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Severity of Urinary Incontinence and Effect on Quality of Life in Women, by Incontinence Type

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Abstract

Objective—To estimate how symptom severity, extent of bother, and quality of life differ across urinary incontinence (UI) subtypes.

Methods—We evaluated prevalent UI cases from the Nurses' Health Studies, including women aged 41–83 years. Women with UI (leaking more than once a month) were subclassified according to reported symptoms as stress (leakage with activity), urgency (leakage with urgency), or mixed UI (stress and urgency co-occurring equally). UI severity was assessed in 102,418 women, based on the Sandvik severity index. In a subset of older women with weekly UI, we asked about bother (n=1,697) and quality of life (Incontinence Impact Questionnaire; n=1,748). UI severity, bother, and quality of life were compared across subtypes using polytomous logistic regression, adjusting for other characteristics.

Results—The distribution of UI subtypes was 51% stress, 27% urgency, and 22% mixed UI. About half had slight UI, 26% had moderate, and 23% had severe UI. Severe UI was more common in women reporting mixed (37%), than urgency (27%) or stress UI symptoms (15%) (P<0.001). More women with severe mixed (21%, P=0.02) and urgency UI symptoms (13%, P=0.1) reported being “greatly” bothered by their UI, compared with stress UI (10%). Women with severe mixed (mean 18.0, P<0.001) and urgency UI symptoms (mean 13.4, P=0.004) had higher mean Incontinence Impact scores compared with stress UI (mean 9.8).

Conclusion—Women reporting mixed UI symptoms describe more severe and bothersome incontinence, with higher effect on quality of life.

Introduction

Urinary incontinence (UI) is a highly prevalent condition affecting women of all ages. UI is generally classified into three subtypes: stress, urgency, and mixed UI. Stress UI symptoms (loss of urine on exertion such as coughing, sneezing, lifting or laughing) are more common in the premenopausal years. Prevalence of urgency UI (loss of urine with a strong desire to urinate) is generally lower than that of stress UI, especially prior to menopause, although the prevalence of urgency UI and mixed UI (co-existing stress and urgency UI symptoms) starts

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to increase after the fourth decade of life, and the latter becomes the most prevalent subtype in older women (1-7).

UI has varying effects on quality of life (1, 2, 4-6, 8, 9). There is evidence to suggest that the effects of UI may vary across UI types, and that mixed UI is more bothersome than either stress or urgency UI alone (4, 10, 11); however, the evidence is not entirely consistent (10, 12-14), is largely from clinical populations (15), and there are limited data from population-based studies with large enough samples to provide stable comparisons across UI types.

Using data from the Nurses' Health Studies, our goal was to estimate how symptom severity, extent of bother, and effect on quality of life differ across UI subtypes.

Methods

The Nurses' Health Study was initiated in 1976 when 121,700 female nurses aged 30 to 55 years responded to a mailed questionnaire about their medical history and lifestyle. The Nurses' Health Study II was initiated in 1989 when 116,430 female nurses aged 25 to 42 years completed and returned a similar questionnaire. Both cohorts utilize identical methods for data collection and follow-up, including biennial mailed questionnaires to update health and lifestyle information. During each questionnaire cycle, full-length questionnaires are sent in initial mailings, followed by abbreviated questionnaires to maximize participation. Participants provided informed consent by returning the questionnaire. Questions about urinary incontinence were included on the full-length questionnaires beginning in 2000 in Nurses' Health Study and 2001 in Nurses' Health Study II. To date, the follow-up rate in both cohorts is approximately 90%. The Institutional Review Board of Brigham and Women's Hospital approved both Nurses' Health Study and Nurses' Health Study II.

To obtain information on UI, women were asked on the questionnaires, "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, once per month, 2 to 3 times per month, about once per week, and almost every day. Women reporting any UI were then asked, "When you lose your urine, how much usually leaks?" Response options were a few drops, enough to wet your underwear, enough to wet your outer clothing, and enough to wet the floor. We defined UI cases as women who leaked urine at least once per month; we further defined a subset of cases with 'weekly UI' if women reported leaking at least once per week. A reliability study among a subgroup of the nurses demonstrated high reproducibility of responses to these questions (16).

In addition, we collected information on UI type. Initially, we collected this information only among women in the Nurses' Health Study with incident weekly incontinence in 2002. Due to the large number of cases of weekly UI in the Nurses' Health Study during this time period, we mailed a supplementary questionnaire to a random sample of 2,183 cases in 2002, and 84% responded. Cases with weekly UI who did and those who did not provide incontinence type information were similar in key characteristics, such as mean age (66 compared with 67 years, respectively), mean body mass index (BMI, calculated as weight/[height(m)²]) (27 kg/m² in both), and cigarette smoking (9% compared with 10%, respectively). Starting in 2004 (Nurses' Health Study) and 2005 (Nurses' Health Study II), information on UI type was ascertained from all women on the biennial questionnaires (Box 1).

Box 1**Urinary Incontinence Questions on Nurses' Health Study (2004) and Nurses' Health Study II (2005) Questionnaires**

During the last 12 months, how often have you leaked or lost control of your urine?

- Never
- Less than once per month
- Once per month
- 2–3 times per month
- About once per week
- Almost every day

When you lose your urine, how much usually leaks?

- A few drops
- Enough to wet underwear
- Enough to wet your outer clothing
- Enough to wet the floor

When you lose urine, what is the usual cause?

- a. Coughing sneezing, laughing or doing physical activity
- b. A sudden or urgent need to go to the bathroom
- c. Both a and b equally
- d. Other circumstances

We defined ‘stress UI’ symptoms as leakage occurring with coughing or sneezing, lifting things, laughing, or exercise. Urine loss with a sudden feeling of bladder fullness or when a toilet was inaccessible was considered ‘urgency UI’. UI classifications were based on the participants' reports of their dominant symptoms. Women who reported that stress and urgency symptoms occurred equally were defined as cases of ‘mixed UI’.

UI severity was measured by the Sandvik severity index among Nurses' Health Study and Nurses' Health Study II participants. The Sandvik index is well validated (17), and is calculated by multiplying the reported frequency of UI (less than 1 time a month, 1–3 times a month, 1 time a week, 1 time a day) by the amount of leakage (drops, more than drops) (17). Frequency of UI is assigned a value from 1 to 4, with a higher number indicating greater frequency, and amount of leakage is assigned a value of 1 for drops or 2 for more than drops. According to the Sandvik index, women with a score of 1–2 are classified as ‘slight’ UI severity, a score of 3–4 is classified as ‘moderate’, and a score of 6 or more is classified as ‘severe’.

Measurements of UI bother and effect on quality of life were collected only on a subset of women; a supplementary questionnaire (described above) sent to the Nurses' Health Study participants with weekly UI in 2002 also included questions to assess bother and effect on quality of life. To assess bother, these women were asked “to what extent are you bothered due to UI”, a commonly used and validated item (15, 18). Response options were “not at all,” “slightly,” “moderately,” and “greatly.” To assess the effect on quality of life, a subset

of the Incontinence Impact Questionnaire was used (19). In our initial feasibility work, we included all seven items of the Incontinence Impact Questionnaire; women were asked to what extent urine leakage affected physical activity, household chores, social activities, entertainment, travel, emotional health, and the extent to which they were frustrated by urine leakage. However, since this feasibility work indicated that our supplementary questionnaire was too long, we chose to use five of seven items in the Incontinence Impact Score (we deleted items on household chores and social activities); this decision was based on a validation study (19) which reported adequate validity of the Incontinence Impact Score with removal of one to two items. Response options were “greatly,” “moderately,” “slightly,” or “not at all.” Responses were assigned values of 0 for “not at all,” 1 for “slightly,” 2 for “moderately,” and 3 for “greatly.” The average score of items was calculated and this average was then multiplied by $33 \frac{1}{3}$ to convert scores to a scale of 0 to 100.

We used different populations for different analyses, according to the data available. Analyses of UI severity included all women with prevalent UI who answered questions regarding UI and its frequency ($n=102,418$) on the Nurses' Health Study and Nurses' Health Study II biennial questionnaires in 2004 (Nurses' Health Study) and 2005 (Nurses' Health Study II); this time period was chosen since it was the first when information regarding UI type was collected in all women. In the analyses of UI bother and of quality of life, only women from the Nurses' Health Study who answered these items on the 2002 supplementary questionnaire were included in the analysis ($n=1,697$ for bother and $n=1,748$ for the Incontinence Impact Questionnaire).

Descriptive statistics (mean, standard deviation, or percentage) were used to evaluate participants' self-reported demographic and health characteristics. In analyses of UI severity according to UI type, categories of Sandvik severity rating were compared across UI types (stress, urgency and mixed), and also stratified by age category (41–50, 51–60, 61–69 and 70–83 years). We used polytomous logistic regression (20) to evaluate statistical differences in severity across UI types, adjusting for age, BMI, and type 2 diabetes (the primary potential confounding variables in our dataset). Similarly, in analyses of extent of bother according to UI type, we compared categories of bother and across UI types; we used polytomous logistic regression to evaluate statistical differences across UI subtypes, controlling for age, BMI, and type 2 diabetes. We conducted a test of trend examining the relationship of increasing Incontinence Impact score to UI type by including a continuous variable for Incontinence Impact score in the polytomous logistic regression model controlling for age, BMI, and type 2 diabetes.

Results

Of the 218,754 women from the Nurses' Health Study and the Nurses' Health Study II who were still alive in 2004 and 2005, complete data were available on 158,789 (72.6%). Women with complete data and those with incomplete data were similar on key characteristics such as mean age (both 60 years) and mean BMI (27 kg/m^2 compared with 28 kg/m^2). Of those, 102,418 (64.5%) reported having UI at least monthly. The distribution of UI by subtypes was 52,570 (51%) with stress, 27,193 (27%) with urgency, and 22,655 (22%) with mixed UI symptoms.

Table 1 presents the demographic and health characteristics of women overall and by the three UI subtypes. In general, women with urgency UI tended to be somewhat older than those with stress or mixed UI and more likely to be African American. Women with urgency or mixed UI reported less physical activity, somewhat higher prevalence of hysterectomy, vascular disease and type 2 diabetes than those with stress UI (Table 1).

In these women with UI, according to the Sandvik severity index, about half had slight UI, and one quarter had moderate and severe UI each (Table 2). This distribution was fairly similar across age groups, although the prevalence of severe UI tended to increase with age, from 18.8% in women aged 41–50 years to 29.8% in those 70–83 years. Overall, women with mixed UI symptoms had the highest report of severe UI (36.7%; $P<0.001$ compared with stress UI), followed by urgency (27.2%; $P<0.001$ compared with stress) and then stress UI (15.3 %). Specifically, the adjusted odds ratio (OR) of severe UI comparing women with mixed versus stress UI was 3.9 (95% confidence interval [CI]: 3.8-4.1), and this OR was 2.2 (95% CI: 2.1-2.3) for urgency compared with stress UI (data not shown). Moreover, across age groups (Table 2), the trend of worst severity for mixed UI persisted, followed by urgency and then stress UI. For example, among the youngest women with mixed UI, 30.9% had severe symptoms compared with 15.0% of those with stress UI (adjusted OR=3.0, 95% CI: 2.8-3.3, $P<0.001$), and in the 70–83 age group, 42.7% of those with mixed UI had severe symptoms compared with 17.4% among women with stress UI (adjusted OR=4.8, 95% CI: 4.4-5.2, $P<0.001$).

Among a subset of women with weekly UI, who provided information on the extent to which they were bothered by UI (Table 3), we found that those with mixed and urgency UI symptoms tended to report more bother from their UI. For example, among those with mixed or urgency UI, 14.9% and 14.0%, respectively, reported they were “greatly” bothered compared with 10.1% for those with stress UI (adjusted OR=1.9, 95% CI: 1.2-3.1; $P=0.009$ and OR=2.3, 95% CI: 1.3-4.0, $P=0.004$ for mixed and urgency UI compared with stress UI, respectively). We also considered the subset of women with severe UI since these individuals may have symptoms that are more clinically relevant (Table 3). Differences in the extent of bother across UI subtypes were more marked in this group. Women with severe mixed UI were over twice as likely to report being “greatly” bothered by UI (21.3%) than those with severe stress UI (9.8%, $P=0.02$); the adjusted odds ratio was 3.3 (95% CI: 1.2-8.7). Women with severe urgency however, did not report significantly different extent of bother (12.9%) than those with severe stress UI ($P=0.1$) (adjusted OR=2.3, 95% CI: 0.8-6.5). These findings were fairly consistent for the relation between subtype and effect on quality of life, as measured by the Incontinence Impact Questionnaire, although there was only a limited distribution of scores across most women (Table 4). In women with severe UI, those with mixed UI had higher mean Incontinence Impact scores (18.0) when compared with either stress (9.8; $P<0.001$) or urgency UI (13.4; $P=0.004$).

Discussion

Our data indicate that, compared to women with symptoms of stress or urgency UI alone, individuals with co-existing symptoms of stress and urgency UI have more severe UI, and report more bother and worse quality of life due to their UI. Women with mixed UI appeared to generally have the most severe UI symptoms followed by urgency and then stress UI; specifically, severe UI symptoms were over twice as common in those with mixed than stress UI and nearly twice as common in urgency as stress UI. The differences in UI severity for the three UI subtypes persisted across each decade of life in our study sample, from age 41 through 83 years. Similar trends were found for the extent of bother, where “great” bother due to UI was reported by 50% more women with urgency or mixed UI symptoms than stress UI; in particular, among women with severe UI symptoms, “great” bother was reported by over twice as many women with mixed than stress UI, and higher incontinence impact scores were also reported.

Previous cross-sectional studies have reported differences in symptom severity, quality of life, and bother by UI subtype (4, 10, 12-14, 21). Consistent with our results, some studies found that mixed and urgency UI versus stress UI had a significantly higher effect on quality

of life (4, 11, 13, 14). Conversely, others reported that stress compared with urgency UI had a more profound effect on quality of life (10, 12). However, all previous studies had a significantly smaller number of patients and lower response rates. Moreover, some studies sampled women with UI from clinic patients that may not necessarily be representative of the general population with the full spectrum of UI. Additionally, since the majority of women with UI do not discuss their symptoms with their physicians, clinical patients represent only the tip of the iceberg, and the overwhelming majority of women with UI remain undetected in the community (22). Thus, overall, the existing literature can be difficult to interpret.

Our findings have some important implications, especially for future clinical research on UI. These data clearly suggest that women with symptoms of mixed UI (and to a somewhat lesser extent, urgency UI) may present particularly difficult symptoms for patients. This is especially important from a clinical perspective. Most women with UI do not seek care, and those who do have more severe and bothersome symptoms. Thus it is likely that physicians caring for women with UI are disproportionately seeing patients with mixed UI. Yet, contrary to stress or urgency UI, epidemiologic and clinical research on mixed UI has been fairly ignored. Indeed, most treatment or intervention studies on UI exclude women with mixed UI from their samples. Moreover, one recent clinical trial designed to compare an initial surgical compared with a medical approach in women with mixed UI proved highly challenging, including the difficulty in prescribing the appropriate treatment options and in finding patients willing to be randomly allocated to a medical versus surgical treatment (23). Thus, trial data for mixed UI treatment may not be forthcoming, and our findings may strongly motivate future research to better understand risk factors for mixed UI, and to develop prevention modalities directed to women with mixed UI.

Limitations of our study should be considered. One limitation is that our cohorts included only nurses and our population is largely Caucasian women. However, prevalence of UI symptoms and the distribution of its subtypes were highly similar to other large population-based studies (4-6), suggesting these results are generalizable to broader populations of Caucasian women. Nonetheless, it is well-established that UI prevalence, incidence, and subtypes are different in African American than in Caucasian women, thus our findings may not apply to non-white women. Another potential limitation is that UI type may be misclassified, especially since we depended on self-reports of UI type. However, although some have suggested that epidemiologic studies may over-estimate prevalence of mixed UI when compared to clinical studies (24), there is no clinical gold standard for diagnosing UI by subtype. Even urodynamics are not always reliable studies to distinguish the different UI subtypes (25). Nonetheless, it has been proposed that women with severe UI are more likely to report mixed symptoms possibly because they are unable to distinguish between stress and urgency UI symptoms given the frequency of their leakage (26). This could yield the false observation that mixed UI leads to worse severity when worse severity leads to increased reports of mixed UI. This is one possible explanation for our study findings. However, to help minimize such bias, we required women to clearly consider and distinguish between only three options of predominant symptoms of stress, urgency versus mixed UI, and we defined mixed UI as women who specifically reported that stress and urgency symptoms occurred equally. In addition, our method of identifying UI types is the most practical, and most commonly utilized method reported in the literature (13, 14, 17, 21, 27). In conclusion, women with mixed UI symptoms report more severe and more bothersome UI, with a higher effect on quality of life when compared with women with either pure stress or, to a lesser extent, pure urgency UI. These findings pose new questions worthy of future research, especially identification of risk factors associated with this more severe and bothersome condition so that women can be educated as to its prevention.

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Table 1
Baseline Characteristics For Nurses' Health Study (2004) and Nurses' Health Study II (2005) Participants*

Characteristic	Overall UI (n=102,418)	Stress UI (n=52,570)	Urgency UI (n=27,193)	Mixed UI (n=22,655)
Age, in years	60.1 (11.3)	57.2 (10.4)	64.1 (11.3)	61.9 (11.5)
Race				
White	97.2	97.4	96.8	97.2
Black	0.9	0.7	1.5	0.8
Asian	1.0	1.1	0.7	0.9
Other	0.9	0.8	1.0	1.1
BMI, in kg/m ²	27.5 (6.1)	27.3 (5.9)	27.2 (6.1)	28.3 (6.6)
Parity				
0	10.2	10.5	10.3	9.2
1-2	44.7	48.4	39.6	42.4
3 or more	45.1	41.1	50.1	48.4
Smoking				
Never	55.0	57.5	52.8	51.8
Past	38.0	35.2	40.7	41.3
Current	7.0	7.3	6.5	6.9
Physical activity, in MET-hours per week [†]	18.9 (17.7)	19.7 (18.3)	18.2 (16.9)	17.9 (16.9)
Hysterectomy	34.2	29.5	39.0	39.1
Postmenopausal hormone use				
Premenopausal	23.4	30.7	13.3	17.9
Never	21.0	20.1	22.7	21.0
Past	38.7	32.0	47.8	43.7
Current	16.9	17.2	16.2	17.4
History of vascular disease [‡]	5.1	3.8	6.1	6.8
Diabetes mellitus	8.6	6.6	10.5	11.1

UI, urinary incontinence; BMI, body mass index; MET, metabolic equivalent.

Data are mean (standard deviation) or percent unless otherwise specified.

* Sample sizes and percentages are of non-missing values.

[†] MET-hour is the amount of energy expended sitting quietly for one hour.

[‡] Defined as myocardial infarction or stroke.

Table 2

Urinary Incontinence Severity by Type and Age Category

Age	Severity Rating*	Overall UI	Stress UI	Urgency UI	Mixed UI	P [†] Urgency vs Stress Mixed vs Stress
Overall		(n=102,418)				
	Slight	51.0	61.1	45.5	34.1	reference
	Moderate	25.8	23.6	27.3	29.2	<0.001 <0.001
	Severe	23.2	15.3	27.2	36.7	<0.001 <0.001
41–50 years		(n=25,146)				
	Slight	55.0	60.2	51.3	38.6	reference
	Moderate	26.2	24.8	27.6	30.5	<0.001 <0.001
	Severe	18.8	15.0	21.1	30.9	<0.001 <0.001
51–60 years		(n=31,626)				
	Slight	52.4	61.2	46.5	34.8	reference
	Moderate	25.9	23.7	27.8	29.7	<0.001 <0.001
	Severe	21.7	15.1	25.7	35.5	<0.001 <0.001
61–69 years		(n=19,932)				
	Slight	51.9	63.1	46.8	35.4	reference
	Moderate	25.4	22.4	26.6	29.8	<0.001 <0.001
	Severe	22.7	14.5	26.6	34.8	<0.001 <0.001
70–83 years		(n=25,714)				
	Slight	44.5	60.2	41.9	29.9	reference
	Moderate	25.7	22.4	27.2	27.4	<0.001 <0.001
	Severe	29.8	17.4	30.9	42.7	<0.001 <0.001

UI, urinary incontinence.

Data are percent unless otherwise specified.

* Measured by the Sandvik index.

[†]Controlling for age, body mass index, and type 2 diabetes.

Table 3
Extent of Bother Due to Urinary Incontinence Among Participants With Weekly Frequent Urinary Incontinence

	Overall UI	Stress UI	Urgency UI	Mixed UI	<i>P</i> * Urgency vs Stress Mixed vs Stress
Extent of bother due to UI	(n=1,697)				
Not at all	9.4	10.7	7.1	8.8	reference
Slightly	52.6	56.6	49.3	48.5	0.1 0.6
Moderately	25.6	22.6	29.6	27.8	0.002 0.03
Greatly	12.4	10.1	14.0	14.9	0.004 0.01
Extent of bother among participants with "severe" Sandvik	(n=608)				
Not at all	5.6	6.7	4.7	4.9	reference
Slightly	48.7	56.3	45.0	41.5	0.6 0.9
Moderately	31.6	27.2	37.4	32.3	0.06 0.2
Greatly	14.1	9.8	12.9	21.3	0.1 0.02

UI, urinary incontinence.

Data are percent unless otherwise specified.

* Controlling for age, body mass index, and type 2 diabetes.

Table 4
Urinary Incontinence and Quality of Life Among Participants With Weekly Frequent Urinary Incontinence

	Overall UI	Stress UI	Urgency UI	Mixed UI	P-trend* Urgency vs Stress Mixed vs Stress
IIQ Score [†]	(n=1,748)				
Mean (SD)	10.9 (12.4)	8.6 (9.0)	11.6 (11.7)	14.2 (16.6)	<0.001 <0.001
IIQ Score [†] among participants with "severe" Sandvik	(n=620)				
Mean (SD)	13.2 (14.2)	9.8 (10.2)	13.4 (12.2)	18.0 (18.8)	0.004 <0.001

UI, urinary incontinence; IIQ, Incontinence Impact Questionnaire; SD, standard deviation.

* P-trend using Incontinence Impact score as a continuous variable and controlling for age, body mass index, and type 2 diabetes.

[†] Based on 5 out of 7 questions (items regarding household chores and social activities were not included).