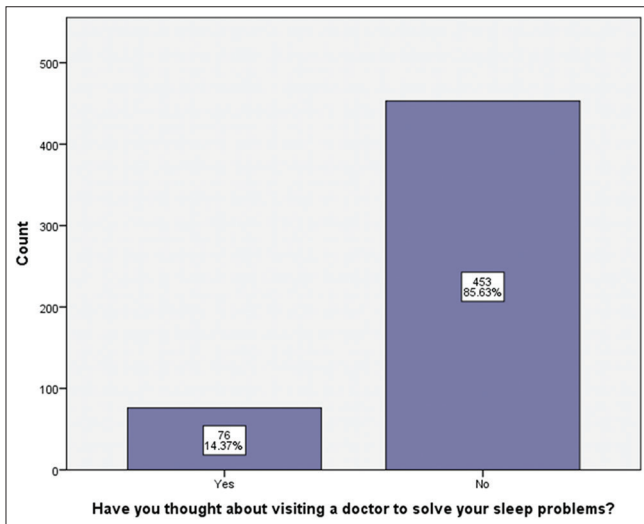


Figure 3: Participants beliefs regarding visiting a physician to solve sleep issue

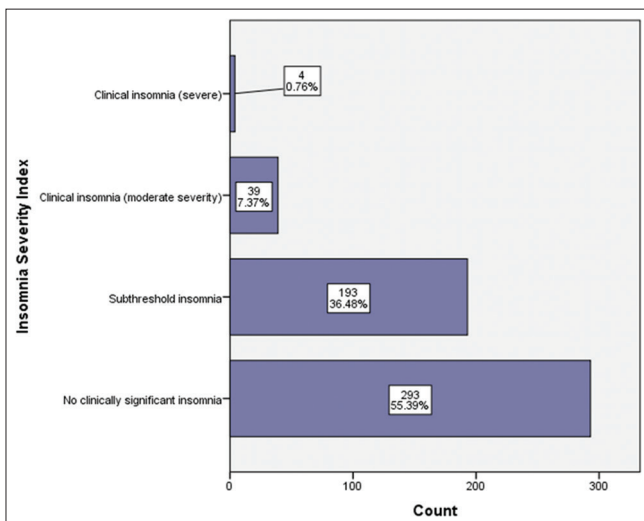


Figure 4: The insomnia score

Table 2: The frequency of overactive bladder syndrome's related profile

Categories	Frequency, n (%)
Previous heard about OAB syndrome term	
Yes	188 (35.5)
No	341 (64.5)
Past medical history of OABS	
Yes	17 (3.2)
No	512 (96.8)
Family history of OABS	
Yes	49 (9.3)
No	480 (90.7)

Frequency of OAB syndrome's symptoms

Item 1. How many times do you typically urinate from waking in the morning until sleeping at night?	
7 or less	360 (68.1)
8-14	160 (30.2)
15 or more	9 (1.7)
Item 2. How many times do you typically wake up to urinate from sleeping at night until waking in the morning?	
0	108 (20.4)
1	209 (39.5)
2	147 (27.8)
3 or more	65 (12.3)
Item 3. How often do you have a sudden desire to urinate, which is difficult to defer?	
Not at all	194 (36.7)
Less than once a week	128 (24.2)
Once a week or more	81 (15.3)
About once a day	37 (7.0)
2-4 times a day	63 (11.9)
5 times a day or more	26 (4.9)
Item 4. How often do you leak urine because you cannot defer the sudden desire to urinate?	
Not at all	362 (68.4)
Less than once a week	77 (14.6)
Once a week or more	30 (5.7)
About once a day	24 (4.5)
2-4 times a day	24 (4.5)
5 times a day or more	12 (2.3)

OAB: Overactive bladder, OABS: Overactive bladder symptom score

However, participants with moderate and severe levels of OAB syndrome corresponded significantly with subthreshold insomnia ($n = 58$ and 7 , respectively) [$P > 0.001$, Table 4].

DISCUSSION

This survey study aimed to determine the relationship between OAB syndrome and insomnia and further screen both among participants in Makkah City, Saudi Arabia.

Globally, many studies reported a prevalence of OAB syndrome. A cross-sectional survey among 402 medical and dental students reported that OAB symptom bother was prevalent across Palestinian universities.^[1] Participants reported an urge to urinate (60.4%), a sudden urge to urinate with little or no warning (36.3%), accidental loss of small amounts of urine (20.1%), nighttime

Table 3: The frequency of insomnia profile

Categories	Frequency, n (%)
Previous heard about insomnia term	
Yes	436 (82.4)
No	93 (17.6)
Past medical history of insomnia	
Yes	49 (9.3)
No	480 (90.7)
Family history of insomnia	
Yes	89 (16.8)
No	440 (83.2)
Tea intake/day	
Once	154 (29.1)
2-3	155 (29.3)
>3	107 (20.2)
None	113 (21.4)
Coffee intake/day	
Once	162 (30.6)
2-3	145 (27.4)
>3	106 (20.0)
None	116 (21.9)
Frequency of insomnia's symptoms	
Item 1. Difficulty falling asleep	
None	186 (35.2)
Mild	192 (36.3)
Moderate	118 (22.3)
Severe	26 (4.9)
Very severe	7 (1.3)
Item 2. Difficulty staying asleep	
None	249 (47.1)
Mild	166 (31.4)
Moderate	87 (16.4)
Severe	19 (3.6)
Very severe	8 (1.5)
Item 3. Problems waking up too early	
None	228 (43.1)
Mild	168 (31.8)
Moderate	107 (20.2)
Severe	23 (4.3)
Very severe	3 (0.6)
Item 4. How satisfied/dissatisfied are you with your current sleep pattern?	
Very satisfied	82 (15.5)
Satisfied	165 (31.2)
Moderately satisfied	187 (35.3)
Dissatisfied	79 (14.9)
Very dissatisfied	16 (3.0)
Item 5. How noticeable to others do you think your sleep problem is in terms of impairing the quality of your life?	
Very satisfied	139 (26.3)
Satisfied	152 (28.7)
Moderately satisfied	150 (28.4)
Dissatisfied	43 (8.1)
Very dissatisfied	45 (8.5)
Item 6. How worried/distressed are you about your current sleep problem?	
Very satisfied	260 (49.1)
Satisfied	118 (22.3)
Moderately satisfied	88 (16.6)
Dissatisfied	39 (7.4)
Very dissatisfied	24 (4.5)
Item 7. To what extent do you consider your sleep problem to interfere with your daily functioning currently?	
Very satisfied	305 (57.7)
Satisfied	132 (25.0)
Moderately satisfied	56 (10.6)
Dissatisfied	24 (4.5)
Very dissatisfied	12 (2.3)

urination (28.1%), waking up at night because you had to urinate (43.8%), and urine loss associated with a strong desire to urinate, respectively (16.9%).^[1] Another cross-sectional study in Saudi Arabia found that OAB is highly prevalent among Saudi women, and 66% of the respondents had to wake up at night and/or look for a restroom if they are out in public to urinate.^[24] Compared to our finding, 68.1% of our participants showed an average of urination from waking in the morning until sleeping at night, seven or less. Furthermore, 39.5% had once woken up to urinate from sleeping at night until waking in the morning. Moreover, 36.7% of participants did not desire to urinate, and 68.4% did not want to leak urine.

On the other hand, our study revealed that 44.61% of participants had insomnia. In Saudi Arabia, a cross-sectional survey among Saudi adults in Riyadh city found that insomnia prevalence was 77.7%.^[25]

According to our findings, a significant relationship was found between an OAB and insomnia. Comparing this finding to published literature, OAB and sleep quality have been addressed in many studies. A cross-sectional examination of 51 OAB patients and 30 age-matched controls revealed that sleep problems were linked to worse psychosocial health and more severe OAB symptoms.^[26] In another prospective trial including 161 women, it has been found that despite nocturnal bladder symptoms, OAB patients had high rates of poor sleep quality and sleep disruption.^[13]

In addition to cross-sectional studies that found links between nocturia and poor sleep,^[17,27] poor sleep was linked to the development of new-onset nocturia in two prospective observational studies, indicating a bidirectional relationship.^[28,29] Individuals with cystometrogram-confirmed detrusor overactivity were likelier to have detrusor contractions before awakening in one urodynamics investigation than individuals with primary insomnia or healthy controls.^[30]

This survey carries out some possible limitations, including collection bias, as this survey-based study. Furthermore, the sample size needs to be increased, and this study needs to be reinvestigated among all Saudi regions to achieve generalizability. Another possible limitation is the distributing process through social media platforms among participants with an age group of more than 50s. Participants with ages <18 need may need further explanation or simplification to answer this survey as it might be challenging to comprehend.

Table 4: The association between the severity of overactive bladder syndrome and with severity of insomnia among participants

Category	Insomnia				P
	No clinically significant insomnia	Subthreshold insomnia	Clinical insomnia (moderate severity)	Clinical insomnia (severe)	
Overactive bladder syndrome					
Mild	245	128	20	2	>0.001*
Moderate	43	58	17	2	
Severe	5	7	2	0	

CONCLUSION

Our finding indicated a significant connection between individuals with OAB and insomnia severity. Health-care provider attention is mandatory for the early detection of OAB and screening for insomnia. More investigation is required to understand this association, identify the underlying mechanisms, and investigate the potential treatment implications. Public awareness and education are needed. Seeking medical advice for management should be facilitated.

Financial support and sponsorship

Nil.

Conflicts of interest

There are no conflicts of interest.

REFERENCES

- Shawahna R, Hijaz H, Jallad K, Abushamma M, Sawafta M. Prevalence of overactive bladder symptoms and their impact on health-related quality of life of medical and dentistry students: A multicenter cross-sectional study. *BMC Urol* 2021;21:142.
- Foley S, Choudhury N, Huang M, Stari A, Nazir J, Freeman R. Quality of life in patients aged 65 years and older with overactive bladder treated with mirabegron across eight European countries: Secondary analysis of BELIEVE. *Int J Urol* 2019;26:890-6.
- Haylen BT, de Ridder D, Freeman RM, Swift SE, Berghmans B, Lee J, *et al.* An International Urogynecological Association (IUGA)/International Continence Society (ICS) joint report on the terminology for female pelvic floor dysfunction. *Int Urogynecol J* 2010;21:5-26.
- Coyne KS, Sexton CC, Vats V, Thompson C, Kopp ZS, Milsom I. National community prevalence of overactive bladder in the United States stratified by sex and age. *Urology* 2011;77:1081-7.
- Irwin DE, Milsom I, Hunskaar S, Reilly K, Kopp Z, Herschorn S, *et al.* Population-based survey of urinary incontinence, overactive bladder, and other lower urinary tract symptoms in five countries: Results of the EPIC study. *Eur Urol* 2006;50:1306-14.
- Stewart WF, Van Rooyen JB, Cundiff GW, Abrams P, Herzog AR, Corey R, *et al.* Prevalence and burden of overactive bladder in the United States. *World J Urol* 2003;20:327-36.
- Milsom I, Stewart W, Thüroff J. The prevalence of overactive bladder. *Am J Manag Care* 2000;6:S565-73.
- Eapen RS, Radomski SB. Review of the epidemiology of overactive bladder. *Res Rep Urol* 2016;8:71-6.
- Cella D, Riley W, Stone A, Rothrock N, Reeve B, Yount S, *et al.* The patient-reported outcomes measurement information system (PROMIS) developed and tested its first wave of adult self-reported health outcome item banks: 2005-2008. *J Clin Epidemiol* 2010;63:1179-94.
- Avery K, Donovan J, Peters TJ, Shaw C, Gotoh M, Abrams P. ICIQ: A brief and robust measure for evaluating the symptoms and impact of urinary incontinence. *Neurourol Urodyn* 2004;23:322-30.
- Jackson S, Donovan J, Brookes S, Eckford S, Swithinbank L, Abrams P. The Bristol female lower urinary tract symptoms questionnaire: Development and psychometric testing. *Br J Urol* 1996;77:805-12.
- Coyne K, Revicki D, Hunt T, Corey R, Stewart W, Bentkover J, *et al.* Psychometric validation of an overactive bladder symptom and health-related quality of life questionnaire: The OAB-q. *Qual Life Res* 2002;11:563-74.
- Savoie MB, Lee KA, Subak LL, Hernandez C, Schembri M, Fung CH, *et al.* Beyond the bladder: Poor sleep in women with overactive bladder syndrome. *Am J Obstet Gynecol* 2020;222:600.e1-13.
- Sexton CC, Coyne KS, Thompson C, Bavendam T, Chen CI, Markland A. Prevalence and effect on health-related quality of life of overactive bladder in older Americans: Results from the epidemiology of lower urinary tract symptoms study. *J Am Geriatr Soc* 2011;59:1465-70.
- Asplund R, Johansson S, Henriksson S, Isacson G. Nocturia, depression and antidepressant medication. *BJU Int* 2005;95:820-3.
- Winkelman WD, Warsi A, Huang AJ, Schembri M, Rogers RG, Richter HE, *et al.* Sleep quality and daytime sleepiness among women with urgency predominant urinary incontinence. *Female Pelvic Med Reconstr Surg* 2018;24:76-81.
- Coyne KS, Zhou Z, Bhattacharyya SK, Thompson CL, Dhawan R, Versi E. The prevalence of nocturia and its effect on health-related quality of life and sleep in a community sample in the USA. *BJU Int* 2003;92:948-54.
- Dean AG, Sullivan KM, Soe MM. OpenEpi: Open Source Epidemiologic Statistics for Public Health, Version. Available from: <https://www.OpenEpi.com>. [Last accessed on 2020 Jul 19, Last updated on 2013 Apr 06].
- Elbaset MA, Hashem A, Taha DE, Zahran MH, El-Hefnawy AS. Validation of the Arabic linguistic version of the overactive bladder symptoms score questionnaire. *Arab J Urol* 2019;17:265-9.
- Pal M, Bandyopadhyay S, Roy A. Overactive bladder symptom score – Translation and linguistic validation in Bengali. *J Family Med Prim Care* 2022;11:79-83.
- Musa NA, Moy FM, Wong LP. Prevalence and factors associated with poor sleep quality among secondary school teachers in a developing country. *Ind Health* 2018;56:407-18.
- Pohl M, Feher G, Kapus K, Feher A, Nagy GD, Kiss J, *et al.* The association of internet addiction with burnout, depression, insomnia, and quality of life among Hungarian high school teachers. *Int J Environ Res Public Health* 2021;19:438.
- Morin CM, Belleville G, Bélanger L, Ivers H. The insomnia severity index: Psychometric indicators to detect insomnia cases and evaluate treatment response. *Sleep* 2011;34:601-8.
- Almousa R, Albagshi S, Alabbad A, Alshamsi H, Almuslim O. Overactive bladder amongst Saudi women: Its prevalence, risk factors, and effect on quality of life. *Arab J Urol* 2018;16:S4-5.
- Ahmed AE, Al-Jahdali H, Fatani A, Al-Rouqi K, Al-Jahdali F, Al-Harbi A, *et al.* The effects of age and gender on the prevalence of insomnia in a sample of the Saudi population. *Ethn Health* 2017;22:285-94.

26. Ge TJ, Vetter J, Lai HH. Sleep disturbance and fatigue are associated with more severe urinary incontinence and overactive bladder symptoms. *Urology* 2017;109:67-73.
27. Fung CH, Vaughan CP, Markland AD, Huang AJ, Mitchell MN, Bliwise DL, *et al.* Nocturia is associated with poor sleep quality among older women in the study of osteoporotic fractures. *J Am Geriatr Soc* 2017;65:2502-9.
28. Araujo AB, Yaggi HK, Yang M, McVary KT, Fang SC, Bliwise DL. Sleep related problems and urological symptoms: Testing the hypothesis of bidirectionality in a longitudinal, population based study. *J Urol* 2014;191:100-6.
29. Fukunaga A, Kawaguchi T, Funada S, Yoshino T, Tabara Y, Matsuda F, *et al.* Sleep disturbance worsens lower urinary tract symptoms: The nagahama study. *J Urol* 2019;202:354.
30. Krystal AD, Preud'homme XA, Amundsen CL, Webster GD. Detrusor overactivity persisting at night and preceding nocturia in patients with overactive bladder syndrome: A nocturnal cystometrogram and polysomnogram study. *J Urol* 2010;184:623-8.