Published in final edited form as:
Obstet Gynecol. 2013 September ; 122(3): 539–545. doi:10.1097/AOG.0b013e31829efbff.

Risk Factors for Urinary, Fecal or Dual Incontinence in the Nurses' Health Study

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Abstract

Objective—To estimate the prevalence of urinary incontinence, fecal incontinence, and dual incontinence in a large cohort of older women and compare risk factors across the three conditions.

Methods—These cross-sectional analyses utilized data from the Nurses' Health Study. The 2008 questionnaire, mailed to 96,480 surviving participants aged 62–87 years, included two separate items on prevalence of urinary and fecal incontinence. A response of leakage at least once per month defined incontinence for both urine and stool. Dual incontinence was defined by responses at this frequency for both conditions. Using a polytomous logistic regression model we assessed each risk factor for prevalence of urinary, fecal, and dual incontinence, respectively.

Results—The survey was completed by 64,396 women. Thirty-eight percent had urinary incontinence alone, 4% had fecal incontinence alone, and 7% had dual incontinence. Age older than 80 years compared with age younger than 70 years was associated most strongly with dual incontinence (odds ratio [OR] 2.49, 95% confidence interval [CI] 2.28–2.73), followed by depression (OR 2.28, 95% CI 2.13–2.43), neurologic disease (OR 1.84, 95% CI 1.65–2.07), functional limitations (OR 1.86, 95% CI 1.71–2.02), multiparity (OR 1.66, 95% CI 1.41–1.94), and heavier fetal birth weight (OR 1.24, 95% CI 1.10–1.41). Obesity was associated only with urinary incontinence (OR 1.99, 95% CI 1.90–2.08) and type 2 diabetes was a stronger risk factor for fecal than urinary incontinence (OR 1.43, 95% CI 1.28–1.59). Black race was associated with a reduced risk of all types of incontinence, especially dual incontinence (OR 0.30, 95% CI 0.21–0.44).

Conclusion—In this large cohort, dual incontinence was primarily associated with advanced age, decompensating medical conditions, depression, and multiparity.

Introduction

Dual incontinence of urine and stool is the most extreme manifestation of pelvic floor dysfunction and is associated with a greater negative effect on quality of life than either

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Presented in part at the 38th Annual Meeting of the International Urogynecologic Association, Dublin, Ireland, May 28–June 1, 2013.

Financial Disclosure: The authors did not report any potential conflicts of interest.

condition in isolation (1,2). It is believed to be a frequent cause of referral to a nursing home (3). Estimates of the prevalence of dual incontinence in community-dwelling adults range from 2.5% to 14.5% (4–11). This variance is largely attributable to different mean ages of the populations studied, with a consistent linear association between advancing age and disease prevalence, and significant differences in disease state definitions (12,13).

Despite the wide difference in published prevalence rates, fairly consistent risk factors for dual incontinence have been identified and include advanced age, depression, medical comorbidities, frailty, and limited mobility (2,4,7,9,14). Conflicting data exist regarding an association between dual incontinence and race (10,13,15,16), parity (13,17,18), and body mass index (BMI) (2,19). A significant limitation of all of the published population-based studies on dual incontinence to date, however, is the modest sample size, with no study including more than 3,500 women (6,13,14). This limits the statistical ability to investigate any risk factors that are uniquely associated with dual incontinence compared with fecal and urinary incontinence alone.

Therefore, the aim of this study was to estimate the prevalence of dual incontinence among over 64,000 community-dwelling older women enrolled in the Nurses' Health Study (20). We wished to determine whether there are different risk factors for fecal compared with urinary incontinence, and whether dual incontinence represents an accumulation of risk factors that are significant for both urinary and fecal incontinence or whether there are unique associations for dual incontinence. The results of this study may help identify modifiable risk factors that can aid in disease prevention.

Materials and Methods

This cross-sectional analysis was performed using data collected from the Nurses' Health Study, a longitudinal closed cohort study that was initiated in 1976 when 121,700 female nurses, aged 30–55 years, responded to a mailed questionnaire about their overall health and lifestyle. Every 2 years, new surveys are sent to the cohort where participants are identified by a unique code, which both conceals participants' identities from researchers and allows linkage of participant data across biennial questionnaires. To help maintain participation rates, abbreviated questionnaires are mailed to initial nonresponders. Items on urinary and fecal incontinence were only included on the full-length 2008 survey. Implied consent was provided when the participants returned the questionnaire. The Institutional Review Board of Brigham and Women's Hospital approved this study.

Of the 96,480 surviving cohort members who were mailed a 2008 survey, 5,618 women returned the abbreviated version of the survey, which did not include the urinary and fecal incontinence items. Of the 90,862 remaining women, we excluded from these analyses 17,127 women who did not return any survey and women who returned the 2008 survey, but did not respond to the specific items on urinary or fecal incontinence (n=9,339). Thus, 64,396 women completed the full-length 2008 survey. Responders were less likely than nonresponders to be black (1.4% compared with 3.5%), but were highly similar in other key demographic and health factors, including age, parity, smoking, and type 2 diabetes, thus there is not likely to be any meaningful bias due to response in most analyses.

The 2008 survey included two separate questions regarding urinary and fecal incontinence: "During the last 12 months, how often have you leaked or lost control of your urine?" and "On average, how often in the past year have you experienced any amount of accidental bowel leakage that was liquid or solid stool?" Response options for each were: never, less than once per month, one to three times per month, approximately once per week, several times per week, and nearly daily. A response of at least once per month defined both urinary and fecal incontinence, and dual incontinence was defined by responses at this frequency for both urinary and fecal incontinence

Data on potential risk factors for urinary, fecal, and dual incontinence, including demographic variables (age, race), self-reported medical and obstetric history (type 2 diabetes, high blood pressure, neurologic disease, depression, parity, birth weight of the participant's heaviest child), functional limitations, and lifestyle factors (body mass index [BMI, in kg/m^2], cigarette smoking), were obtained from participants' reports from all biennial questionnaires including the 2008 version. For variables included on multiple questionnaires, we used the participant's status as of 2008 (eg, history of type 2 diabetes considered reports from all questionnaires through 2008). A description of when specific variables were collected has been previously published (21). Neurologic disease was defined as a history of stroke, multiple sclerosis, amyotrophic lateral sclerosis, Parkinson disease, or Alzheimer disease. Depression was defined as history of depression diagnosis or antidepressant medication use, or a score greater than 5 on the 15-item Geriatric Depression Scale (22). Responses on the Medical Outcomes Short Form-36 physical functioning subscale (23) were used to identify women with functional limitations; these were defined as being limited "a lot" because of health reasons in walking one block, climbing one flight of stairs, bathing, or dressing.

Statistical analyses were performed using SAS 9.2 (SAS Institute, Cary, NC). For each case definition, the overall prevalence was determined by dividing the number of women who met the case definition (eg, for dual incontinence, leaking stool and urine at least monthly) by the total number of women in the study population. Age-specific and race-specific prevalence of each incontinence type was calculated by dividing the number of women in a particular age or race stratum with monthly leakage of only urine, stool, or both by the total number of women in that stratum. We used chi-square tests to assess the statistical significance of differences in prevalence across age and race strata. Using a polytomous logistic regression model, we calculated multivariable-adjusted odds ratios (OR) and 95% confidence intervals (CI) for each type of incontinence according to each risk factor, and simultaneously compared risk factor associations across the three different types of incontinence to identify any unique associations. Odds ratios for each risk factor (except BMI) were adjusted for all other risk factors; odds ratios for BMI were not adjusted for potential mediating variables (type 2 diabetes and high blood pressure). For these analyses, the comparison group of "noncases" was women who reported leaking urine or stool less than once per month or never. Analyses of birth weight were restricted to parous women. Two-tailed $P< 0.05$ was considered statistically significant.

In secondary analyses, we repeated the polytomous logistic regression analysis using alternate definitions for urinary incontinence, fecal incontinence, and dual incontinence. Specifically, we required a response of at least weekly incontinence, rather than at least monthly, for each type of incontinence. The comparison group of "noncases" remained women reporting leaking urine or stool less than once per month or never.

Results

In 2008, participants were aged 62–87 years, with a mean age of 72.7 years. The prevalence of fecal incontinence was two times higher in women with urinary incontinence (n=4,660/29,001; 16%) compared with those without urinary incontinence (n=2,786/35,395; 8%). Urinary incontinence was 1.5 times more common in women with fecal incontinence (n=4,660/7,446; 63%) than without (n=24,341/56,950; 43%). Overall, 4660 (7%) had dual incontinence, 2786 (4%) had fecal incontinence alone, and 24,341 (38%) had urinary incontinence alone. The prevalence of each condition, stratified by race and age, is presented in Table 1. Prevalence of dual incontinence was lowest in black women (n=29/929; 3%) and highest in women over 80 years of age (n=1,345/12,705; 11%).

The age-standardized characteristics of women by continence status are presented in Table 2. Comorbid medical conditions were more common in women with dual incontinence than either urinary or fecal incontinence alone including history of hypertension, type 2 diabetes, neurologic disease (ie, stroke, Parkinson Disease, multiple sclerosis, amyotrophic lateral sclerosis, Alzheimer Disease), and functional limitations. History of depression was twice as common in women with dual incontinence (n=1,916/4,660; age-standardized prevalence=42.2%) than no incontinence (n=6,987/32,609; age-standardized prevalence=21.1%).

The results of the polytomous logistic regression model are presented in Table 2. We found several variables that were more strongly associated with dual incontinence than either fecal or urinary incontinence alone. Specifically, black compared with white race was associated with reduced odds of dual incontinence (OR 0.30, 95% CI 0.21–0.44) compared with fecal incontinence alone (OR 0.51, 95% CI 0.34–0.75) or urinary incontinence alone (OR 0.50, 95% CI 0.43–0.58). In addition, age older than 80 years compared with age younger than 70 years (OR 2.49, 95% CI 2.28–2.73), depression (OR 2.28, 95% CI 2.13–2.43), neurologic disease (OR 1.84, 95% CI 1.65–2.07), functional limitations (OR 1.86, 95% CI 1.71–2.02), and multiparity (OR 1.66, 95% CI 1.41–1.94) were stronger risk factors for dual than for fecal or urinary incontinence alone. Heavier fetal birth weight also appeared more strongly related to dual incontinence (OR 1.24, 95% CI 1.10–1.41) than urinary incontinence alone (OR 1.10, 95% CI 1.02–1.18) or fecal incontinence alone (OR 1.08, 95% CI 0.91–1.28), although the difference between the dual incontinence and fecal incontinence odds ratio was not significant (p=0.2). While a significant association between BMI and dual incontinence was observed (OR 1.95, 95% CI 1.80–2.12 comparing BMI 30 or higher versus less than 25), this was principally derived from the strong association between BMI and urinary incontinence (OR 1.99, 95% CI 1.90–2.08 comparing BMI 30 or higher versus less than 25). Similarly, type 2 diabetes was a significant risk factor for dual incontinence (OR 1.42, 95% CI 1.30–1.54), but the magnitude of the association was similar to that between type 2 diabetes and fecal incontinence alone (OR 1.43, 95% CI 1.28–1.59).

Table 2 also provides an opportunity to identify risk factors which may be uniquely associated with fecal compared with urinary incontinence. Advancing age and BMI were more strongly associated with urinary than fecal incontinence, while current smoking, type 2 diabetes, and depression were more strongly associated with fecal than urinary incontinence (p-value < 0.001 comparing urinary and fecal incontinence odds ratios for each risk factor).

In secondary analyses, we examined associations between risk factors and at least weekly urinary incontinence, fecal incontinence, or dual incontinence (data not shown in tables). In general, associations were similar to those in Table 2, but tended to be of slightly greater magnitude. For example, ORs for dual incontinence were 0.22 (95% CI 0.11–0.43) in black compared with white women and 3.05 (95% CI 2.67–3.49) in women aged 80–87 years compared with 62–69 years. In addition, differences between ORs across outcomes largely mirrored those in the primary analyses, although, unlike in the primary analyses, differences between urinary incontinence and dual incontinence ORs for parity of two or more, offspring birth weight greater than 9.5 pounds, and high blood pressure were not statistically significant, possibly due to the smaller number of cases with these stricter definitions.

Discussion

In this cohort of over 64,000 community-dwelling older women, dual incontinence of urine and stool was reported by 7% overall. These prevalence data are similar to those reported in a number of smaller studies from Japan (4), Sweden (14), the United States (16) and the United Kingdom (7). We confirmed from our much larger population of women that dual incontinence is associated with age older than 80 years, multiparity, and the medical comorbidities of depression, functional limitations, neurologic disease, and hypertension. Given the aging population in the United States (24), dual incontinence will represent a growing health care burden and these data should assist with planning for the treatments and services that are required.

The successful control of urine and stool relies on a complex set of neurophysiologic pathways, normal connective tissue and neuromuscular function, in addition to adequate cognition and mobility. With aging, deterioration in any of these systems can occur which likely explains why dual incontinence was most commonly observed in women over 80 years of age. The medical comorbidities of neurologic disease and limited mobility may have contributed to the progression from isolated to dual incontinence.

The most significant potentially modifiable risk factor that we identified for dual incontinence was depression (2.28 times higher for dual incontinence compared with 1.39 higher for urinary incontinence alone and 1.66 times higher for fecal incontinence alone), a risk factor previously associated with urinary (25) and fecal incontinence (2,26). A bidirectional pathophysiologic mechanism likely exists for the significantly stronger association that we observed in those with dual incontinence. While these women suffer from a greater negative effect on quality of life and therefore could be more likely to develop depression as a consequence of their disease, a dysfunction in neurotransmitters has been implicated in both urinary and fecal incontinence. Furthermore, treatment with potent serotonin and norepinephrine reuptake inhibitors has been successfully used in the treatment of both depression and urinary incontinence (27). It is possible that dual incontinence results in women with more advanced neurotransmitter or neurologic dysfunction. In this cross-sectional study, we were not able to elucidate cause and effect but further research is clearly needed in this area.

Increased parity has been significantly associated with pelvic floor disorders in other studies (11,13,26) and we identified a stronger association between multiparity and dual incontinence. It is possible that cumulative anatomic and neuropathic injury is more likely to result in “global” pelvic floor dysfunction. Additional investigation into obstetric risk factors is planned for future surveys.

The only factor that was associated with reduced odds of dual incontinence was black race. The association of racial/ethnic group with incontinence has been confirmed in some (10, 16, 28) but not other (9,13) studies. While black race was associated with lower odds for all types of incontinence, it was particularly true for dual incontinence (OR 0.30 comparing black with white women). A similar finding was previously reported in a cross-sectional study of 1,000 Medicare beneficiaries in Alabama where the prevalence of dual incontinence in blacks was 8% compared with 18.5% in whites (10). While lower response rates for black women could have contributed to this finding, it is unlikely to explain the 70% lower odds of dual incontinence we observed. Other potential explanations could include racial differences in dietary factors, differences in bowel motility, and differential rates of occurrence or recovery from obstetric pelvic floor injury (29).

A significant strength of our study is the large sample size that allowed precise estimation of the associations between a variety of potential risk factors and isolated as well as dual incontinence. Our response rate of more than 70% is better than other population-based studies on incontinence (14,18,26) and similarities in responders and nonresponders suggests that bias is an unlikely explanation for our results. The significant limitations that exist are the absence of data regarding symptom bother that may more appropriately define women with prevalent "clinically significant" incontinence. In addition, we collected no information regarding diarrhea or rectal urgency, known independent risk factors for fecal incontinence in other studies (17,30), or delivery data beyond parity and largest fetal weight, which precludes more detailed information on how reproductive factors may affect continence. Another limitation is that the Nurses' Health Study cohort enrolled only women and reflects the racial distribution of U.S. nurses in the late 1970s; therefore evaluation of associations between a wider range of racial or ethnic groups and dual incontinence was not possible. Finally, it is unclear how an exclusive population of health care professionals might bias self-reporting of health conditions.

In conclusion, from this large cohort, we found a significant and independent association between dual incontinence and age older than 80 years and the medical comorbidities of depression, functional limitations, neurologic disease, and hypertension.

Acknowledgments

Supported by grants P01 CA87969, R01 DK62438 and R01 HS018695 from the National Institutes of Health.

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Table 1

Prevalence of Urinary Incontinence Alone, Fecal Incontinence Alone, and Dual Incontinence, Overall and Stratified by Race and Age

		Urinary Incontinence Alone		Fecal Incontinence Alone		Dual Incontinence	
Stratification variable	**n**	**Cases**	**% (95% CI)**	**Cases**	**% (95% CI)**	**Cases**	**% (95% CI)**
All women	64,396	24,341	37.8 (37.4–38.2)	2,786	4.3 (4.2–4.5)	4,660	7.2 (7.0–7.4)
Race							
White	62,777	23,855	38.0 (37.6–38.4)	2,721	4.3 (4.2–4.5)	4,584	7.3 (7.1–7.5)
Black	929	257	27.7 (24.8–30.7)*	27	2.9 (1.9–4.2)*	29	3.1 (2.1–4.5)*
Asian	494	142	28.7 (24.8–33.0)*	34	6.9 (4.8–9.5)*	31	6.3 (4.3–8.8)
Age, years							
62–69	24,077	7,897	32.8 (32.2–33.4)	1,077	4.5 (4.2–4.7)	1,303	5.4 (5.1–5.7)
70–79	27,614	11,038	40.0 (39.4–40.6)†	1,123	4.1 (3.8–4.3)†	2,012	7.3 (7.0–7.6)†
80–87	12,705	5,406	42.6 (41.7–43.4)†	586	4.6 (4.3–5.0)	1,345	10.6 (10.1–11.1)†

CI, confidence interval.

* Statistically significant difference in prevalence compared with white women (*P*<0.05).

† Statistically significant difference in prevalence compared with women aged 62–69 years (*P*<0.05).

Table 2

Associations of Variables With Urinary Incontinence Alone, Fecal Incontinence Alone, and Dual Incontinence

	No Urinary Incontinence or Fecal Incontinence		Urinary Incontinence Alone			Fecal Incontinence Alone			Dual Incontinence		
Variable	**n**	**%***	**n**	**%***	**OR (95% CI)† vs No UI or FI**	**n**	**%***	**OR (95% CI)† vs No UI or FI**	**n**	**%***	**OR (95% CI)† vs No UI or FI**
Race											
White	31,617	96.9	23,855	98.0	1.00	2,721	97.7	1.00	4,584	98.3	1.00
Black	616	1.9	257	1.0	0.50 (0.43, 0.58)	27	1.0	0.51 (0.34, 0.75)	29	0.7	0.30 (0.21, 0.44)‡,§
Asian	287	0.9	142	0.6	0.74 (0.61, 0.91)	34	1.2	1.45 (1.01, 2.08)‖	31	0.7	0.88 (0.60, 1.29)§
Age, years											
62–69	13,800	42.3	7,897	32.4	1.00	1,077	38.7	1.00	1,303	27.9	1.00
70–79	13,441	41.2	11,038	45.4	1.49 (1.43, 1.55)	1,123	40.3	1.04 (0.95, 1.14)‖	2,012	43.2	1.59 (1.47, 1.71)§
80–87	5,368	16.5	5,406	22.2	1.86 (1.77, 1.96)	586	21.0	1.28 (1.14, 1.43)‖	1,345	28.9	2.49 (2.28, 2.73)‡,§
Body mass index, kg/m^2											
Less than 25	15,653	49.5	9,299	37.9	1.00	1,301	47.6	1.00	1,808	36.7	1.00
25–29	10,680	32.9	8,144	33.9	1.33 (1.28, 1.38)	899	33.1	1.03 (0.94, 1.12)‖	1,512	33.1	1.29 (1.20, 1.39)§
30 or higher	5,855	17.6	6,588	28.2	1.99 (1.90, 2.08)	523	19.3	1.06 (0.95, 1.18)‖	1,266	30.2	1.95 (1.80, 2.12)§
Parity											
0	1,945	6.1	1,218	5.1	1.00	129	4.6	1.00	181	3.7	1.00
1	2,442	7.6	1,564	6.6	1.05 (0.95, 1.15)	176	6.4	1.10 (0.87, 1.39)	267	5.8	1.23 (1.01, 1.50)
2 or more	27,735	86.3	21,206	88.3	1.22 (1.13, 1.32)	2,430	89.0	1.35 (1.12, 1.62)	4,144	90.5	1.66 (1.41, 1.94)‡,§
Birth weight of heaviest child greater than 9.5 lbs¶	1,682	7.2	1,564	8.5	1.10 (1.02, 1.18)	163	8.0	1.08 (0.91, 1.28)	354	9.9	1.24 (1.10, 1.41)‡
Cigarette smoking											
Never	14,904	45.9	10,915	44.8	1.00	1,205	43.1	1.00	2,072	44.2	1.00
Past	15,664	48.2	12,195	50.1	1.03 (0.99, 1.06)	1,383	49.9	1.06 (0.98, 1.15)	2,358	50.7	1.02 (0.95, 1.08)
Current	1,991	5.9	1,191	5.0	0.88 (0.82, 0.95)	194	7.0	1.17 (0.99, 1.38)‖	221	5.1	0.85 (0.73, 0.98)§
Type 2 diabetes	3,751	11.7	3,671	15.0	1.07 (1.02, 1.13)	474	17.1	1.43 (1.28, 1.59)‖	957	20.6	1.42 (1.30, 1.54)‡
High blood pressure	20,306	63.3	16,758	68.1	1.06 (1.02, 1.10)	1,895	68.1	1.15 (1.05, 1.25)	3,445	72.3	1.20 (1.12, 1.29)‡

Variable	No Urinary Incontinence or Fecal Incontinence		Urinary Incontinence Alone			Fecal Incontinence Alone			Dual Incontinence		
	n	%*	n	%*	OR (95% CI)† vs No UI or FI	n	%*	OR (95% CI)† vs No UI or FI	n	%*	OR (95% CI)† vs No UI or FI
Neurologic disease#	1,312	4.2	1,424	5.6	1.21 (1.12, 1.31)	181	6.4	1.32 (1.12, 1.55)	496	9.3	1.84 (1.65, 2.07)‡,§
Functional limitations	2,868	9.4	3,792	14.9	1.43 (1.35, 1.51)	408	14.5	1.42 (1.26, 1.60)	1,085	20.5	1.86 (1.71, 2.02)‡,§
Depression	6,987	21.1	6,959	28.9	1.39 (1.33, 1.44)	904	32.5	1.66 (1.53, 1.81)||	1,916	42.2	2.28 (2.13, 2.43)‡,§

OR, odds ratio; CI, confidence interval; UI, urinary incontinence; FI, fecal incontinence.

*Percentages are calculated among nonmissing values and standardized to the age distribution of the population. Percentages for age group are not age adjusted.

†Odds ratios for each variable, except body mass index, and each type of incontinence are adjusted for all other variables in the table. Odds ratios for body mass index and each type of incontinence are adjusted for all other variables in the table except potential mediating factors, type 2 diabetes and high blood pressure.

‡Difference between odds ratios for dual incontinence and urinary incontinence alone is statistically significant (*P*=.046 for birth weight of heaviest child more than 9.5 lbs; *P*≤.01 for all other indicated variables); *P* values generated from polytomous logistic regression model.

§Difference between odds ratios for dual incontinence and fecal incontinence alone is borderline statistically significant (*P*=.06 for black race; *P*=.09 for parity of two or more) or statistically significant (*P*=.048 for Asian; *P*<.01 for all other indicated variables); *P* values generated from polytomous logistic regression model.

||Difference between odds ratios for urinary incontinence alone and fecal incontinence alone is statistically significant (*P*<.01 for all indicated variables); *P* values generated from polytomous logistic regression model.

¶Estimates calculated only among parous women.

#Neurologic disease defined as history of stroke, multiple sclerosis, amyotrophic lateral sclerosis, Parkinson disease, or Alzheimer disease.