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Mental Health, Sleep, and Physical Function in Treatment-Seeking Women With Urinary Incontinence

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Abstract

Purpose—To examine how mental health measures, sleep, and physical function are associated with presence and type of urinary incontinence (UI) and severity in women seeking treatment for lower urinary tract symptoms (LUTS).

Methods—This is a baseline cross-sectional analysis in treatment-seeking women with LUTS. All participants completed the LUTS Tool, which was used to classify women based on UI symptoms and measure severity. Patient-Reported Outcomes Measurement Information System (PROMIS) questionnaires for depression, anxiety, sleep disturbance, and physical function; the Perceived Stress Scale (PSS); and the International Physical Activity Questionnaire Short Form

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(IPAQ-SF) were administered. Multivariable regression modeling was used to assess associations with the presence, type, and severity of urinary symptoms.

Results—We studied 510 women; mean age was 56±14 years, 82% were Caucasian, 47% were obese, and 14% reported diabetes. Most women (n=420, 82.4%) reported UI (70 stress UI, 85 urgency UI, 240 mixed UI, 25 other UI). In adjusted analyses, there were no differences in any of the mental health, sleep, or physical function measures based on presence versus absence of UI. Among those with UI, PROMIS anxiety and sleep disturbance scores were higher for those with mixed UI compared to stress UI. Increasing UI severity was associated with higher PROMIS depression and anxiety, and higher PSS scores, though higher UI severity was not associated with differences in sleep or physical function.

Conclusions—Among treatment-seeking women with LUTS, increasing UI severity, rather than presence or type of UI, is associated with increased depression, anxiety, and stress.

Keywords

depression; anxiety; stress; incontinence severity; urinary incontinence; lower urinary tract symptoms

INTRODUCTION

Lower urinary tract symptoms (LUTS) are common and negatively impact quality of life.[1] Of various LUTS, urinary incontinence (UI) is highly prevalent in women[2, 3] and is often associated with depression, anxiety, sleep disturbances, and poorer physical function.[4–8] However, prior research has been performed in community-based populations or was ascertained from single-institution studies. In treatment-seeking patients, it is not clear if: a) LUTS alone; b) the presence of UI; or c) certain types of UI are associated with disturbances in mental health, sleep, and physical function.

The Symptoms of Lower Urinary Tract Dysfunction Research Network (LURN) was created to address gaps in understanding of LUTS[9]. As part of this effort, LURN clinical sites recruited treatment-seeking patients into an observational cohort, where data and validated questionnaires were collected. We hypothesized that women who report UI experience greater impairment in mental health, sleep, and physical function measures than women with LUTS but without UI. We also hypothesized that women with urgency urinary incontinence (UUI) or mixed urinary incontinence (MUI) would have greater depression, anxiety, stress, and sleep disturbance, as well as poorer physical function than women with stress urinary incontinence (SUI) symptoms, and that these differences would become greater as UI severity increased. The objectives of this study were to examine whether mental health, sleep, and physical function were associated with the presence and type of UI, and with UI severity in women seeking treatment for LUTS.

MATERIALS AND METHODS

LURN consists of six research sites and a data coordinating center. This network is conducting a prospective observational study (ClinicalTrials.gov #NCT02485808); details regarding recruitment, inclusion, and exclusion criteria have been published elsewhere.[2] The

observational cohort study was approved by the Institutional Review Board at each site, and all participants provided informed consent prior to enrollment. We performed a cross-sectional analysis of baseline information from women seeking treatment for LUTS who enrolled in the LURN observational cohort. As specified for this cohort, women with urologic pain (e.g., interstitial cystitis) were excluded.

All participants completed baseline questionnaires to assess medical history and demographic information, as well as a series of validated questionnaires assessing pelvic floor symptoms, LUTS severity, mental health, sleep, and physical function measures. The LUTS Tool (LUTS Tool, Version 1.0. Copyright 2007 by Pfizer, Inc. Used with permission.) is a validated measure including 22 questions that assess severity and bother for a range of urinary symptoms.[10] This tool was used to categorize women with LUTS into subgroups based on presence of UI and type of UI (SUI, UUI, MUI, and other UI). Question #16 of the LUTS Tool states, “Below are several situations in which people can leak urine. How often in the past week have you...” followed by seven sub-items (a-g) which specify different triggers for leakage. Women who responded affirmatively with “sometimes”, “often”, or “almost always” to any sub-item (a-g) for question #16 were categorized into the with UI group. Those who responded with “never” or “rarely” to all seven sub-items were categorized into the without UI group. Next, those with UI were further categorized into groups based on the type of UI. Those who responded affirmatively to items c or d (leakage with laughing, sneezing, coughing, or physical activity) were considered to have SUI; affirmative responses to item b (leakage with a sudden need to rush to urinate) were considered UUI. Affirmative responses to a combination of item b *and* items c or d were considered MUI. Those who only responded affirmatively to any of the other UI items (leakage with sleeping, sexual activity, post-void, or for no reason) were considered to have “other” UI (n=25), and were not further analyzed as a UI subgroup. Finally, we calculated a continuous incontinence severity measure using the seven LUTS Tool sub-items related to incontinence (#16a-g). For this severity measure, we converted the seven sub-items to distance measures and calculated a weighted Euclidean length with high numbers indicating more severe symptoms. Details and validation of this UI severity measure are published elsewhere.[11] We created UI severity scores for all participants, including those who were classified into the “other” UI subgroup.

Participants also completed several short form measures, including Patient-Reported Outcomes Measurement Information System (PROMIS) questionnaires for: 1) sleep disturbance; 2) depression; 3) anxiety; and 4) physical function,[12–14] as well as the Perceived Stress Scale (PSS),[15] and International Physical Activity Questionnaire Short Form (IPAQ-SF).[16] PROMIS raw scores were converted into T-Scores using the recommended scoring methodology.[17] The T-Score rescales raw scores into standardized scores on a range of 0–100 with a mean of 50 and standard deviation (SD) of 10. Higher PROMIS T-Scores indicate higher levels of the health concept. For example, higher sleep disturbance scores signify more sleep disturbance, while higher physical function scores indicate better physical function. With PROMIS T-Scores, the minimal clinically-important difference (MCID) is generally considered to be a 3–5 point difference, or medium effect size.[18] We used the IPAQ-SF to assess physical activity. This scale assesses three types of physical activity: walking, moderate intensity activities, and vigorous activities. The

duration (minutes) and frequency of these various activities are incorporated into the score; a higher score indicates more physical activity. Scores can also be categorized into overall Low, Moderate, and High activity groups. The PSS uses a Likert scale to score 10 questions regarding feelings of stress in the prior month. PSS scores can range from 0–40 with higher scores indicating more stress.

Baseline demographic and medical history variables were assessed for all patients. The Functional Comorbidity Index (FCI)[19] was administered and used as an overall comorbidity indicator. The Childhood Traumatic Events Scale (CTES)[20] was also administered. The CTES inquired into six areas of potential childhood trauma that range from “major upheaval between parents (such as divorce, separation)” to “traumatic sexual experience”. Because there are no widely accepted conventions for how to use CTES scores, we assessed for proportions of women who answered “yes” to any question; we also separately assessed for the report of a childhood traumatic sexual experience.

Demographic and clinical characteristics were assessed using chi-square tests and non-parametric analysis of variance (ANOVA). In unadjusted analyses, differences in mean outcome measure scores by group (with vs. without UI and type of UI [SUI vs. UUI vs. MUI]) were assessed using parametric and non-parametric ANOVA (Kruskal-Wallis and Wilcoxon post-hoc tests) or chi-square tests, as appropriate. All of the baseline demographic, medical history, FCI, and CTES variables, along with presence, type, and severity of UI were considered as candidate predictors in multivariable regression modeling. The selection of covariates for the final models for each outcome was guided by the best subsets method.[21] For each outcome, three separate models were fitted using presence, type, and severity of UI as the primary predictor with relevant adjustment covariates. Multivariable linear regression was used for all outcomes except the IPAQ-SF, which used multivariable logistic regression. All p-values were adjusted for multiple testing to control the false discovery rate (FDR) using the method proposed by Benjamini and Hochberg.[22] All statistical tests were performed using SAS Version 9.4 (Cary, North Carolina) and $p<0.05$ was considered to be statistically significant.

RESULTS

Among the 545 women enrolled in the LURN observational cohort study**,** 510 women had complete responses to question 16 of the LUTS Tool and comprised our study population. Their mean age was 56±14 years; 82% were Caucasian, 47% were obese (body mass index [BMI] > 30 mg/k^2), and 14% reported diabetes (Table 1).

We first assessed mental health, sleep, and physical function based on the presence of UI in women with LUTS. Using the categorization from the LUTS Tool, 420 women were considered to be “with UI” and 90 were considered “without UI” (Table 1). In unadjusted analyses, women with UI reported more sleep disturbance (score mean±SD=53.5±8.5 vs. 50.7±9.1) and poorer physical function (score mean±SD=46.7±10.3 vs. 50.6±10.0) compared to those without UI (Table 2). However, in adjusted analyses, there were no differences in any of the outcomes based on presence or absence of UI (Table 2; models with

covariates shown in Supplementary Tables 1 & 2). Results of all adjusted analyses based on presence of UI are summarized in Figure 1.

Among the 420 women "with UI", we next considered whether there were differences in mental health, sleep, or physical function based on the type of UI. Using the LUTS Tool for categorization, 70 women had SUI, 85 women had UUI, and 240 had MUI (as mentioned earlier, the 25 women with "other" UI alone were excluded from this portion of the analysis). In our study population, women with SUI (compared to UUI or MUI) were younger (mean age 53.0±13.4 years), had lower BMI (43% with BMI<25), had less sleep apnea (6%), and had a lower mean FCI (1.9±1.8) than the other two UI subgroups, particularly when comparing with those with MUI (Table 1). In unadjusted analyses, women with MUI reported the highest depression (mean score 54.2±8.7), anxiety (mean score 51.8±9.5), perceived stress (mean score 14.1±7.7), and the poorest physical function (mean score 44.8±10.2, Table 3). However, in adjusted analyses the only association that remained statistically significant was a higher PROMIS anxiety s core in those with MUI when compared to SUI (β=3.22, confidence interval [CI] [0.84–5.59], p=0.01, FDR p=0.02). Results of adjusted analyses for all outcomes based on UI subtype are summarized in Figure 2 (models with covariates shown in Supplementary Tables 3 & 4).

Finally, we assessed mental health, sleep, and physical function based on UI severity. As noted above, UI severity scores were calculated using results from all LUTS Tool UI items, regardless of UI category. Thus, we were able to create an individual UI severity score for each study participant. UI severity scores ranged from 0 – 9.44 and mean scores were highest in women with MUI (5.39±1.54) compared to SUI (3.98±1.48), UUI (3.31±1.13), and other UI (Figure 3, all p<0.001). In linear regression models using UI severity as a predictor of various outcome measures while adjusting for relevant covariates, increasing UI severity was associated with higher PROMIS depression (β=0.50, [CI: 0.16–0.84], p=0.004, FDR p=0.01), PROMIS anxiety (β=0.63, [CI: 0.27–0.98], p=0.001, FDR p=0.002), and PSS scores (β=0.38, [CI: 0.10–0.67], p=0.01, FDR p=0.01). UI severity was not associated with differences in other outcome measures (Table 4, Figure 4; models with covariates shown in Supplementary Tables 5 & 6).

DISCUSSION

We report our findings from a large cohort of treatment-seeking women with LUTS. Contrary to our hypothesis and previous reports in the literature, among these women, the dichotomous presence or absence of UI was not independently associated with differences in mental health, sleep, or physical function. However, higher UI severity, regardless of type, was associated with increased anxiety, depression, and stress. UI severity was not an independent predictor of sleep disturbance or physical function in a population of treatment-seeking women reporting bothersome LUTS.

Our findings differ from some of those previously reported. We only studied women seeking treatment for LUTS, and did not compare to a healthy control population without LUTS. Two recent population-based studies from Ireland and Korea included ~7,000 participants each and found that depression was higher in adults with UI compared to those without UI.

[23, 24] In these studies, those without UI may have more closely resembled a healthy control population, while in our study those without UI still had other bothersome LUTS. Other groups have studied mental health factors in adults seeking treatment for overactive bladder (OAB).[5–7] Together, these studies showed that OAB was associated with higher anxiety, depression, and sleep disturbance compared to controls. Again, the comparison groups in these studies were control participants without LUTS. Also, in these studies, sample size precluded rigorous multivariable analyses with adjustment for potential confounders. In our analysis, adjustments for medical comorbidities (i.e., FCI) and the presence of diabetes were particularly important. These covariates were highly prevalent in our study population, and in most models adjustment for these covariates removed significance that was seen in unadjusted results. Age, education, and sleep apnea were additional covariates that led to changes in significance in some models (see Supplementary Tables 1–6).

Despite the differences noted, our findings with regards to UI severity are quite consistent with prior publications. In the Korean study by Lim et al, the US studies by Lai et al, and a similar Brazilian study by Melotti et al, UI severity was positively correlated with anxiety, depression, and stress measures, even when different outcome measures were used.[5–7, 23, 25] The consistency of these results improve the credibility of our findings that worsening UI severity is an important factor associated with mental health. In women reporting UI in our study, UI severity scores ranged from 1.84–9.44. Based on our modeling results, there is a 3.8–4.8 point margin of difference in PROMIS depression and anxiety scores for women with the lowest versus highest UI severity scores. This is considered a medium sized difference in PROMIS T-Scores, which may be clinically relevant.[18] Thus, our findings show that higher UI severity is associated with higher anxiety and depression, though how this impacts clinical care requires further study. Regarding the PSS, our modeling results suggest that there could be a 3-point higher PSS score in those with high UI severity compared to no UI. Unfortunately, there are no published data on the MCIDs for the PSS, and for a scale that ranges between 0–40 points, the clinical relevance of these findings require further study.

Strengths of the study include the large sample size from a geographically varied cohort. Data were collected using high-quality validated tools for UI and quality of life. We included multiple covariates in our analyses to account for possible confounding factors. A novel analytic method incorporating the Euclidean length principle[11] was used to determine UI severity from the LUTS Tool. This method is a useful contribution since it incorporates responses from all questions rather than just those that fall into pre-determined clinical definitions of types of incontinence. Thus, we are likely to achieve a more comprehensive understanding of how global UI severity is associated with mental health compared to the information we can gather using single item ratings.

Our study is limited by multiple factors. The study population was predominantly Caucasian and lacked racial and ethnic diversity. The participants were those seeking care at tertiary medical centers and thus may not be representative of the general population. We did not control for the influence of the perception of general health on our outcomes of interest, and we lacked a healthy control group for comparison. An additional limitation is that our definitions may have resulted in misclassification of some women with very mild or minimal

UI into the “without UI” group. Finally, we performed many statistical comparisons, which increases the risk of false positive results. However, we included FDR adjustments for all of our analyses to reduce the risk of Type I errors.

CONCLUSIONS

We evaluated associations between UI and multiple measures among treatment-seeking women with LUTS. Women with SUI, UUI, or MUI did not demonstrate clinically important differences in mental health, sleep, or physical function. However, higher UI severity, regardless of the type of UI, was associated with higher depression, anxiety, and perceived stress.

Supplementary Material

Refer to Web version on PubMed Central for supplementary material.

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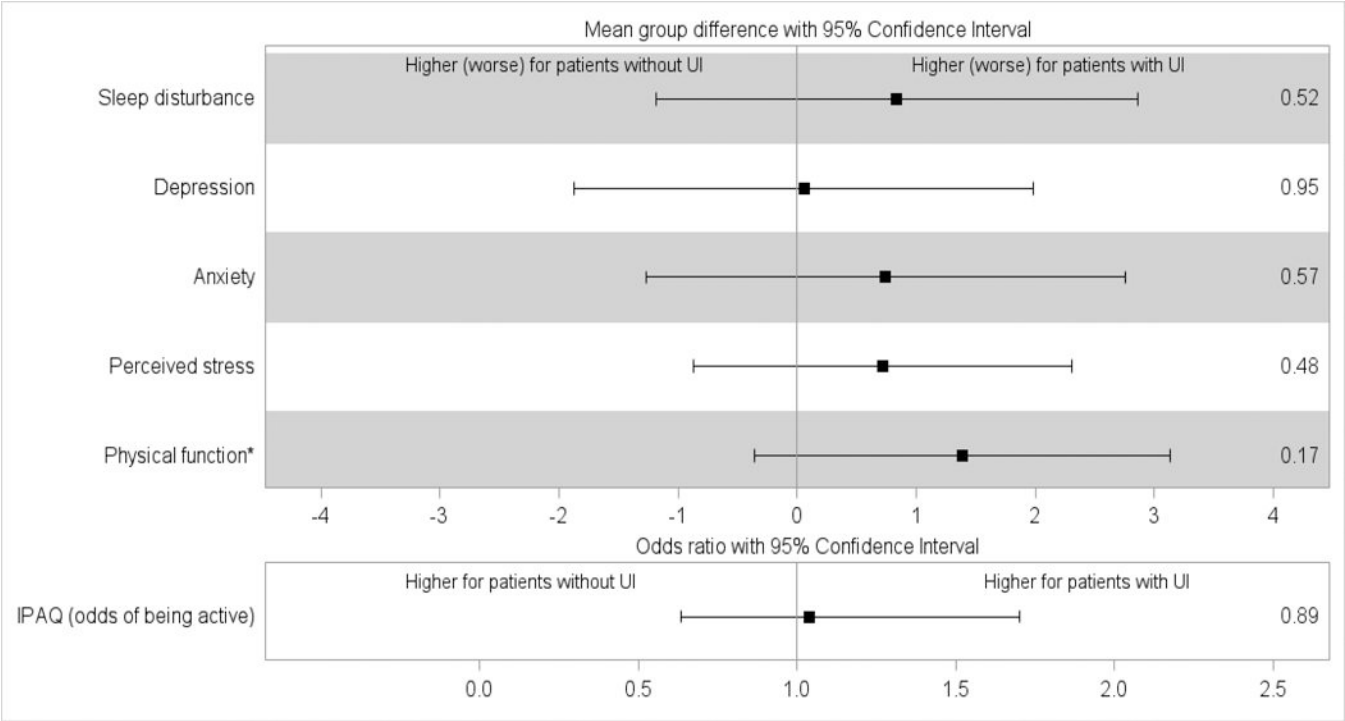

Fig 1:

Forest plot depicting differences in mental health, sleep, and physical function measures for women with versus without UI. Those without UI still reported bothersome LUTS. Adjusted mean group differences from the PSS and PROMIS short form questionnaires were obtained from linear regression models; the adjusted odds ratio for the IPAQ-SF was modeled using logistic regression. Full models with covariates are presented in Supplementary Tables 1 & 2. *The Physical Function scale was reversed for this figure to be consistent with other outcomes.

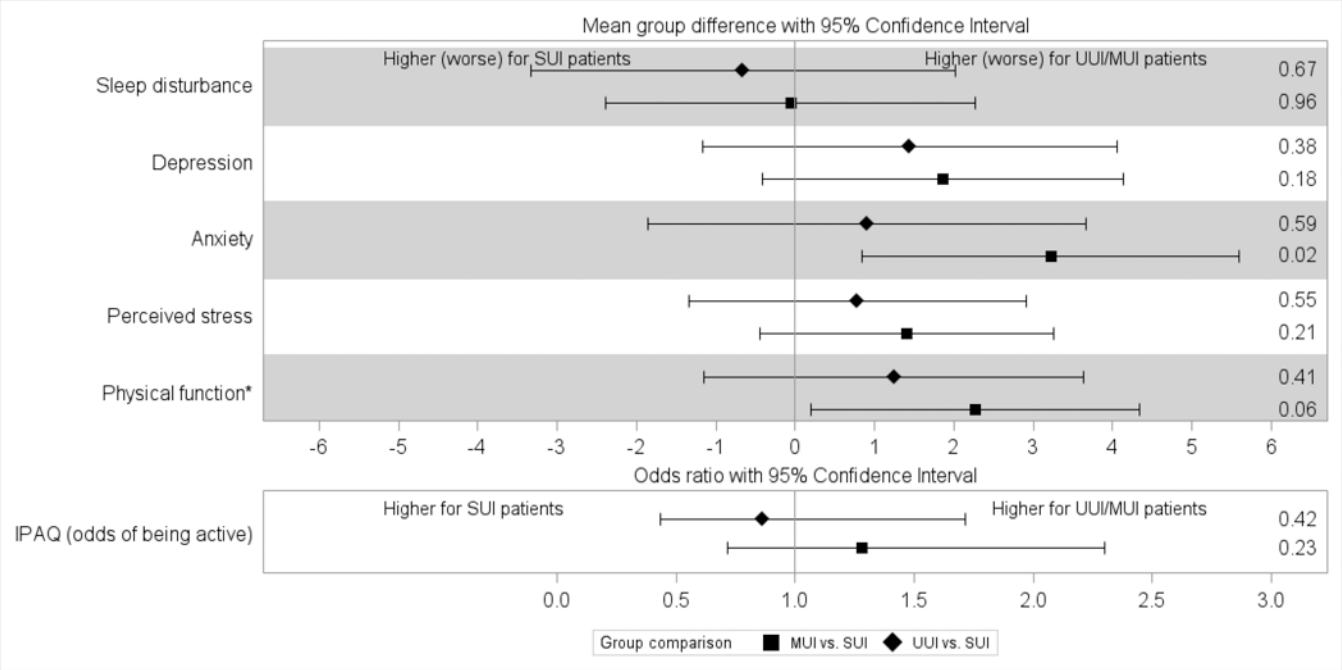

Fig 2:

Forest plot depicting differences in mental health, sleep, and physical function measures between stress, urgency, and mixed urinary incontinence (SUI, UUI, MUI) subtypes. Adjusted mean group differences from the PSS and PROMIS short form questionnaires were obtained from linear regression models with SUI as the reference group; the adjusted odds ratio for the IPAQ-SF was modeled using logistic regression. Full models with covariates are presented in Supplementary Tables 3 & 4. *The Physical Function scale was reversed for this figure to be consistent with other outcomes.

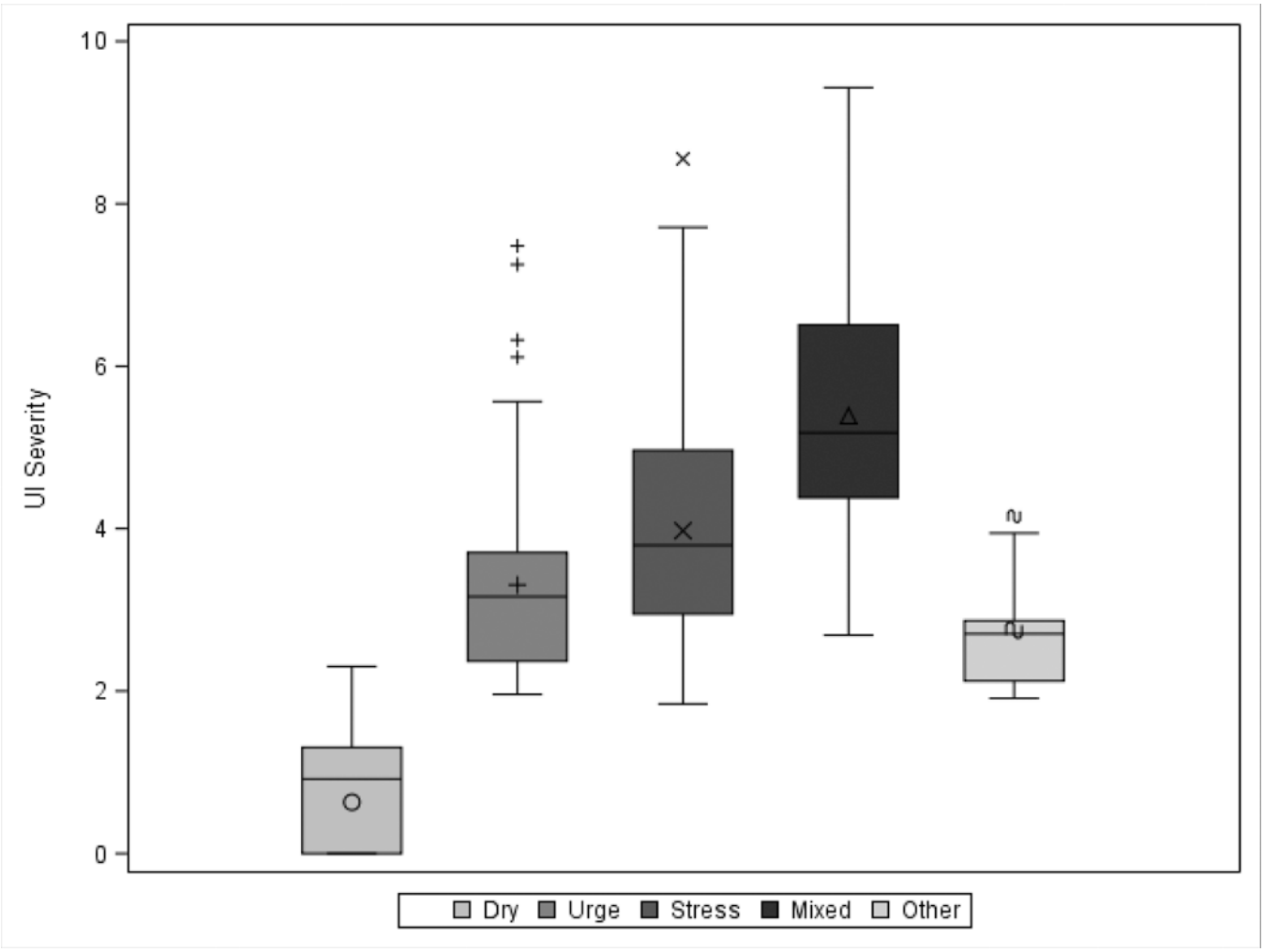

Fig 3:

UI Severity by subtype. UI severity was calculated as the weighted Euclidean distance (square root of sum of squared responses) of 7 LUTS Tool incontinence questions. Weights were calculated using the ratio of average correlation of a given question to the average total correlation of all 7 questions in order to account for potential redundancy in questions.

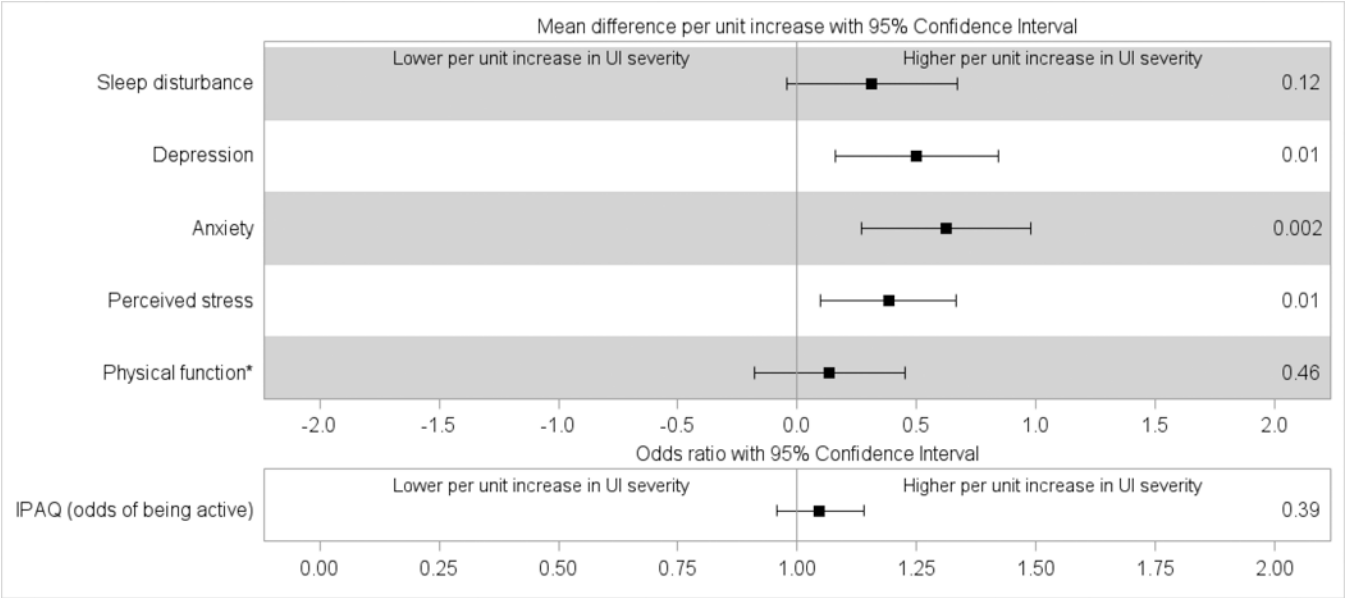

Fig 4:

Forest plot depicting differences in mental health, sleep, and physical function measures based on UI severity. Adjusted mean group differences from the PSS and PROMIS short form questionnaires were obtained from linear regression models; the adjusted odds ratio for the IPAQ-SF was modeled using logistic regression. Full models with covariates are presented in Supplementary Tables 5 & 6. *The Physical Function scale was reversed for this figure to be consistent with other outcomes.

Table 1:

Characteristics of study population

	Total (n=510)	*Without UI (n=90)*	*With UI (n=420)*	*p-value**	*SUI (n=70)*	*UUI (n=85)*	*MUI (n=240)*	*p-value***
Age	56.4 (14.4)	55.8 (17.1)	56.6 (13.8)	0.953	53.0 (13.4)	56.8 (15.8)	57.6 (13.1)	0.022
Race				0.448				0.178
American Indian/Alaskan Native	5 (1%)	2 (2%)	3 (1%)		0 (0%)	1 (1%)	1 (0%)	
Asian	14 (3%)	2 (2%)	12 (3%)		4 (6%)	3 (4%)	5 (2%)	
African-American	59 (12%)	8 (9%)	51 (12%)		6 (9%)	14 (16%)	30 (13%)	
Native Hawaiian/Pacific Islander	1 (0%)	0 (0%)	1 (0%)		0 (0%)	1 (1%)	0 (0%)	
White	418 (82%)	74 (82%)	344 (82%)		59 (84%)	62 (73%)	200 (84%)	
Multi-racial/Other	12 (2%)	4 (4%)	8 (2%)		1 (1%)	4 (5%)	3 (1%)	
Hispanic/Latino	16 (3%)	4 (4%)	12 (3%)	0.456	5 (7%)	1 (1%)	6 (3%)	0.070
Education				0.094				0.112
High school or less	56 (11%)	5 (6%)	51 (12%)		7 (10%)	7 (8%)	36 (15%)	
Some college/tech school (no degree)	117 (23%)	17 (20%)	100 (24%)		10 (14%)	19 (22%)	64 (27%)	
Associate's degree	57 (11%)	7 (8%)	50 (12%)		11 (16%)	9 (11%)	26 (11%)	
Bachelor's degree	153 (30%)	29 (34%)	124 (30%)		21 (30%)	27 (32%)	68 (29%)	
Graduate degree	119 (24%)	28 (33%)	91 (22%)		21 (30%)	23 (27%)	42 (18%)	
Employment status				0.145				0.054
Employed part-time	72 (14%)	12 (14%)	60 (14%)		10 (14%)	14 (16%)	35 (15%)	
Employed full-time	197 (39%)	30 (34%)	167 (40%)		38 (54%)	32 (38%)	81 (34%)	
Unemployed (looking for work)	14 (3%)	0 (0%)	14 (3%)		3 (4%)	1 (1%)	10 (4%)	
Not employed (not looking for work)	221 (44%)	46 (52%)	175 (42%)		19 (27%)	38 (45%)	110 (47%)	
Marital status				0.281				<.001
Married/civil union/living with partner	302 (60%)	52 (58%)	250 (60%)		56 (80%)	49 (58%)	132 (55%)	
Separated or divorced	85 (17%)	11 (12%)	74 (18%)		6 (9%)	8 (9%)	52 (22%)	
Widowed	41 (8%)	11 (12%)	30 (7%)		1 (1%)	11 (13%)	17 (7%)	
Single, never married	79 (16%)	15 (17%)	64 (15%)		7 (10%)	17 (20%)	37 (16%)	
BMI category				0.015				0.006
Underweight/normal (BMI<25)	137 (27%)	28 (32%)	109 (26%)		30 (43%)	25 (29%)	47 (20%)	
Overweight (BMI 25–30)	131 (26%)	31 (36%)	100 (24%)		17 (24%)	19 (22%)	55 (23%)	
Obese (BMI 30–35)	108 (22%)	16 (18%)	92 (22%)		13 (19%)	18 (21%)	60 (26%)	
Morbidly obese (BMI>35)	126 (25%)	12 (14%)	114 (27%)		10 (14%)	23 (27%)	73 (31%)	
Current or Former Smoker	174 (35%)	22 (26%)	152 (37%)	0.050	23 (33%)	22 (26%)	96 (41%)	0.040
Alcohol use								
No past alcohol use	83 (17%)	11 (13%)	72 (18%)	0.576	10 (14%)	10 (12%)	49 (21%)	0.442
0–3 drinks per week	334 (68%)	62 (74%)	272 (66%)		47 (67%)	58 (69%)	150 (65%)	
4–7 drinks per week	60 (12%)	8 (10%)	52 (13%)		11 (16%)	12 (14%)	24 (10%)	
>7 drinks per week	17 (3%)	3 (4%)	14 (3%)		2 (3%)	4 (5%)	8 (3%)	
Functional Comorbidity Index	2.4 (2.2)	1.8 (1.7)	2.5 (2.2)	0.007	1.9 (1.8)	2.2 (2.0)	2.8 (2.3)	0.002

	Total (n=510)	*Without UI (n=90)*	*With UI (n=420)*	*p-value*[*]	*SUI (n=70)*	*UUI (n=85)*	*MUI (n=240)*	*p-value*[**]
Diabetes	71 (14%)	12 (14%)	59 (14%)	0.887	5 (7%)	13 (15%)	38 (16%)	0.178
Sleep Apnea	90 (18%)	10 (11%)	80 (19%)	0.087	4 (6%)	12 (14%)	59 (25%)	<.001
History of psychiatric diagnosis[†]	218 (43%)	32 (36%)	186 (45%)	0.156	26 (37%)	33 (39%)	116 (49%)	0.104
Previous brain or spinal surgery	37 (7%)	5 (6%)	32 (8%)	0.511	1 (1%)	6 (7%)	23 (10%)	0.071
Presence of childhood traumatic event[‡]	368 (76%)	60 (71%)	308 (77%)	0.260	49 (74%)	60 (73%)	179 (79%)	0.453
Childhood traumatic sexual experience[§]	120 (25%)	13 (15%)	107 (27%)	0.029	13 (20%)	15 (19%)	73 (32%)	0.020
2 or more UTIs in the past year	236 (48%)	32 (37%)	204 (50%)	0.029	32 (46%)	34 (41%)	128 (55%)	0.057
Vaginally parous	365 (72%)	55 (63%)	310 (75%)	0.022	54 (77%)	62 (73%)	178 (75%)	0.827
Hysterectomy	154 (30%)	23 (26%)	131 (31%)	0.328	21 (30%)	27 (32%)	76 (32%)	0.948
Post-menopausal	323 (64%)	52 (59%)	271 (66%)	0.245	39 (56%)	59 (69%)	155 (66%)	0.170
Hormone use (systemic and local)	54 (11%)	11 (12%)	43 (10%)	0.579	12 (17%)	8 (9%)	22 (9%)	0.150

All variables have less than 4% missing values

[*] P-values for wet vs. dry from chi-square test or Wilcoxon 2-sample test

[**] P-values for SUI vs. UUI vs. Mixed UI from chi-square test or Kruskal-Wallis test

[†] Diagnosis of psychiatric disease includes self-reported depression, anxiety, post-traumatic stress disorder.

[‡] Affirmative response to any question on the Childhood Traumatic Events Scale (CTES)

[§] Affirmative response to question 9 on the CTES

Table 2:

Mental health, sleep, and physical function measures among women with and without UI

	Without UI		*With UI*			
Indices	***N***	***Mean (SD)***	***N***	***Mean (SD)***	***p-value****	***Adjusted p-value***
PROMIS Sleep disturbance†	84	50.7 (9.1)	406	53.5 (8.5)	0.03	0.52
PROMIS Depression†	84	47.9 (7.9)	408	49.6 (8.9)	0.14	0.95
PROMIS Anxiety†	86	48.5 (8.1)	404	50.4 (9.2)	0.12	0.57
Perceived stress scale†	82	11.0 (7.1)	384	13.1 (7.5)	0.06	0.48
PROMIS Physical function†	85	50.6 (10.0)	400	46.7 (10.3)	0.01	0.17
IPAQ MET-minutes‡	90	1386 [495,2697]	420	1272 [495,2963]	0.74	
Active§	84	46.4 %	407	43.2 %	0.69	0.89

*P-values from Mann-Whitney U test for IPAQ continuous outcome, logistic regression model for IPAQ categorical outcome, and T-test for all other outcomes.

**P-values from multivariable logistic regression models for IPAQ categorical outcomes and linear regression models for all other outcomes. Models were built using best subset selection with potential adjustment using variables listed in Table 1. Full model results and covariates reported in Supplementary Tables 1 & 2.

†Higher scores indicate higher levels of the concept being assessed.

‡Median and interquartile range for the I-PAQ calculated metabolic equivalent (MET)-minutes shown for each group.

§Proportion of patients reporting “high” or “moderate” activity on IPAQ shown for each group.

Table 3:

Mental health, sleep, and physical function measures among women by UI subtype

	SUI		*UUI*		*MUI*							
Indices	***N***	***Mean (SD)***	***N***	***Mean (SD)***	***N***	***Mean (SD)***	***Overall ANOVA p-value****	***UUI vs. SUI p-value****	***MUI vs. SUI p-value****	***Adjusted overall p-value*****	***Adjusted UUI vs. SUI p-value*****	***Adjusted MUI vs. SUI p-value*****
PROMIS Sleep disturbance†	66	53.0 (9.1)	85	52.1 (8.0)	230	54.2 (8.7)	0.25	0.64	0.43	0.85	0.96	0.67
PROMIS Depression†	66	46.8 (7.5)	84	48.6 (8.0)	233	51.0 (9.4)	0.01	0.33	0.005	0.38	0.38	0.18
PROMIS Anxiety	68	48.2 (8.2)	82	48.8 (9.0)	229	51.8 (9.5)	0.01	0.71	0.02	0.02	0.59	0.02
Perceived stress scale†	66	11.6 (7.2)	80	12.2 (7.1)	216	14.1 (7.7)	0.06	0.65	0.05	0.41	0.55	0.21
PROMIS Physical function	66	52.2 (9.0)	80	47.9 (10.4)	229	44.8 (10.2)	<0.001	0.03	<0.001	0.15	0.41	0.06
IPAQ MET-minutes‡	70	1653 [578,3240]	85	1100 [440,2721]	240	1280 [476,3173]	0.44	0.24	0.24			
Active§	66	47.0 %	83	38.6 %	234	45.3 %	0.62	0.36	0.65	0.41	0.42	0.23

*P-values from Kruskal-Wallis test for IPAQ continuous outcome, logistic regression for IPAQ categorical outcome, and one-way ANOVA with pairwise p-values for UUI vs. SUI and Mixed vs. SUI for all other outcomes.

**P-values from multivariable logistic regression models for IPAQ categorical outcomes and linear regression models for all other outcomes. Models were built using best subset selection with potential adjustment using variables listed in Table 1. Full model results and covariates reported in Supplementary Tables 3 & 4.

†Higher scores indicate higher levels of the concept being assessed.

‡Median and interquartile range for the I-PAQ calculated MET minutes shown for each group.

§Proportion of patients reporting “high” or “moderate” activity on IPAQ shown for each group.

Table 4:

Mental health, sleep, and physical function measures among women by UI severity

Indices	*Parameter estimate**	*Lower 95% confidence limit**	*Upper 95% confidence limit**	*FDR Adjusted p-value**
PROMIS Sleep disturbance	0.312	−0.045	0.669	0.12
PROMIS Depression	0.499	0.157	0.840	0.01
PROMIS Anxiety	0.625	0.270	0.980	0.002
Perceived stress scale	0.382	0.097	0.667	0.01
PROMIS Physical function	−0.136	−0.453	0.182	0.46
IPAQ (odds of being active)	1.045	0.957	1.140	0.39

* False discovery rate (FDR) adjusted p-values and parameter estimates with confidence limits from multivariable logistic regression models for IPAQ categorical outcomes and multivariable linear regression models for all other outcomes. Models were built using best subset selection with potential adjustment using variables listed in Table 1. Full model results and covariates reported in Supplementary Tables 5 & 6.