Published in final edited form as:

Int Urogynecol J. 2014 June ; 25(6): 823–829. doi:10.1007/s00192-013-2309-2.

Urinary incontinence and prevalence of high depressive symptoms in black and white older women

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Abstract

Introduction and Hypothesis—Previous studies have reported higher prevalence of depression among women with urgency or mixed urinary incontinence (UI) than stress UI. Urgency UI is the dominant UI type among black women, while stress UI is the predominant type among white women. Thus, UI-related mental health issues could be a key consideration among black women. We hypothesized that the association between UI and depression might be stronger in black versus white women.

Methods—These cross-sectional analyses included 934 black and 71,161 white women aged 58–83 in the Nurses' Health Study, which was established among women living in the USA. Depressive symptoms were assessed using the ten-item Center for Epidemiologic Studies Depression scale (CESD-10). Multivariable-adjusted odds ratios (ORs) and 95% confidence intervals (CIs) for high depressive symptoms (CESD-10 score ≥ 10) according to self-reported UI frequency, severity, and type were calculated using logistic regression models.

Results—Although point estimates for associations of UI frequency, severity, and type with high depressive symptoms were higher in black women, differences in ORs between black and white

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FINANCIAL DISCLAIMERS/CONFLICT OF INTEREST: NONE

AUTHOR CONTRIBUTIONS:

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women were not statistically significant. For example, the OR for at least weekly UI compared with no UI was 2.29 (95% CI 1.30-4.01) in black women and 1.58 (95% CI 1.49-1.68) in white women (p-interaction=0.4).

Conclusions—We did not find statistically significant differences in associations of UI frequency, severity, and type with high depressive symptoms between black and white women. However, small numbers of black women with high depressive symptoms limited statistical power to detect significant interactions. Thus, these results should be interpreted with caution.

Keywords

depression; epidemiology; urinary incontinence; women

INTRODUCTION

Urinary incontinence (UI) is a common condition among older women. In several large studies of U.S. women aged 50 years and older, approximately one-third to two-thirds of women reported UI [1,2]. The impact of UI on quality of life can be substantial, including causing embarrassment and shame which may lead to harmful coping behaviors such as decreased participation in social and physical activities [3]. In addition, there is evidence that the prevalence of depression is higher among women with UI compared with those without UI [4,5]. In particular, findings suggest that depression is more common with increasing UI severity [5-7] and more common in women with mixed or urgency UI than in women with stress UI [5,8].

However, emerging data indicate that the epidemiology of UI differs between black and white women. In particular, on average, urgency UI appears to be the dominant UI type among black women while stress UI appears to be more common in white than black women [9,10], especially at younger ages [11]. This suggests that mental health issues accompanying UI could be a key consideration in black women given the predominance of urgency UI in this group. Yet, the majority of previous studies have focused on the association between UI and depression in white women and, among the limited studies examining racial differences in associations between UI and mental health, results have been inconsistent [7,12,13].

Therefore, our objective was to examine the associations of UI frequency, severity, and type with prevalent depressive symptoms among older women enrolled in the Nurses' Health Study. In particular, we examined whether these associations differed by black versus white race. We hypothesized that the association between UI and depressive symptoms might be stronger in black versus white women.

MATERIALS AND METHODS

Study population

The Nurses' Health Study began in 1976 when 121,700 female nurses, age 30 to 55 years, returned a mailed questionnaire about their health and lifestyle. Since then, updated information has been collected using questionnaires mailed every two years. To facilitate

participation, an abbreviated version of the questionnaire is sent to women who do not respond to initial mailings of the full-length questionnaire. Questions about UI and about depressive symptoms were both included on the full-length questionnaire mailed in 2004 to 1,612 black and 90,687 white active participants (i.e., women who had responded to at least 1 full-length questionnaire in the past 10 years and were alive in 2004). The Institutional Review Board of Brigham and Women's Hospital approved this study.

For these cross-sectional analyses of UI and depressive symptoms, we excluded 20,204 women who did not return the full-length questionnaire in 2004 or were missing information on UI frequency or depressive symptoms, leaving 934 black women and 71,161 white women available for analysis (Figure). Of active participants, a smaller proportion of black women (58%) were available for analysis than white women (78%), partly because black women were more likely than white women to complete the abbreviated version of the questionnaire in 2004 (i.e., 24% versus 11% of active black and white participants, respectively), which did not include items on UI and depressive symptoms. However, among women excluded from analysis, the distribution of reasons for exclusion was similar between black and white women (Figure). Also, black women in the population for analysis and black women who were excluded from analysis due to missing data were identical in mean age (70 years in both groups) and median number of pregnancies (2 pregnancies in both groups), and similar in mean body mass index (BMI) (29 versus 28 kg/m², respectively). White women included in the population for analysis were identical to those who were excluded from analysis in mean age (70 years in both groups), median number of pregnancies (3 pregnancies in both groups), and mean BMI (27 kg/m² in both groups).

Measurement of UI

To assess UI frequency, participants were asked, "During the last 12 months, how often have you leaked or lost control of your urine?" Response options were: never, less than once per month, 2-3 times per month, about once per week, and almost every day. Women who reported involuntary urine loss were then asked, "When you lose urine, how much usually leaks?" Response options were: a few drops, enough to wet the underwear, enough to wet outer clothing, and enough to wet the floor. A reliability study among 200 participants demonstrated high reproducibility of response to these questions [14].

UI severity was defined using the index developed and validated by Sandvik et al [15]. Specifically, UI frequency was categorized into 4 levels ranging from less than once a month (scored 1) to almost every day (scored 4). UI quantity was categorized into 3 levels: a few drops (scored 1), enough to wet the underwear (scored 2), and enough to wet outer clothing or the floor (scored 3). Scores for UI frequency and UI quantity were multiplied, resulting in an index with scores ranging from 1 to 12. Scores from 1 to 2 indicated slight UI, scores from 3 to 6 indicated moderate UI, and scores from 8 to 12 indicated severe or very severe UI [15].

UI type was measured by asking women, "When you lose urine, what is the usual cause?" Stress UI was defined as leaking usually caused by coughing, sneezing, laughing, or doing physical activity. Urgency UI was defined as leaking usually caused by a sudden and urgent need to go to the bathroom. UI type was classified as mixed when women reported that

stress and urgency UI symptoms were equally common. We classified UI type among women with at least monthly UI. In analyses of UI frequency, severity, and type, the reference group was women without UI.

Measurement of depressive symptoms

Depressive symptoms were assessed by the 10-item version of the Center for Epidemiologic Studies Depression scale (CESD-10) [16]. There are 4 response categories for each item, ranging from rarely or none of the time (scored 0) to all of the time (scored 3). Women who provided data on at least 9 of the 10 items were included in analyses, with mean imputation used to replace missing responses. Scores for each item were summed, resulting in a scale ranging from 0 to 30. In primary analyses, we considered scores ≥ 10 indicative of high depressive symptoms; this definition is highly predictive of high depressive symptoms as determined by the full-length 20-item Center for Epidemiologic Studies Depression scale ($\kappa=0.97$) [16].

Statistical analysis

Logistic regression models were used to calculate multivariable-adjusted odds ratios (ORs) and their 95% confidence intervals (CIs) for high depressive symptoms according to UI frequency (no UI, <once/month, 1-3 times/month, $\geq$ once/week), UI severity (no UI, slight, moderate, severe), or UI type (no UI, stress, urgency, mixed), separately among black and white women (three separate analyses were conducted of these three UI classification schemes). Model covariates were factors associated with depressive symptoms that were also important UI risk factors identified from the literature, or factors that caused $>5\%$ change in the OR estimates for UI frequency. These two considerations resulted in a model including age (years; continuous), BMI (kg/m^2 ; continuous), physical activity (MET-hours per week; continuous), functional limitation (yes or no), and number of times getting out of bed each night to urinate (0-1 versus ≥ 2). In analyses of UI type, we additionally adjusted for UI severity in the multivariable logistic regression model. Functional limitation was defined as a participant's report of being limited "a lot" due to health reasons in any of the following basic activities of daily living: walking 1 block, climbing 1 flight of stairs, bathing, or dressing. Covariates reflected participants' status as of the same questionnaire on which they reported UI (i.e., 2004 questionnaire). Other covariates considered, but not included in final models because they did not impact OR estimates for the association between UI frequency and depressive symptoms, were: parity, stroke, type 2 diabetes, high blood pressure, myocardial infarction, cigarette smoking, diuretic use, social network, and daytime urinary frequency. In analyses of UI prevalence and severity, tests for linear trend in ORs across categories were conducted by creating a continuous variable using the mid-point value of UI frequency or UI severity score in each category. To examine whether associations between UI and depressive symptoms differed between black and white women, we used interaction terms created by multiplying the relevant UI variable by the indicator variable for black versus white race.

We conducted several secondary analyses. First, since one of the CESD-10 items concerns restless sleep, and restless sleep may be related to urinary incontinence, we repeated analyses in which high depressive symptom cases were women with scores ≥ 10 even

without considering this item [17]. In addition, given evidence that the optimal CESD-10 scale cut-point for clinical depression may be higher in older versus younger adults [18,19], we conducted additional analyses in which high depressive symptoms was defined as a CESD-10 score ≥ 12 rather than ≥ 10 [20]. Finally, to explore whether socioeconomic status variables partly explained differences in associations between UI and depressive symptoms between black and white women, we compared interaction term effect estimates in models before and after adjusting for socioeconomic status variables (i.e., highest attained degree, marital status, and census tract median family income).

For all analyses, two-tailed p-values <0.05 were considered statistically significant. Data were analyzed using SAS 9.2 (SAS Institute Inc, Cary, NC).

RESULTS

In 2004, participants were age 58 to 83 years (mean age 70 years). Mean BMI was higher in black versus white women (29 versus 27 kg/m²) (table 1). Black women were also slightly more likely than white women to get out of bed two or more times each night to urinate (41% versus 33%). However, white women reported more UI, including more severe symptoms, than black women.

Overall, although odds ratio point estimates generally were higher in black than white women, we found no statistically significant differences between black and white women in the associations of UI frequency, severity, or type with high depressive symptoms (p-values for interaction >0.3) (table 2). More frequent UI and greater UI severity were significantly associated with higher prevalence of high depressive symptoms in both black and white women. For example, among black women, the odds ratio for high depressive symptoms increased from 1.58 (95% CI 0.97-2.58) in women with UI less than once per month to 2.29 (95% CI 1.30-4.01) in women with UI at least once per week, compared with women without UI (P-trend across categories=0.02). Among white women, the corresponding odds ratios ranged from 1.18 (95% CI 1.11-1.25) to 1.58 (95% CI 1.49-1.68) (P-trend <0.01). In analyses of UI type, odds ratios for high depressive symptoms were similar among women with stress UI and urgency UI compared with women without UI and highest among women with mixed UI among both black and white women (mixed UI OR 2.04, 95% CI 0.76-5.50 among black women and 1.43, 95% CI 1.30-1.57 among white women). Confidence intervals for UI frequency, severity, and type odds ratios in black women were wide, reflecting the small number of black women with high depressive symptoms.

We conducted several secondary analyses to determine the robustness of results to different definitions of high depressive symptoms, including CESD-10 score ≥ 10 without considering the item on restless sleep and CESD-10 score ≥ 12 . Results of these analyses were similar to those in the primary analyses. For example, when high depressive symptoms were defined as a score ≥ 10 without considering restless sleep, ORs in black women were 2.30 (95% CI 1.19-4.42) for at least weekly UI, 2.67 (95% CI 1.17-6.07) for severe UI, and 1.20 (0.35-4.10) for mixed UI versus no UI; corresponding ORs in white women were 1.58 (95% CI 1.48-1.70), 1.86 (95% CI 1.72-2.02), and 1.39 (95% CI 1.24-1.55).

We also conducted secondary analyses to examine the influence of adjusting for socioeconomic status variables (highest attained degree, marital status, and census tract median family income) on the effect estimates for the black race by UI interaction terms. Overall, additional adjustment for socioeconomic status minimally changed results. For example, the odds ratio for the black race by mixed UI interaction was 1.30 (95% CI 0.72-2.34) and 1.31 (0.73-2.36) before and after adjusting for socioeconomic status, respectively.

DISCUSSION

Overall, we found that UI was associated with more depressive symptoms in both black and white women. Although stronger point estimates of these associations were observed in black versus white women, due to small numbers of black women with high depressive symptoms, precision of odds ratio estimates in black women was limited and associations were not statistically significantly different between black and white women. Thus, findings should be interpreted with caution. Nonetheless, these results merit further attention and investigation.

Several potential explanations may account for a link between UI and depression [21]. It is possible that women with UI, and particularly those with severe symptoms, are embarrassed by their condition and that lifestyle changes due to UI (e.g., avoiding social activities) may adversely impact mental health [3]. The association may also be bi-directional. Depression-related abnormalities in serotonin, an important neurotransmitter involved in bladder function, might lead to UI [21-24]. In addition, increased sympathetic nervous system activity associated with depression may increase circulating levels of cortisol and catecholamines and, consequently, lead to physiologic changes in the bladder and UI [21,25]. Future research to improve understanding of the mechanisms linking UI and depression will be important to help identify potential intervention strategies to reduce depression in UI and/or UI in depression.

Our results regarding the association of UI frequency and severity with depressive symptoms in white women are similar to those reported in previous studies. For example, among 5,321 Norwegian women aged 40 to 44 years in the Hordaland Health Study, the multivariable-adjusted OR for depression comparing women with severe versus no UI was 2.14 (95% CI 1.08-4.22) [5]. In addition, among 5,701 women (72% white) age 50 to 69 years in the Health and Retirement Study, the OR for depression, as determined by the 8-item CES-D scale, was 1.33 (95% CI 0.91-1.94) comparing women with UI on >15 days in the last month with women without UI [4].

Previous studies, which have been conducted mainly among white women, have also reported greater risk of depression in mixed versus stress UI [5,8]. For example, among 218 women with UI, age 18 to 90 years, the odds of major depression were 13.5-fold (95% CI 3.0-61.5) higher in women with mixed compared with stress UI [8]. In addition, in the Hordaland Health Study, the OR for depression was highest when comparing women with mixed versus no UI (OR 2.24, 95% CI 1.65-3.03) and lowest when comparing stress versus no UI (OR 1.27, 95% CI 0.95-1.69) [5].

Few studies have examined potential differences in the association between UI, UI type, and depression by race and, among the limited existing studies, results have been inconsistent [7,12,13]. For example, two population-based studies [12,13], which included women aged 30 years and older, observed 3.8-5.6-fold higher odds of depression in black adults with versus without UI, and no association between UI and depression in white adults, although CIs for ORs in both blacks and whites were somewhat wide. However, an analysis in the Reproductive Risks of Incontinence Study at Kaiser, a cohort of 2,109 female members of an integrated health care delivery system in Northern California, USA, aged 40-69 years, found no clear difference between black and white women in the association of UI frequency with mental health score [7]. Still, results from studies examining racial differences in UI bother may provide support for differences in UI-mental health associations by race. For example, among women in the Establishing the Prevalence of Incontinence study, a population-based study of black and white women aged 35-64 years in Michigan, USA, black women had significantly higher bother scores for moderate UI, and tended to be bothered more by urgency and mixed UI ($p=0.06$ for both comparisons), than white women [26].

Several potential explanations for a difference in UI-mental health associations by race, which is not a biologically meaningful construct, can be hypothesized. For example, it has been suggested that differences in UI epidemiology between black and white women (e.g., lower overall UI prevalence and higher likelihood of urgency UI in black versus white women [9,10]) possibly reflect differences in UI pathophysiology, which may relate to varying mental health impact of UI [12]. It is also possible that unmeasured sociocultural differences mediate racial/ethnic differences in mental health impact of UI observed in previous studies. A stronger association between UI and mental health in black versus white women would suggest that inquiring about depressive symptoms among women with UI may be particularly important in black women. In our study, although there was a suggestion that greater UI frequency and severity were related more strongly to UI in black versus white women and that the association between UI subtypes and prevalent depressive symptoms was stronger in black versus white women, we did not find statistically significant differences in associations between racial groups.

Our study has several limitations. First, since UI symptoms were self-reported, it is possible that we over- or under-estimated its prevalence. However, the validity of self-reported UI compared with clinical diagnosis has been established in previous research [27]. Also, evidence from previous validation studies suggests that UI type is reported with high specificity, but moderate sensitivity [28]. Another limitation of our study was that black women were more likely to be excluded from analyses than white women, partly because black women were more likely to complete the abbreviated questionnaire which did not include items on UI and depressive symptoms. However, demographic characteristics of black women excluded from analyses were almost identical to those included in analyses. In addition, selective non-response, resulting in qualitatively stronger odds ratio point estimates in black women, seems unlikely. For example, overestimation of ORs in black women could have occurred if response to the full-length questionnaire was lower in black women with depressive symptoms and without UI than black women with both depressive symptoms and UI. However, higher non-response in women with UI than without UI seems more likely,

which would result in attenuation of OR estimates. Bias due to underreporting of stigmatizing conditions (i.e., UI and depressive symptoms) could explain the results if underreporting were more likely in white women than black women. However, we expect that the possibility of such bias is minimized among nurses who have similar health education and health knowledge. Nonetheless, lower response to the full-length questionnaire contributed to the relatively small number of black women included in the analyses, resulting in limited precision of OR estimates and limited statistical power to detect a significant interaction between race and UI. In addition, small numbers of black women with incident UI or incident depressive symptoms meant that we could not conduct prospective analyses and thus, could not examine temporal relations between UI and depressive symptoms (i.e., we could not distinguish UI as a risk factor for depression versus depression as a risk factor for UI). Still, given the limited data on UI and depression in black women, who differ from white women in UI prevalence and distribution of UI types, these data are an important addition to the meager literature. Finally, although we considered a wide variety of variables for adjustment in the multivariable models, uncontrolled confounding cannot be ruled out as a potential explanation for the results in an observational study. For example, we did not have data available on uterine fibroids, which are more common in black than white women [29] and have been associated with both lower urinary tract symptoms and mental health [30]. A stronger association between uterine fibroids and UI, or uterine fibroids and depression, in black versus white women might partly explain the higher odds ratio point estimates for the association between UI and depression we observed in black women. Other studies with data on UI, depression, and uterine fibroids are necessary to understand the inter-relationships of these variables in black and white women.

In conclusion, we found several similarities in the association between UI and depressive symptoms in black and white women. In particular, the prevalence of depressive symptoms increased with increasing UI frequency and severity and were most common in mixed UI. While our results also suggested that the magnitude of the association between UI and depressive symptoms might be greater in black compared with white women, differences in associations between black and white women were not statistically significant. Larger, prospective studies are needed to better understand potential racial differences in mental health impact of UI and determine whether measures instituted to screen for depression among women with UI may be especially important in black women.

Acknowledgments

Financial support for this research was provided by the National Institutes of Health (R01 DK62438, P01 CA87969) and Pfizer (Young Investigator OAB-LUTS grant WS624525 to MK Townsend).

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Figure.

Flow chart of the study population

* Active participants are women who responded to at least 1 full-length questionnaire in the past 10 years and were alive in 2004.

Table 1

Characteristics of Nurses' Health Study participants in 2004 according to UI frequency

Variable	Black (n=934)	White (n=71,161)
Mean age, yrs	69.8	69.6
Mean body mass index, kg/m ²	28.7	26.5
Mean physical activity, MET-hours/week	15.6	18.1
Functional limitation, % ^a	11.9	10.9
Number of times getting out of bed each night to urinate, %		
0-1	59.4	67.4
2	40.6	32.6
UI frequency, %		
None	42.2	24.8
<1/month	26.9	28.5
1-3 times/month	16.9	20.4
1/week	14.0	26.3
UI severity, % ^b		
None	42.2	24.8
Slight	32.2	36.8
Moderate	18.1	25.3
Severe	6.3	12.0
UI type, % ^c		
Stress	2.1	7.1
Urgency	5.9	8.7
Mixed	4.7	8.8
Other/missing	1.3	1.8
Mean CESD-10 score	5.3	5.7
CESD-10 score 10, %	13.7	16.3

CESD-10, 10-item Center for Epidemiologic Studies Depression scale; UI, urinary incontinence.

^aFunctional limitation was defined as substantial limitation in walking 1 block, climbing 1 flight of stairs, bathing, or dressing.^bPercentages do not sum to 100% due to missing data on quantity of leakage.^cUI type defined only among women with at least weekly UI.

Table 2

Multivariable-adjusted odds ratios for high depressive symptoms according to frequency, severity, and type of prevalent urinary incontinence among black and white women

	Black women			White women		
	High depressive symptoms N (%) ^a	Age-adjusted OR (95% CI)	MV-adjusted OR (95% CI) ^b	High depressive symptoms N (%) ^a	Age-adjusted OR (95% CI)	MV-adjusted OR (95% CI) ^b
No UI	39 (10)	1.00 (referent)	1.00 (referent)	2151 (12)	1.00 (referent)	1.00 (referent)
UI frequency						
UI <1/month	37 (15)	1.56 (0.96-2.53)	1.58 (0.97-2.58)	2928 (14)	1.21 (1.14-1.29)	1.18 (1.11-1.25)
UI 1-3/month	25 (16)	1.72 (0.99-2.95)	1.70 (0.98-2.94)	2548 (18)	1.53 (1.44-1.63)	1.42 (1.33-1.51)
UI 1/week	27 (21)	2.26 (1.32-3.88)	2.29 (1.30-4.01)	3939 (21)	1.87 (1.76-1.98)	1.58 (1.49-1.68)
P-trend			0.02			<0.01
UI severity						
Slight	42 (14)	1.46 (0.92-2.33)	1.48 (0.92-2.36)	3738 (14)	1.20 (1.13-1.27)	1.17 (1.11-1.24)
Moderate	30 (18)	1.94 (1.16-3.25)	1.95 (1.15-3.31)	3405 (19)	1.66 (1.56-1.76)	1.50 (1.41-1.59)
Severe	14 (24)	2.66 (1.33-5.30)	2.63 (1.28-5.40)	2105 (25)	2.27 (2.12-2.42)	1.80 (1.68-1.93)
P-trend			<0.01			<0.01
UI type						
Stress	10 (17)	2.05 (0.96-4.39)	1.64 (0.61-4.38)	1714 (17)	1.47 (1.37-1.57)	1.17 (1.07-1.28)
Urgency	21 (18)	1.84 (1.03-3.29)	1.48 (0.59-3.70)	2130 (19)	1.66 (1.55-1.77)	1.15 (1.05-1.26)
Mixed	19 (26)	3.02 (1.62-5.62)	2.04 (0.76-5.50)	2199 (23)	2.10 (1.96-2.24)	1.43 (1.30-1.57)

CI, confidence interval; MV, multivariable; OR, odds ratio; UI, urinary incontinence.

^aPercentages refer to prevalence of high depressive symptoms among women in each incontinence category.

^bAdjusted for age (continuous), body mass index (continuous), physical activity (continuous), functional limitation, number of times getting out of bed each night to urinate (0-1 versus 2 times per night), UI type analyses are additionally adjusted for UI severity.