Original Article

Predictors of the international prostate symptoms scores for patients with lower urinary tract symptoms: A descriptive cross-sectional study

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Abstract

Background: Lower urinary tract symptoms (LUTSs) can significantly reduce men's quality of life and may point to serious pathology of the urogenital tract. This study aimed at finding predictors of symptoms score on the International Prostate Symptom Score (IPSS) for patients with LUTS.

Materials and Methods: The study was cross-sectional conducted among 225 Ghanaian men visiting the urology clinic at Komfo Anokye Teaching Hospital. Trained interviewers used the IPSS, which adds a quality of life question to the American Urology Association symptom index to determine the extent to which patients are troubled by their symptoms. Five milliliters of blood was collected for total prostate-specific antigen (PSA) measurement. Transrectal ultrasonography was performed to evaluate the prostate volume (PV).

Results: The mean age of the participants was 67.96 ± 14.57. The average score obtained from the study participants using the IPSS scale was 17.52 ± 7.83. There was a significant association between bother score and IPSS symptoms grade ($P < 0.0001$). Regression plot of the participants' points for IPSS in relation to the age, PSA, and PV showed statistically significant positive associations ($P < 0.05$). However, the coefficients of determination (R^2) were 0.156, 0.022, and 0.048, respectively. This means that each unit increase of age, PSA, and PV only influences 15.6%, 2.3%, and 4.8% of the change in the symptom score. There was statistically significant association between age and moderate-to-severe LUTS with age range of 75 years above recording the highest odds (adjusted odds ratio (AOR) = 18.72, (1.15–99.78), $P < 0.0001$). The PSA range 20.1–50 ng/ml was significantly associated with moderate-to-severe LUTS (AOR = 17.37 (2.19–223.45), $P = 0.006$). Moreover, other factors, which were significantly associated with moderate-to-severe LUTS, were smoking (AOR = 0.32 (0.11–0.94) $P = 0.038$) and being widowed (AOR = 0.05 (0.002–0.52), $P =0.010$) respectively.

Conclusion: The study found a statistically significant correlation between age, PSA, PV, and IPSS scores; however, these influences were mild.

Keywords: International prostate symptoms score, lower urinary tract symptoms, prostate specific antigen predictors

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INTRODUCTION

Lower urinary tract symptoms (LUTSs) are used to define the complex of symptoms which includes bladder storage, sensation, or voiding symptoms affecting the lower urinary tract. LUTS affects 15%–60% of patients older than 40 years which poses a public health burden.[1,2]

LUTS can significantly reduce men's quality of life and may point to serious pathology of the urogenital tract. The symptoms are common and nonspecific, but LUTS is not necessarily a reason to suspect prostate cancer. Prevailing guidelines suggest that the pathogenesis of LUTS is multifactorial and can include one or several diagnoses including benign prostatic hyperplasia (BPH) with obstruction, detrusor muscle weakness and/or instability, urinary tract infection, chronic prostatitis, urethral stricture, urinary stone, malignancy, and neurological disease.[3] However, BPH is thought to account for the vast majority of LUTS. BPH causes symptoms in approximately 90% of men over the age of 80 and one-third of men will develop urinary tract symptoms once in their life.[4,5] In Ghana, the prevalence of BPH using ultrasound detected enlarged prostate was 40.0%.[6] The International Prostate Symptom Score (IPSS), coupled with a physician's examination, is employed to assess these LUTSs posed by BPH. Primary and secondary tests are often carried out such as a prostate-specific antigen (PSA) test, urinalysis, ultrasound, urinary flow studies, imaging, temporary prostatic stent placement, prostate biopsy, and/or cystoscopy. The IPSS was developed in 1992 following the previous use of the American Urological Association (AUA) score, with an intention to quantify the symptoms experienced by patients.[7]

The previous study by Vesely, 2003, reported statistically significant but weak correlation between prostate volume (PV) and age and between PSA and age. The study also reported that PV correlated positively with serum PSA.[8] Agrawal *et al.*, 2008, found a statistically insignificant correlation between PV and age, IPSS, and QOL score except for two domains; incomplete emptying and nocturia that appear to be correlated with PV.[9] The correlation between IPSS and QOL score was, however, strong. Similarly, correlation between QOL score and age was significant but weak.[10] There is, therefore, conflicting evidence for the relationships between size of the prostate, PSA, and symptoms reported on the IPSS by patients. A few studies have been conducted to determine the prevalence of LUTS among Ghanaians, but no study has stepped up the search for appropriate predictors of symptom scores on the IPSS and quality of life of patients

to facilitate early diagnosis and management of disease of the prostate. This study aimed at finding predictors of symptoms score on the IPSS for patients with LUTS.

MATERIALS AND METHODS

Study design/setting

The study was a hospital-based cross-sectional study among 225 Ghanaian men visiting the urology clinic at the Komfo Anokye Teaching Hospital (KATH) between December 2014 and March 2016. KATH is a tertiary referral teaching hospital located in Kumasi, the regional capital of the Ashanti region in Ghana with a total projected population of 4,780,380 according to the Ghana Statistical Service, 2010. It is the second largest Hospital in Ghana.

Study population/subject selection

Nonprobability sampling was used to recruit informed and consented participants for the study. Recruited patients were male patients aged 40 years and above who presented to the urology clinic KATH for the first time. Male patients who were below 40 years of age who presented with LUTS were excluded from the study and male patients who were 40 years and above who presented without LUTS to the urology clinic were recruited. Data were obtained during clinic consultations from participants who presented with LUTS to the researchers. Information was obtained on their sociodemographic, medical history, major comorbid conditions, and detailed self-reported symptoms of the urogenital system. Trained interviewers used the IPSS, which adds a quality of life question to the American Urology Association symptom index to determine the extent to which patients are troubled by their symptoms. This validated tool contains eight questions. Seven fall under the LUTS categories and one pertains to quality of life.[11,12] It has sound internal consistency, as measured by a Cronbach's alpha coefficient of 0.89. The seven questions of the IPSS comprise one on postmicturition symptoms, three on voiding symptoms, and three on bladder storage symptoms. The sum of the IPSS was obtained by combining the sum of the answers for questions 1–7. This symptom category allows the physician to understand the degree of inconvenience that patients perceive their symptoms to have caused. Significant LUTS is usually defined as a total IPSS of at least eight (moderate or severe).[11] Physical examination of the patients was carried out by an experienced urologist who performed a DRE to evaluate prostate size, consistency, induration, nodularity, asymmetry, or the presence of a rectal mass. An enlarged, firm, mobile rectal mucosa, smooth surface, well-defined margins, and symmetrical prostate was indicative of prostate enlargement

Estimation of prostate-specific antigen and transrectal ultrasonography

Before ultrasonography, 5 ml of blood was collected into a serum separator Vacutainer® tube and centrifuged to obtain the serum used for total PSA assay. The assay was performed using the electrochemiluminescence method (Cobas e411 Analyzer, Roche Diagnostics, Germany). Transrectal ultrasonography was performed using an endocavitary convex probe with a 6.5 MHz transducer. Measures of the triaxial distances of the prostate were taken in its larger diameter and total volume was calculated using the formula; volume 0.52 × transverse diameter × anterior-posterior diameter × longitudinal diameter.

Sample size determination

The study was designed to detect a 5% difference in the prevalence of LUTS, with α-error of 5%, acceptable β-error of 20%, and a statistical power of 80%. Based on an average prevalence, 31.8% of BPH using the IPSS, PSA, and an enlarged prostate on DRE in a study conducted in the capital of Ghana, Accra and using the formula for sample size determination for studying prevalence in male populations of 2,316,052; the minimum required sample size was thus determined to be 225.

Data analysis

Responses to questionnaires were coded and entered into a database using Statistical Package for the Social Sciences® (SPSS, Chicago, Illinois, USA) version 16 for analysis. Associations between categorical variables were compared using the Chi-squared test, Yates's Chi-square test, and Fischer's exact test. Statistical significance was set at $P < 0.05$. Multiple logistic regression models, adjusting for age, were used to identify explanatory variables that predicted the odds of having moderate-to-severe LUTS.

Ethical consideration

Ethical approval (CHRPE/AP/243/15) for the study was obtained from the Committee on Human Research, Publication, and Ethics of the School of Medical Sciences, Kwame Nkrumah University of Science and Technology as well as Ethical Review Board of the KATH. Participation was voluntary and verbal informed consent was obtained from each participant according to the Helsinki Declaration. Respondents were assured on the confidentiality of their responses. In addition, respondents were given the freedom to opt out any time they thought that they could not continue with the study.

RESULTS

The mean age of the participants was 67.96 ± 14.57 (range = 40–100). The average score obtained from the study participants using the IPSS scale was 17.52 ± 7.83. Most of the participants (88.00%) were married with an average marital period of 37.72 ± 7.83. Higher proportions of them (57.78%) was pensioners. Majority of the participants (58.67%) attained tertiary level in education. The majority of the participants (34.22%) were at least 75 years. Only 13.3% were younger than 50 years [Table 1].

Table 2 shows the factors associated with moderate-to-severe LUTS suggestive of BPH. Greater proportions of the participants with moderate-tosevere LUTS were above 75 years of age (97.4%). The age ranges 50–54 years and 70–74 years, respectively, were not statistically significant ($P > 0.05$) in the univariate logistic model but were statistically significant in the multivariate logistic model ($P < 0.05$) with the age range ≥75 years recording the highest odds (odds ratio [OR] = 18.72; $P < 0.0001$). The age range 45–49 years was not statistically significant in both univariate and multivariate logistic models. Considerable proportions of the participants (71.43%) with moderate-to-severe LUTS were in the 20.1–50 ng/ml PSA levels range. There was no significant associations of the categorized PSA levels in the univariate logistic model, but PSA range 20.1–50 ng/ml was statistically significant ($P = 0.006$) in the multivariate

Table 1: Sociodemographic characteristic of study participants

Variables	Frequency, *n* (%)
Age (years), mean±SD	67.96±14.57
Age groups (years)	
40-44	11 (4.89)
45-49	19 (8.44)
50-54	20 (8.89)
55-59	22 (9.78)
60-64	25 (10.20)
65-69	28 (11.11)
70-74	28 (12.44)
75+	77 (34.22)
Marital status	
Single	11 (4.89)
Widower	10 (4.44)
Divorced	6 (2.67)
Married	198 (88.00)
Marital period, mean±SD	37.72±7.83
Religion	
Christian	211 (93.78)
Islam	14 (6.22)
Educational status	
No education	8 (3.56)
Basic	63 (28.00)
Secondary	22 (9.78)
Tertiary	136 (58.67)
Occupational status	
Informal	80 (35.56)
Pensioner	130 (57.78)
Formal	7 (3.11)
Unemployed	8 (3.56)
Score from IPSS, mean±SD	17.52±7.83

SD: Standard deviation, IPSS: International Prostate Symptom Score

Table 2: Factors associated with moderate-to-severe lower urinary tract symptoms

Variables	IPSS symptoms grade			Crude OR (95% CI)	*P*	Adjusted OR (95% CI)	*P*
	Total (%)	Moderate-severe (%)	Mild (%)				
Age (groups)							
40-44	11 (4.89)	4 (36.36)	7 (63.63)	Referent	Referent	Referent	Referent
45-49	19 (8.44)	7 (36.80)	12 (63.20)	1.02 (0.22-4.77)	0.999	1.26 (0.05-18.90)	0.860
50-54	20 (88.89)	11 (55.0)	9 (45.0)	2.14 (0.47-9.70)	0.458	3.43 (0.32-99.40)	0.002
55-59	22 (9.78)	17 (72.27)	5 (22.73)	5.95 (1.22-6.82)	0.052	4.33 (0.57-60.21)	<0.0001
60-64	23 (10.22)	23 (100)	0	18.33 (3.76-163.1)	<0.0001	5.97 (0.40-250.27)	<0.0001
65-69	25 (11.1)	24 (96.0)	1 (4.0)	22.00 (2.21-114.3)	0.0003	13.85 (0.83-120.62)	<0.0001
70-74	28 (12.4)	27 (96.43)	1 (3.57)	3.50 (0.24-51.93)	0.539	9.08 (0.50-53.23)	<0.0001
75+	77 (34.22)	75 (97.4)	2 (2.60)	27.63 (10.15-174.3)	<0.0001	18.72 (1.15-99.78)	<0.0001
PSA value (ng/ml)							
0-4	41 (18.3)	34 (82.93)	7 (17.07)	Referent	Referent	Referent	Referent
4.1-10	37 (16.52)	29 (78.38)	8 (21.62)	0.99 (0.31-3.27)	0.890	4.24 (0.48-46.77)	0.195
10.1-20	40 (17.86)	34 (85.0)	6 (15.0)	1.43 (0.46-4.45)	0.526	2.81 (0.37-28.78)	0.329
20.1-50	60 (26.79)	40 (71.43)	20 (28.57)	1.49 (0.59-3.98)	0.252	17.37 (2.19-223.45)	0.006
>50	46 (20.54)	28 (51.35)	18 (48.65)	1.33 (0.45-3.97)	0.610	6.23 (0.65-87.67)	0.116
Prostate volume (ml)							
Grade I	21 (9.33)	13 (61.91)	8 (38.09)	Referent	Referent	Referent	Referent
Grade II	43 (19.11)	32 (74.42)	11 (25.58)	1.79 (0.58-5.47)	0.385	3.91 (0.46-41.98)	0.217
Grade III	62 (27.56)	40 (76.92)	12 (23.08)	2.05 (0.69-6.11)	0.248	1.18 (0.13-10.20)	0.878
Grade IV	99 (44.0)	75 (75.76)	24 (24.24)	1.92 (0.71-5.20)	0.280	4.05 (0.166-7.28)	0.206

IPSS: International Prostate Symptom Score, OR: Odds ratio, PSA: Prostate-specific antigen, CI: Confidence interval

logistic model in comparison to mild LUTS. Majority of the participants experiencing moderate-to-severe LUTS had Grade IV PV (75.70%) compared to those with mild LUTS; however, no significant difference was observed in the univariate and multivariate logistic models with Grade IV recording the highest odds (OR = 4.05: 95% confidence interval [CI] = 0.166–7.28).

Majority of men with moderate-to-severe LUTS were married (75.0%), had a tertiary education (74.24%), consumed alcohol (75.1%), and smoke cigarette (57.89%), respectively, in comparison to mild LUTS. Furthermore, a higher proportion of participants having moderator-to-severe LUTS reported having diabetes (63.33%), hypertension (71.70%), and family history of LUTS (73.08%) in comparison to mild LUTS. There was a significant difference between moderate-to-severe LUTS in reference to being a widowed in both univariate ($P = 0.041$) and multivariate logistic models ($P = 0.10$). No significant difference was observed between moderate-to-severe and mild LUTS in reference to smoking in the univariate logistic analysis but was statistically significant upon multivariate logistic model ($P = 0.038$) [Table 3].

Table 4 shows the association between quality of life and LUTS. None of the participants with severe LUTS were pleased with their symptoms, while 1 (0.96%) with severe LUTS was most satisfied with the symptoms. None of the participants with moderate LUTS was pleased or most satisfied with their symptoms. In addition, no participants felt terrible with mild LUTS, while 68 (65.39%) with

severe LUTS felt terrible in relation to their symptoms. One hundred and seventy-six (78.22%) had a mix of most satisfied and dissatisfied, most dissatisfied, unhappy, and terrible which suggest that 78.2% had bothersome LUTS.

Figure 1 shows regression graphs between IPSS and PSA, age, and PV. The regression plot of the individual patient data points for IPSS in relation to the age and PSA showed a mild statistically significant positive relationship ($P < 0.05$). However, the coefficients of determination (R^2 value) were 0.156 and 0.022, respectively. This means that each unit increase of age and PSA only influences 15.6% and 2.3% of the change in the symptom score. PV had a statistically significant positive relationship with PSA ($P = 0.0013$). The coefficients of determination (R^2 value) were 0.0482 which means that each unit increase of PSA influences 4.8% of the change in the PV.

DISCUSSION

As age advances, it is expectant that the prevalence of LUTS seen in men increases. This current study found that prevalence of LUTS increased significantly with age. In parallel, logistic model results showed that were at higher risk LUTS followed by participants in the 60–69 age range. These findings are consistent with previous research results.[13,14]

Several studies have reported that PSA levels correlate positively with prostate size and have been used as a surrogate marker for PV as well as to estimate a patient's risk of progression to BPH. Traditionally, it has been

Table 3: Association between demographic, life and medical history characteristics, and moderate-to-severe lower urinary tract symptoms

Variables	IPSS symptom grading			Crude OR (95% CI)	P	Adjusted OR (95%CI)	P
	Total (%)	Moderate-to-severe (%)	Mild (%)				
Alcohol consumption							
No	181 (81.53)	136 (75.14)	45 (24.86)	Referent		Referent	
Yes	41 (18.47)	31 (75.61)	10 (24.39)	1.03 (0.47-2.26)	0.990	1.29 (0.56-3.18)	0.551
Smoking cigarette							
No	204 (91.48)	157 (76.96)	47 (23.03)	Referent		Referent	
Yes	19 (8.52)	11 (57.89)	8 (42.11)	0.41 (0.19-1.26)	0.916	0.32 (0.11-0.94)	0.038
Marital status							
Single	11 (4.93)	10 (90.91)	1 (9.09)	Referent		Referent	
Married	196 (87.89)	147 (75.0)	49 (25.0)	0.30 (0.04-2.40)	0.303	0.37 (0.02-2.08)	0.294
Widowed	8 (3.58)	3 (37.50)	5 (62.50)	0.06 (0.004-0.74)	0.041	0.05 (0.002-0.52)	0.010
Divorced	8 (100.0)	8 (3.56)	0	0.80 (0.04-14.90)	0.992	0.68 (0.06-18.94)	0.356
Educational status							
No education	8 (3.56)	7 (87.50)	1 (12.50)	Referent		Referent	
Basic	63 (28.0)	48 (76.19)	15 (23.81)	0.46 (0.05-4.02)	0.673	0.34 (0.09-6.02)	0.673
Secondary	22 (9.78)	15 (68.18)	7 (31.82)	0.36 (0.03-2.99)	0.391	0.29 (0.10-3.96)	0.391
Tertiary	132 (58.67)	98 (74.24)	34 (25.76)	0.41 (0.05-3.47)	0.697	0.19 (0.02-4.56)	0.697
Diabetes							
No	193 (86.5)	149 (77.20)	44 (22.80)	Referent		Referent	
Yes	30 (13.45)	19 (63.33)	11 (36.67)	0.51 (0.23-1.15)	0.113	1.19 (0.41-3.78)	0.750
Hypertension							
No	117 (52.47)	92 (78.63)	25 (21.36)	Referent		Referent	
Yes	106 (47.53)	76 (71.70)	30 (28.30)	0.69 (0.37-1.27)	0.217	0.96 (0.48-1.91)	0.896
Family history							
No	197 (88.34)	149 (75.5)	48 (24.36)	Referent		Referent	
Yes	26 (11.66)	19 (73.08)	7 (26.92)	0.87 (0.35-2.21)	0.870	0.75 (0.29-3.47)	0.870
Heart disease							
No	221 (99.10)	166 (75.11)	55 (24.89)	Referent		Referent	
Yes	2 (0.9)	2 (0.89)	0	1.67 (0.07-35.27)	0.990	1.02 (0.47-38.26)	0.137

OR: Odds ratio, CI: Confidence interval, IPSS: International Prostate Symptom Score

Table 4: Association between quality of life and lower urinary tract symptoms

Variables	IPSS symptom grade			χ^2, df (P)
	Mild (%)	Moderate (%)	Severe (%)	
Quality of life				
Pleased	36 (65.45)	0	0	19.56, 10
Mostly satisfied	11 (20.00)	0	1 (0.96)	(<0.0001)
Mixed	4 (7.27)	9 (13.64)	4 (3.85)	
Mostly dissatisfied	2 (3.64)	4 (6.06)	11 (10.58)	
Unhappy	1 (1.82)	17 (25.76)	20 (19.23)	
Terrible	0	36 (54.54)	68 (65.39)	
Total	55 (24.44)	66 (29.33)	104 (46.22)	

IPSS: International Prostate Symptom Score

thought that an increase in PV precipitates the development of LUTS, due to the bladder outlet obstruction caused by the prostate exerting pressure on the urethra. Nonetheless, some studies also reported that prostate size and PSA levels do not always correlate well with symptom severity.[15,16] Regression analysis in this study showed that IPSS was linearly and positively related to PSA ($R^2 = 0.023$; $P = 0.029$) and age ($R^2 = 0.156$; $P < 0.0001$). These findings are similar to reports from the Tsukamoto study. However, the clinical utility of this finding is mild as it is only able to influence 2.3% and 15.6% of the symptoms reported by patients, hence making it a poor predictor.

Moreover, according to logistic regression model results, an elevated PSA level in the range of 20.1–10 ng/ml was an important risk factor but statistically not significant for LUTS (OR = 1.49; $P = 0.252$). Therefore, this supports the fact that prostate size is associated with PSA levels and the symptoms severity.

Educational level plays an important role in making the individual aware of LUTS, enabling them to seek and agree to treatment endorsed to them. In parallel, Signorello *et al.*, 1999, reported that as education levels increased, LUTS risk decreased. This relationship is related to the fact that those whose educational level is higher have better access to health service.[17,18] According to the logistic model result in this study, advancement in education was associated with reducing risk for LUTS in reference to no education but statistically not significant; basic education level (OR = 0.46; $P = 0.673$), secondary education level (OR = 0.36; $P = 0.391$), and tertiary education level (OR = 0.41; $P = 0.679$), respectively. Most studies examining the role of alcohol consumption in risk of surgically treated BPH, clinically diagnosed BPH, or severity of LUTS have shown an inverse association[19,20] or no association[21,22] with alcohol consumption. In this study, we observed higher proportion (75.61%) of men
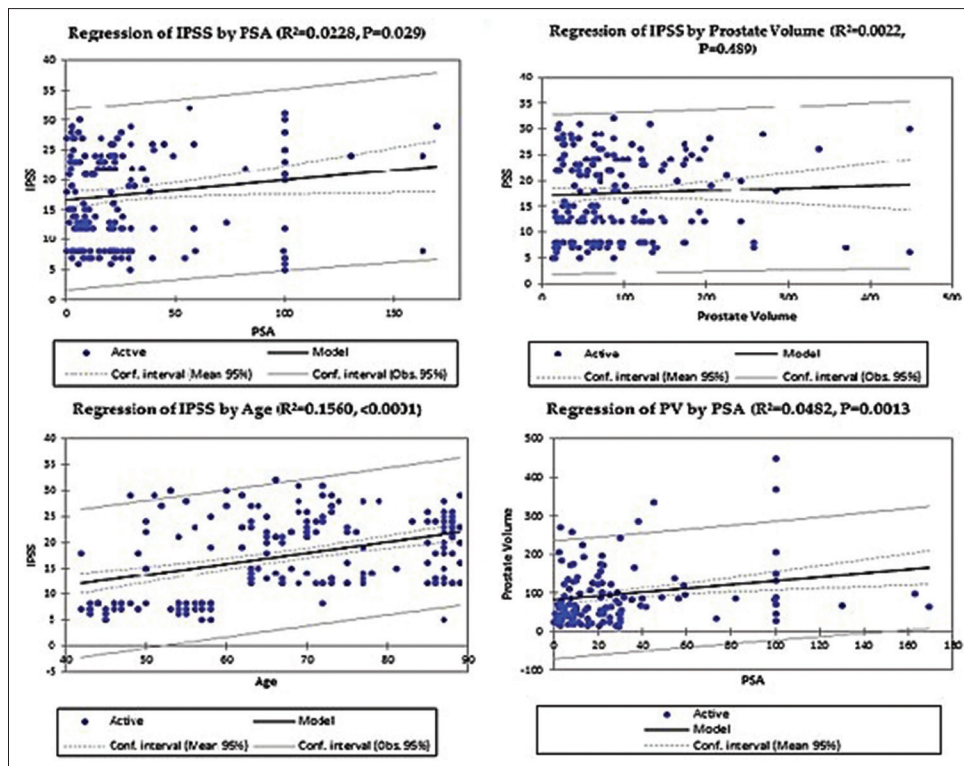
Figure 1: Regression graphs between international prostate symptom score and prostate-specific antigen, age, and prostate volume

with moderate-to-severe symptoms scores who consumed alcohol. In addition, we did not find a significant association between alcohol consumption and moderate-to-severe symptoms but with increased odds (OR = 1.026; P = 0.990) according to logistic model results. Nicotine increases sympathetic nervous system activity and might contribute to LUTS through an increase in the tone of the prostate and bladder-smooth muscle. Some previous studies have indicated that those who smoke cigarettes had a higher prevalence of LUTS.[20,23] Similarly, our study revealed that a higher proportion (57.89%) of participants who smoked had moderate-to-severe symptoms scores. Platz *et al.* noted that obstructive symptoms were strongly associated with smoking,[20] but we did not observe any significant association between history of smoking and moderate-to-severe symptoms score upon univariate logistic regression, but there was a significant association (OR = 0.32: P = 0.038) in the multivariate logistic model holding other variables constant.

LUTS is usually concurrently associated with cardiovascular disease, hypertension, and diabetes mellitus which are common conditions in elderly men.[24,25] However, we did not observe a significant association with stroke, hypertension, and diabetes mellitus in men as compared to severe LUTS. In this study, the prevalence of LUTS was higher in married men in reference to single ones. This finding is in line with other studies showing similar results.[26,27] Moreover, the logistic model results in this study showed that married men were more likely to experience LUTS (OR = 2.89; P = 0.303). There was also a significant association (P = 0.041) between widowed men and moderate-to-severe symptoms with reduced odds for LUTS (OR = 0.06 [0.004–0.740]). Up to now, no acceptable reason has been given to explain why married men have more LUTS than single men; therefore, there is the need to assess the impact of being single and or married on prevalence of LUTS in individuals. The reports of this study were hospital based, and this may not be representative of what occurs in the community. Therefore, extrapolations should be made with restraint.

CONCLUSION

The study found statistically significant correlation found between age, PSA, PV, and IPSS scores. However, these influences were mild; it is only able to demonstrate the trend that PSA, PV, and age are related to symptom scores but cannot clearly provide a snapshot of the situation. Furthermore, factors, which were significantly associated with moderate-to-severe LUTS, were smoking and being widowed, respectively. Further studies are required in larger populations.

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