



Anxiety and depression in association with lower urinary tract symptoms: results from the COBaLT study

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Abstract

Purpose Depression and anxiety have been associated with lower urinary tract symptoms (LUTS) in several studies. In our population, the prevalence of LUTS is high, consequently, it is essential and an objective of this study, to determine the association between anxiety, depression, and LUTS in a large Hispanic population.

Methods A sub-analysis of a cross-sectional population-based study to estimate LUTS prevalence in the Colombian population was performed (COBaLT study) (Plata et al. in *Neurourol Urodyn* 38:200–207, 2018). The Hospital Anxiety and Depression Scale (HADS) was used to evaluate mental health. Logistic regression was carried out to estimate the association of depression and anxiety with different LUTS. Variables that proved statistically significant ($p < 0.05$) were included in a multivariate model.

Results A total of 1060 individuals were assessed. The prevalence of anxiety in women and men was 17.1% and 6.7%, respectively. Depression in women and men was 20.1% and 9.4%, respectively. An association was found between anxiety and overactive bladder (OAB) without urinary incontinence (OR = 3.7) and moderate or severe LUTS in men (OR = 3.8). In women, anxiety was associated with nocturia (OR = 4.2) and stress urinary incontinence (OR = 2.4). For depression, an association was found between sexual dysfunction (OR = 4.3) and moderate or severe LUTS (OR = 4.0) in men; while in women it was associated with stress urinary incontinence (OR = 2.3), the sensation of incomplete emptying (OR = 1.7) and decreased frequency of sexual activity (OR = 1.8).

Conclusions The associations found are consistent with other reports. It is essential to inquire about possible symptoms related to the mental sphere in the urology consultation to make appropriate referrals and subsequent management.

Keywords Anxiety · Depression · Lower urinary tract symptoms · Nocturia · Urinary incontinence

Introduction

Lower urinary tract symptoms (LUTS) [1] are anatomically related to the urethra, prostate, bladder, pelvic organs, or lower ureter. These are divided into three groups: storage, voiding and postvoiding [2]. LUTS have a high prevalence

in the world and represent an important condition to address when talking about quality of life and mental health [3, 4].

In Colombia, the estimated prevalence of at least one LUTS in men and women over 18 years of age is 84%. Likewise, among people with at least one LUTS 13.2% would feel “mostly dissatisfied”, “unhappy” or “terrible” about spending the rest of their lives with their current urinary condition [1]. The association between mental health scores and LUTS, anxiety disorders and depressive disorders appear to be triggered by discomfort, functional disability, or lifestyle changes caused by LUTS [4–6]. Studies in other countries conclude that the incidence of anxiety and depression disorders is higher in patients with concomitant LUTS [7].

Depression and anxiety are common conditions in our population [8]. The hospital anxiety and depression scale

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(HADS) is an objective tool to measure the presence of clinically significant depression and anxiety during the last seven days in patients suffering from any medical condition [9]. Depression and anxiety have been evaluated and correlated in different medical conditions [1, 10–12]. A higher prevalence of depression has been seen in patients with diabetes, arthritis and cardiovascular diseases [13].

In our country, there are no studies establishing the association or relation between LUTS and these mental pathologies. In consequence, our objective was to evaluate the prevalence of anxiety and depression in patients with LUTS and to describe their association in the Hispanic population.

Methods

This is a sub-analysis of a cross-sectional, population-based study conducted in Colombian men and women over 18 years of age to assess LUTS and overactive bladder (OAB) COBaLT [1]. Patients of legal age who had the capacity to answer the questionnaires and give their informed consent were included. Pregnant women or people with active urinary tract infection (UTI) were excluded. LUTS were defined based on the terminology of The Standardization of Terminology of Lower Urinary Tract Function Report [14] and the Joint Report on the Terminology for Female Pelvic Floor Dysfunction in 2010 [15]. A more detailed survey and study design are exposed in the original article [1].

To assess depression and anxiety in these patients, we used the Hospital Anxiety and Depression Scale (HADS) [9]—Spanish version. Patients were asked to fill out the two subscales of the questionnaire, to assess the presence or absence of anxiety or depression concomitant to LUTS. According to each subscale, a case of anxiety and depression is defined as a final score > 7 points and > 5 , respectively. The Sexual Health Inventory for Men (SHIM) < 22 points was considered as sexual dysfunction in men. LUTS severity was classified using the IPSS score.

Descriptive statistics were used to present sociodemographic characteristics and comorbidities using frequencies for discrete variables and measures of central tendency and dispersion for continuous variables. This analysis was performed using STATA 14 statistical software. Bivariate analysis (logistic regression) was carried out to estimate the association between depression and anxiety in separate models. Variables that proved statistically significant ($p < 0.05$) were included in a multivariate model for each gender group.

Results

1060 participants were included; half were women and the other were men. Table 1 describes the sociodemographic characteristics of patients with and without depression and anxiety. The average age of women diagnosed with anxiety was 38 ± 16.3 and in women with depression was 41 ± 16.1 . The median age of men with anxiety was 40 ± 16.1 and in men with depression was 42 ± 17.9 . Most of the patients (93.58%) were Hispanic/Caucasian. In relation to mental health, we found that the prevalence of anxiety in women and men was 17.1% and 6.7%, respectively. On the other hand, the prevalence of depression in women and men was 20.1% and 9.4%, respectively.

Regarding LUTS, as seen in Table 2, in the group of women with anxiety, storage symptoms such as urgency (62%), nocturia (61%) and increased urinary frequency (54%) occurred more frequently. In the same way, these storage symptoms were the most prevalent in women with depression, 65%, 66%, and 57%, respectively. Otherwise, more than half of the male patients with anxiety reported storage symptoms like nocturia (72%) and increased urinary frequency (61%). Correspondingly, men with depression also presented these last two symptoms more frequently.

Also, the reporting of moderate and severe LUTS was higher in women and men with > 8 HADS. Furthermore, 83% of the men that suffered from depression also presented sexual dysfunction. Some additional urinary symptoms were analyzed, such as OAB dry type, which was reported in about twice as many men with depression (42% vs 22%) or anxiety (52% vs 22%). In addition, stress urinary incontinence was reported approximately twice as often in female patients with anxiety (23% vs 12%) or depression (26% vs 12%).

The bivariate and multivariate analyses are shown in Table 3. We observe the relationship between depression, and several comorbidities such as high blood pressure (OR = 2.3; 95% CI = 1.2–4.4), active smoker (OR = 2.6; 95% CI = 1.7–5.1) and OSA (OR = 2.4; 95% CI = 1.2–4.9) in women. We also found that women who had stress urinary incontinence had much risk for depression than those who did not (OR = 2.3; 95% CI = 1.2–4.2). In addition, a positive association was observed between the presence of this mental disease and the sensation of incomplete emptying (OR = 1.7; 95% CI = 1.0–2.8) and decreased frequency of sexual activity (OR = 1.8; 95% CI = 1.0–3.3) in women.

In the depression model for men, a significant association was found with OSA (OR = 9.5; 95% CI = 3.0–30.3); likewise, having a family history of prostate cancer was also correlated (OR = 4.2; 95% CI = 3.0–30.3). There was

Table 1 Sociodemographic characteristics of women and with anxiety or depression

| | Women | | | | Men | | | | p value |
|-------------------------------|---------------|---------------|----------------|---------------|---------------|---------------|---------------|---------------|---------|
| | Anxiety | | Depression | | Anxiety | | Depression | | |
| | Yes n = 91 | No n = 439 | Yes n = 107 | No n = 423 | Yes n = 36 | No n = 494 | Yes n = 50 | No n = 480 | |
| HADS (median) ^a | 3 [1–6] | | 5 [3–17] | | 2 [0–4] | | 4 [4–5] | | |
| Age (Mean) ^b | 38,4 ± 16,3 | 43,9 ± 16,4 | 41,4 ± 16,1 | 43,25 ± 16,6 | 40,1 ± 16,1 | 42,4 ± 17,2 | 41,8 ± 17,9 | 42,3 ± 17,1 | |
| BMI (Mean) ^b | 25,6 ± 4,7 | 25,5 ± 4,3 | 24,8 ± 4,1 | 25,7 ± 4,4 | 26,6 ± 4,9 | 24,9 ± 3,8 | 25,3 ± 4,7 | 25,1 ± 3,8 | |
| Race (n,%) | | 0.032 | | | | 0.486 | | | 0.123 |
| Hispanic/caucasian | 76 (83,5) | 419 (95,4) | 91 (85) | 402 (95,0) | 32 (88,8) | 464 (94) | 45 (90) | 452 (94,1) | |
| Afro—Latin American | 8 (8,7) | 17 (3,8) | 6 (5,6) | 19 (4,4) | 3 (8,3) | 20 (4,0) | 2 (4) | 21 (4,3) | |
| Indigenous | 2 (2,1) | 3 (0,6) | 3 (2,8) | 2 (0,4) | 1 (2,7) | 9 (1,8) | 3 (5,7) | 7 (1,4) | |
| SES (n,%) | | 0.015 | | | | 0.249 | | | 0.473 |
| Low | 55 (60,4) | 214 (48,7) | 62 (57,9) | 206 (48,6) | 21 (58,3) | 240 (48,5) | 29 (58) | 233 (48,5) | |
| Middle | 35 (38,4) | 207 (47,2) | 41 (38,3) | 201 (47,5) | 14 (38,8) | 229 (46,3) | 20 (40) | 222 (46,2) | |
| High | 1 (1,09) | 18 (4,1) | 4 (3,7) | 16 (3,7) | 1 (2,7) | 25 (5,0) | 1 (2) | 25 (5,2) | |
| Marital status (n,%) | | 0.343 | | | | 0.804 | | | 0.017 |
| Single | 32 (35,1) | 142 (32,3) | 29 (27,1) | 145 (34,2) | 15 (41,6) | 190 (38,4) | 25 (50) | 180 (37,5) | |
| Living with partner/married | 51 (55,2) | 223 (50,7) | 63 (58,8) | 210 (49,6) | 19 (52,7) | 273 (55,2) | 19 (8) | 273 (56,8) | |
| Divorced | 4 (4,39) | 33 (7,5) | 9 (8,4) | 29 (6,8) | 2 (5,5) | 19 (3,8) | 4 (8) | 15 (3,1) | |
| Widow/widower | 4 (4,39) | 41 (9,3) | 6 (5,6) | 39 (9,2) | 0 | 12 (2,4) | 2 (4) | 12 (2,5) | |
| Education (n,%) | | 0.776 | | | | 0.618 | | | 0.725 |
| None | 5 (5,5) | 16 (3,6) | 8 (7,4) | 13 (3,0) | 1 (2,7) | 18 (3,6) | 3 (6) | 16 (3,3) | |
| Primary/High School | 59 (64,8) | 297 (67,6) | 73 (68,2) | 283 (66,9) | 27 (75) | 328 (66,3) | 34 (68) | 321 (66,8) | |
| University/Technical | 26 (28,5) | 123 (28,0) | 26 (24,2) | 123 (29,0) | 8 (22,2) | 135 (27,3) | 13 (26) | 130 (27,0) | |
| Postgraduate | 1 (1,0) | 3 (0,6) | 0 | 4 (0,9) | 0 | 13 (2,6) | 0 | 13 (2,7) | |
| Comorbidities | | | | | | | | | |
| High blood pressure (n,%) | 20 (21,9) | 86 (19,5) | 28 (26,1) | 78 (18,4) | 8 (22,2) | 65 (13,1) | 10 (20) | 63 (13,1) | 0.257 |
| IBS (n,%) | 18 (19,7) | 42 (9,5) | 22 (20,5) | 38 (8,9) | 2 (5,5) | 21 (4,2) | 2 (4) | 21 (4,3) | 0.831 |
| Obstructive sleep apnea (n,%) | 22 (24,1) | 40 (9,1) | 22 (20,5) | 40 (9,4) | 7 (19,4) | 29 (5,8) | 9 (18) | 27 (5,6) | 0.002 |
| Cigarette smoking (n,%) | | | | | | | | | |
| Never smoked | 56 (61,5) | 335 (76,3) | 65 (60,7) | 326 (76,5) | 12 (33,3) | 245 (49,5) | 21 (42) | 236 (49,1) | 0.173 |
| Previous smoker | 20 (21,9) | 67 (15,2) | 19 (17,7) | 68 (16) | 14 (38,8) | 149 (30,1) | 17 (34) | 146 (30,4) | 0.826 |
| Active smoker | 11 (12,0) | 39 (8,8) | 18 (16,8) | 32 (7,5) | 12 (33,3) | 98 (19,8) | 15 (30,6) | 95 (19,7) | 0.153 |

BMI body mass index, SES socioeconomic status, IBS irritable bowel syndrome

^aData presented as Median and IQR

^bData are presented as mean ± standard deviation. HADS scores divided by depression and anxiety

Table 2 Prevalence of LUTS and sexual function in women and with anxiety or depression

| | Women | | | | | | Men | | | | | |
|--|---------------|----------------|----------------|----------------|----------------|----------------|---------------|----------------|----------------|---------------|----------------|----------------|
| | Anxiety | No anxiety | <i>p</i> value | Depression | No depression | <i>p</i> value | Anxiety | No anxiety | <i>p</i> value | Depression | No depression | <i>p</i> value |
| | <i>n</i> = 91 | <i>n</i> = 439 | | <i>n</i> = 107 | <i>n</i> = 423 | | <i>n</i> = 36 | <i>n</i> = 494 | | <i>n</i> = 50 | <i>n</i> = 480 | |
| Lower tract urinary symptoms | | | | | | | | | | | | |
| Incomplete voiding (<i>n</i> ,%) | 43 (47.2) | 169 (38.4) | 0.05 | 56 (52.3) | 156 (36.8) | 0.001 | 17 (47.2) | 139 (28.1) | 0.032 | 23 (46) | 133 (27.7) | 0.019 |
| Intermittency (<i>n</i> ,%) | 21 (23.0) | 80 (18.2) | 0.148 | 30 (28.0) | 71 (16.7) | 0.034 | 10 (27.7) | 77 (15.5) | 0.043 | 15 (30) | 72 (15) | 0.001 |
| Weak stream (<i>n</i> ,%) | 25 (27.4) | 92 (20.9) | 0.187 | 24 (22.4) | 93 (21.9) | 0.003 | 17 (47.2) | 89 (18.0) | 0.087 | 22 (44) | 84 (17.5) | 0.014 |
| Straining (<i>n</i> ,%) | 10 (10.9) | 34 (7.7) | 0.027 | 14 (13.0) | 30 (7.0) | 0.002 | 8 (22.2) | 54 (10.9) | 0.089 | 17 (34) | 45 (9.3) | 0.323 |
| Frequency (<i>n</i> ,%) | 50 (54.9) | 217 (49.4) | 0.101 | 61 (57.0) | 206 (48.6) | 0.694 | 22 (61.1) | 202 (40.8) | 0 | 34 (68) | 190 (39.5) | 0 |
| Urgency (<i>n</i> ,%) | 57 (62.6) | 233 (53.0) | 0.238 | 70 (65.4) | 220 (52.0) | 0.027 | 19 (52.7) | 178 (36.0) | 0.063 | 23 (46) | 174 (34.8) | 0 |
| Nocturia (<i>n</i> ,%) | 56 (61.5) | 279 (63.5) | 0.806 | 71 (66.3) | 264 (62.4) | 0.136 | 26 (72.2) | 272 (55.0) | 0.116 | 34 (68) | 264 (55) | 0.22 |
| SHIM (<i>n</i>,%) | | | | | | | | | | | | |
| None (SHIM >22) | – | – | – | – | – | – | 11 (30.5) | 213 (43.1) | 0.056 | 7 (14) | 217 (45.2) | 0.056 |
| Sexual dysfunction (SHIM <22) | – | – | – | – | – | – | 22 (61.1) | 220 (44.5) | 0.547 | 35 (70) | 207 (43.1) | 0.547 |
| Sexual frequency (<i>n</i>,%) | | | | | | | | | | | | |
| Never/almost never | 39 (42.8) | 187 (42.5) | 0.981 | 39 (36.4) | 187 (44.2) | 0.148 | 8 (22.2) | 93 (18.8) | 0.431 | 14 (28) | 86 (17.9) | 0.064 |
| < 1 time per month | 3 (3.2) | 20 (4.5) | 0.596 | 4 (3.7) | 20 (4.7) | 0.743 | 1 (2.7) | 12 (2.4) | 0.941 | 0 | 15 (3.1) | 0.224 |
| A few times a week | 43 (47.2) | 220 (50.1) | 0.638 | 58 (54.2) | 206 (48.6) | 0.57 | 23 (63.8) | 369 (74.6) | 0.108 | 34 (68) | 357 (74.3) | 0.275 |
| Every day | 6 (6.5) | 12 (2.7) | 0.049 | 9 (8.4) | 10 (2.3) | 0.006 | 4 (11.1) | 20 (4.0) | 0.139 | 2 (4) | 22 (4.5) | 0.781 |
| Severity of LUTS (<i>n</i>,%) | | | | | | | | | | | | |
| None | 7 (7.6) | 51 (11.6) | 0.344 | 5 (4.6) | 50 (11.8) | 0.030 | 4 (11.1) | 107 (21.6) | 0.101 | 5 (10) | 106 (22.0) | 0.03 |
| Mild | 54 (59.3) | 310 (70.6) | 0.040 | 65 (60.7) | 302 (71.3) | 0.044 | 21 (58.3) | 336 (68.0) | 0.351 | 32 (64) | 325 (67.7) | 0.829 |
| Moderate | 27 (29.6) | 73 (16.6) | 0.007 | 33 (30.8) | 67 (15.8) | 0.001 | 8 (22.2) | 44 (8.9) | 0.016 | 9 (18) | 43 (8.9) | 0.064 |
| Severe | 3 (3.2) | 5 (1.1) | 0.105 | 4 (3.7) | 4 (0.9) | 0.026 | 3 (8.3) | 7 (1.4) | 0.005 | 4 (8) | 6 (1.25) | 0.001 |
| OAB dry type (<i>n</i> ,%) | 43 (47.2) | 165 (37.5) | 0.033 | 86 (80.37) | 153 (36.1) | 0.000 | 19 (52.7) | 109 (22.0) | 0.000 | 21 (42) | 107 (22.2) | 0.006 |
| OAB wet type (<i>n</i> ,%) | 19 (20.8) | 70 (15.9) | 0.168 | 29 (27.1) | 60 (14.1) | 0.000 | 5 (13.8) | 28 (5.6) | 0.066 | 5 (10) | 28 (5.8) | 0.308 |
| OAB + Nocturia | 33 (36.2) | 112 (25.5) | 0.016 | 41 (38.3) | 104 (24.5) | 0.001 | 13 (36.1) | 78 (15.7) | 0.004 | 16 (32) | 75 (15.6) | 0.008 |
| Urge urinary incontinence (<i>n</i> ,%) | 26 (28.5) | 94 (21.4) | 0.077 | 37 (34.5) | 83 (19.6) | 0.000 | 6 (16.6) | 40 (8.0) | 0.106 | 5 (10) | 41 (8.5) | 0.837 |
| Stress urinary incontinence (<i>n</i> ,%) | 21 (23.0) | 56 (12.7) | 0.005 | 26 (24.2) | 51 (12.0) | 0.000 | 3 (8.3) | 13 (2.6) | 0.068 | 3 (6) | 13 (2.7) | 0.236 |

LUTS lower tract urinary symptoms, OAB overactive bladder

Table 3 Bivariate and multivariate analysis

| | OR | 95% CI | |
|---|------------|---------------|----------------|
| Bivariate analysis in men and women with depression | | | |
| Women | | | |
| Unemployed | 2.82 | 1.2–6.08 | |
| High blood pressure | 2.39 | 1.27–4.48 | |
| Active smoker | 2.66 | 1.37–5.17 | |
| Obstructive sleep apnea | 2.48 | 1.25–4.94 | |
| Stress urinary incontinence | 2.31 | 1.25–4.25 | |
| Incomplete voiding | 1.72 | 1.05–2.84 | |
| Sexual frequency (never or almost never) | 1.8 | 1.02–3.31 | |
| Men | | | |
| Obstructive sleep apnea | 9.57 | 3.01–30.3 | |
| Family history of CaP | 4.2 | 3–30.3 | |
| Sexual dysfunction (SHIM <22) | 4.37 | 1.5–12.2 | |
| LUTS (moderate or severe in IPSS) | 4.09 | 1.6–10.1 | |
| Bivariate analysis in men and women with anxiety | | | |
| Women | | | |
| High blood pressure | 2.24 | 1.03–4.89 | |
| Obstructive sleep apnea | 4.35 | 2.15–8.8 | |
| Stress urinary incontinence | 4.33 | 1.29–13.08 | |
| OAB + nocturia | 2.44 | 1.22–4.88 | |
| IBS | 2.7 | 1.26–5.77 | |
| Men | | | |
| Obstructive sleep apnea | 6.2 | 1.89–20.22 | |
| Active smoker | 4.53 | 1.7–11.9 | |
| Obesity | 6.32 | 1.8–21.6 | |
| OAB dry type | 3.83 | 1.46–10 | |
| LUTS (moderate or severe in IPSS) | 3.3 | 0.97–11.1 | |
| | AOR | 95% CI | p value |
| Multivariate analysis in men and women with depression | | | |
| Women | | | |
| Stress urinary incontinence | 2.3 | 1.2–4.2 | 0.007 |
| Incomplete voiding | 1.7 | 1.0–2.8 | 0.03 |
| Sexual frequency (never or almost never) | 1.8 | 1.0–3.3 | 0.03 |
| Men | | | |
| Sexual dysfunction (SHIM <22) | 4.3 | 1.5–12.2 | 0.005 |
| LUTS (moderate or severe in IPSS) | 4.0 | 1.6–10.1 | 0.002 |
| Multivariate analysis in men and women with anxiety | | | |
| Women | | | |
| Stress urinary incontinence | 2.4 | 1.2–4.8 | 0.01 |
| OAB + nocturia | 4.2 | 1.2–13.8 | 0.01 |
| Men | | | |
| OAB dry type | 3.7 | 1.4–9.9 | 0.07 |
| LUTS (moderate or severe in IPSS) | 3.8 | 1–13.6 | 0.03 |

CaP prostate cancer, LUTS Lower tract urinary symptoms, OR Odds Ratio, OAB Overactive bladder, IBS irritable bowel syndrome, AOR Adjusted Odds Ratio

also a connection between this mental disease and sexual dysfunction (OR = 4.3; 95% CI = 1.5–12.2) or moderate or severe LUTS (OR = 4.0; 95% CI = 1.6–10.1).

On the other hand, the anxiety model showed a relationship with high blood pressure (OR = 2.24; 95% CI = 1.0–4.9), OSA (AOR = 4.3; 95% CI = 2.1–8.8) and

irritable bowel syndrome (AOR = 2.7; 95% CI = 1.2–5.7) and some LUTS such as, stress urinary incontinence (AOR = 4.3; 95% CI = 1.2–13.0) and overactive bladder (OAB) + nocturia (OR = 2.4; 95% CI = 1.2–4.8) in women.

In men, a positive association with anxiety was observed with OSA (OR = 6.2; 95% CI = 1.8–20.2). Furthermore, we found a correlation between active smoker (OR = 4.5; 95% CI = 1.7–11.9) and obesity (OR = 6.3; 95% CI = 1.8–21.6). OAB dry type or OAB without incontinence (OR = 3.8; 95% CI = 1.4–10 $p = 0.006$) and moderate or severe LUTS (AOR = 3.3; 95% CI = 1.0–13.6 $p = 0.05$) have an important association with anxiety also.

Finally, the multivariate analysis showed a statistically significant association between the variables that described urinary symptoms and mental illnesses such as depression and anxiety as shown in Table 3.

Discussion

Although the relationship between depression and anxiety with urinary tract symptoms has gained interest in recent years, a study that describes this association did not exist in the Hispanic population. In our study, both the prevalence of anxiety and depression were higher in women than in men. These results behave similarly to those reported in the Colombian population, where the prevalence of these mental illnesses is higher in females than males; in 2016 the prevalence in men was 6.3% for depression and 2.9% for anxiety, and in women, the prevalence was 7.1% and 4.9%, respectively [8]. We found that the prevalence of depression and anxiety was significantly higher in both genders when LUTS were present concomitantly. In recent years, interprofessional practice for patient care has become imperative since it allows better care for patients and their families, reduces costs, and improves time use [16]. Therefore, this study also seeks to reinforce the idea of providing multidisciplinary care to urological and psychiatric patients, by demonstrating the relationship between the comorbidities and the urinary symptoms that patients may suffer with psychiatric diseases.

A secondary analysis of the Epidemiology of Lower Urinary Tract Symptoms (EpiLUTS) found that men with mixed urinary incontinence followed by those with urgency urinary incontinence had the highest rates of anxiety and depression. In women anxiety and depression was highest in stress urinary incontinence and mixed urinary incontinence [17]. In the same way, our study found an association between LUTS and depression or anxiety. This agrees with studies such as the one published in 2017 using the Asian national database where a bidirectional relationship was found (depression HR = 2.03 95% CI = 1.76–2.33 and anxiety HR = 2.12 95% CI = 1.95–2.30) [17]. This is also closely related to our results since urinary incontinence (specifically

stress urinary incontinence) had a positive association with the presence of both anxiety and depression in women; and in men, a positive relationship was found between symptoms such as incomplete voiding and the risk of depression. Furthermore, a cross-sectional study with 8284 participants found stress urinary incontinence as a predictor of anxiety and depression in men and women and incomplete voiding only in women [18].

Based on the logistic regression result, in our study, we observed that male patients who presented moderate to severe LUTS tended to be diagnosed three times more with anxiety or depression. This correlates to a study that included 2890 men aged 40 years or older, who reported a higher risk of developing symptoms of severe depression in patients who reported a greater presence of LUTS (AOR 3.09 for 1 symptom and AOR 8.06 for 2 or more symptoms, $p < 0.0001$) [19]. Also, a longitudinal study published in 2019 concluded that patients with clinically significant LUTS have a 1.8 higher risk of developing depression [20]. Alike, an Asian male population cohort study found that depression was strongly associated with LUTS, and the increasing severity of depression was significantly associated with an increasing trend of LUTS [21].

In addition, the high risk of depression we found in men with sexual dysfunction is compelling. Atlantis et al. in their systematic review and meta-analysis, found a bidirectional relationship between these two pathologies, they reported that sexual dysfunction increases the odds of depression by 130–210% (OR = 2.71; 95% CI = 1.93–3.79, I-squared = 41.2%, $p = 0.130$) [22]. This association is explained in most cases by social isolation, performance anxiety, and sexual rejection [22]. As a result of this relationship, Brotto et al. proposed the evaluation of depressive symptoms in patients with sexual dysfunction as a grade-A recommendation [23].

Our study found a significant statistical association between multiple LUTS variables and the development of depression or anxiety in our population. We observed that women with stress urinary incontinence have a major risk of developing anxiety and depression, and women with OAB + nocturia have three times the risk of developing anxiety. Additionally, men who had moderate or severe LUTS had three times the risk of developing depression or anxiety. Moreover, sexual dysfunction and OAB without incontinence in men were significantly associated with the development of depression or anxiety, respectively. Finally, we also observed the positive association between mood disorders and chronic diseases, such as high blood pressure and OSA, which is consistent with the different studies published in the literature [24–26].

This is the first study to our knowledge assessing the relationship between LUTS, anxiety and depression in men and women using a multi-stage probabilistic sampling technique,

which allowed us to accurately represent the Hispanic population. In addition, trained personnel were able to answer participants' questions when completing the self-administered questionnaires. In contrast to other studies where telephone-based interviews were used [27] impacting data quality, having in consideration that most validated questionnaires used for evaluating LUTS, OAB, depression and anxiety have been developed to be completed by the patient and not by the interviewer. In addition, as in other studies such as EpiLUTS, EPIC, UrEpiK and Brazilian LUTS, IPSS was used to evaluate LUTS in both men and women, and scales such as ICIQ-UI and the ICIQ-OAB were used for urinary incontinence, making our results comparable to other published series. The limitations of this study include the use of self-administered questionnaires, which are vulnerable to inaccuracy, compared to more objective measures such as medical records, which was the only feasible tool for assessing LUTS given our study design, also directional causality cannot be assumed in this work. As an additional limitation, very few men had SUI or severe LUTS, limiting analysis in this group.

Despite these limitations, to date, there are no studies in Colombia and Latin America addressing the association between LUTS and mental illnesses, and those published included small Hispanic population [28]. Therefore, we consider this study provides knowledge and answers the question raised. Also provides awareness of the importance of screening for mental illnesses and interdisciplinary work in urological pathologies.

Conclusions

This study demonstrates the clear relationship between symptoms of mental illness and LUTS. Within Hispanic population, we can highlight the susceptibility of the female gender to suffer from depression, anxiety, and LUTS concomitantly. The multivariate model of anxiety showed that in men and women, the most associated manifestations are symptoms of irritative voiding dysfunction, while in depression, in addition to presenting the previously mentioned symptoms, sexual dysfunctions were also found. These associations found in this study are consistent with other international reports. It is essential to inquire about possible symptoms related to the mental sphere in the urology consultation due to the possible risks that mental illness entails to make appropriate referrals and subsequent management and integral care of these types of patients.

Author contributions LZ: data analysis, manuscript writing, manuscript editing. JIC: manuscript writing, manuscript editing. MPM: data analysis, manuscript writing. JS: manuscript writing. AB-B: protocol development, protocol development, data collection. CGT: manuscript

editing. CAD: manuscript writing, manuscript editing. MR: data analysis, data management. MP: manuscript editing. We confirm that all the authors listed above contributed, read, and approved the submitted material. Material preparation, data collection and analysis were performed by Alejandra Bravo-Balado, Laura Zuluaga, Martin Rondon and Maria Paula Mogollon. The first draft was written by Laura Zuluaga and Maria Paula Mogollon. Review and editing were made by Jessica Santander, Juan Ignacio Caicedo, Mauricio Plata and Carlos Trujillo. The final draft and edition were made by Cesar Alejandro Diaz and Laura Zuluaga.

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Data availability Data available on request from the authors.

Declarations

Conflict of interest The authors declare no conflict of interest. The authors have no relevant financial or non-financial interests to disclose.

Ethical approval The original study was performed in line with the principles of the Declaration of Helsinki. Approval was granted by the Ethics Committee of Fundación Santa Fe de Bogotá (CCEI–3263-2015).

Informed consent Verbal informed consent was obtained prior to the interview.

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