ORIGINAL CONTRIBUTION

Prevalence Correlates and Impact of Fecal Incontinence Among Older Women

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BACKGROUND: Fecal incontinence is a common problem that has been associated with anatomic, physiological, and medical conditions. There are very few data on the factors associated with fecal incontinence in elderly women.

OBJECTIVES: We aimed to determine the factors associated with fecal incontinence via a population-based survey in a large cohort of elderly Australian women.

DESIGN AND SETTING: Data from a large longitudinal population-based study of elderly Australian women aged 82 to 87 years were analyzed.

PATIENTS: Participants were 5560 women (aged 82–87 years) who participated in the Australian Longitudinal Study on Women's Health; 4815 women responded to questions relating to fecal incontinence.

MAIN OUTCOME MEASURES: Fecal incontinence was defined as leakage of liquid and/or solid stool at least once per month over the past 12 months. Self-reported medical conditions and lifestyle factors as well as demographic factors were recorded.

RESULTS: The prevalence of fecal incontinence was 10.4% (95% CI, 9.6–11.3) (n = 510). The prevalence was significantly higher among institutional- versus community-dwelling women (14.1% vs 9.7%; $p = 0.0002$). Univariately, lifestyle factors including fruit intake and fluid intake, along with a range of comorbidities, were associated. However, independent factors for fecal incontinence among community-dwelling women included diabetes mellitus (OR, 1.51; 95% CI, 1.14–2.01; $p = 0.004$), depression (OR, 1.84; 95% CI, 1.30–2.62; $p = 0.001$), urinary incontinence (OR, 2.29; 95% CI, 1.83–2.86; $p < 0.0001$), and osteoarthritis (OR, 0.73; 95% CI, 0.57–0.94; $p = 0.013$). Among institutional-dwelling women, however, we found urinary incontinence (OR, 4.43; 95% CI, 2.83–6.93; $p < 0.0001$) and poorer general health (OR, 0.98; 95% CI, 0.97–0.99; $p = 0.003$) to be independently associated.

LIMITATIONS: This is a cross-sectional study, which prevents making conclusions about the cause and effect of observed correlations.

CONCLUSIONS: The independent factors associated with fecal incontinence in this population do not appear readily modifiable, and many previously identified risk factors may not be important in the elderly women with fecal incontinence.

KEY WORDS: Fecal incontinence; Risk factors; Cohort study; Epidemiology; Elderly women.

Fecal incontinence (FI) can be a devastating condition with wide-reaching personal and social consequences for those affected.[1–5] Several studies have demonstrated that FI can lead to social isolation, depression, work absenteeism, as well as nursing home placement depending on its severity.[1–4] A consensus definition of FI does not exist, but many studies have defined FI as accidental leakage of liquid or solid stool for at least 1 month.[2–4] The reported prevalence of FI in population-based studies varies greatly depending on the population studied and the definition of FI used.[2–9] The prevalence increases with age and for those people who are living in institutional care, the prevalence is particularly high.[10] For example, a previous study from the United States found that the prevalence was 47% in institutional-dwelling women.[11] Few studies have evaluated

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the prevalence and risk factors for FI in women aged over 80 years. A study performed by Goode et al[12] included 1000 community-dwelling adults in Alabama, of whom 12% had FI, but only 61 participants were aged 85 or above. Varma et al[4] found a 25% prevalence of FI among 2106 community-dwelling women aged over 40, but only 159 of these women were aged 70 or above. Because there are few data on the prevalence of FI in community-dwelling women aged over 80 years, the risk factors in this age group are not well understood.

There are several recognized risk factors for FI, including advancing age, pelvic floor dysfunction, diarrhea, chronic obstructive airways disease, and prolapse.[2,4,6,13–15] Joh et al[16] evaluated 981 elderly Koreans and found that urinary incontinence and irritable bowel syndrome were important correlates in this population.

Understanding the factors associated with FI in older women is important, because this may guide treatment and improve symptoms. Identifying those factors in community-dwelling women may subsequently impact the requirement for nursing home placement and quality of life. We aimed to determine the prevalence, correlates, and impact of FI during the past year in a large cohort of elderly Australian women living in the community and in institutional care, with a particular focus on identifying factors associated with FI that can be modified.

METHODS

Participants

Participants were women aged 82 to 87 who had responded to the fifth survey of the Australian Longitudinal Study on Women's Health (ALSWH) (Fig. 1). As part of this study, 12,432 older women were originally surveyed in 1996. By the time of the fifth survey in 2008, 28.4% of the women had died and 26.9% had withdrawn, were too frail to participate in the study, or were otherwise lost to follow-up. Of the remaining 7003 eligible women, 5560 (79.4%) completed the fifth survey; 4815 women provided complete responses to the questions pertaining to FI and residential status. Of these, 4020 (82.2%) women were community dwelling and 795 (16.3%) were living in institutional care. Detailed descriptions of the ALSWH study have been published elsewhere[17] and are also available from www.alswh.org.au. Informed consent was obtained from all participants at each survey.

Measures

Fecal Incontinence

Participants were asked how often they experienced accidental leakage of solid and/or liquid stool. Response options were listed as "Never," "Less than once per month," "Once per month, less than once per week," "Once or more per week, less than once a day," or "Once or more per day."

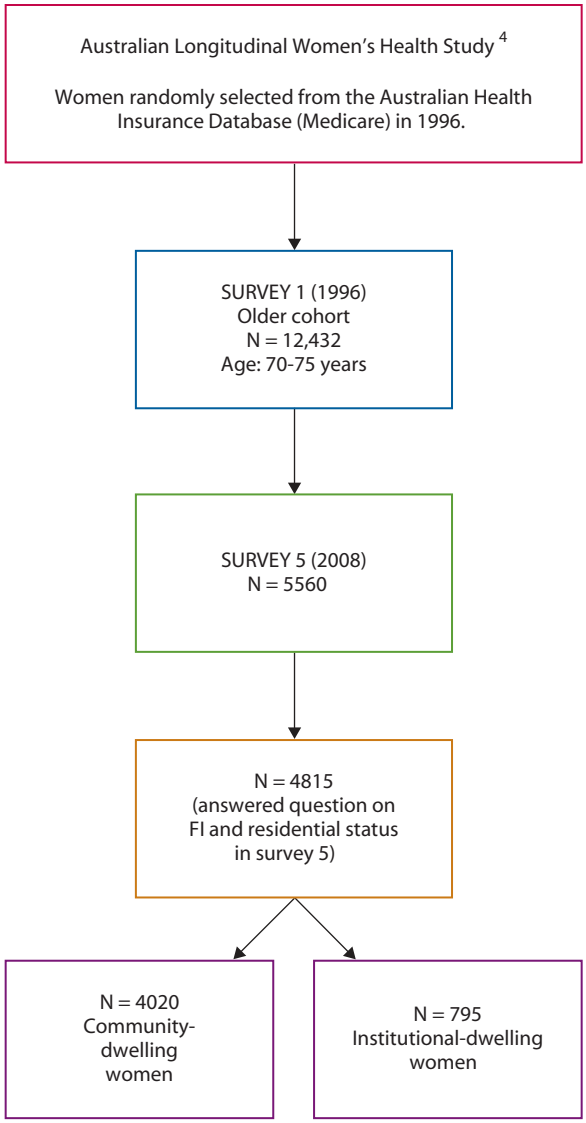

FIGURE 1. Sampling framework for the study. FI = fecal incontinence.

From this, FI in this report was defined as any leakage of liquid and/or solid stool occurring at least once per month.

Lifestyle Variables

Lifestyle factors included smoking status (never, current, past). Alcohol intake was defined by using the National Health and Medical Research Council guidelines (nil, low, and high).[18] Other lifestyle factors including BMI (abnormal vs normal) and number of live births were obtained from the baseline survey in 1996. Information on vegetable and fruit intake was taken from a question asking, "How many serves of vegetables do you usually eat each day?" (1 serve = half a cup of cooked vegetables or 1 cup of salad vegetables) and "How many serves of fruit do you usually eat each day?" (1 serve = 1 medium piece or 2 small pieces or 1 cup of diced fruit). Response items were grouped according to none or 1 or 2 to 3 or 4 serves

per day versus 5 or more serves per day. Nonalcoholic fluid intake was assessed by the question, "How many glasses/cups of nonalcoholic drinks do you usually have each day?" Response items were grouped according to 0 to 2 or 3 to 5 glasses per day versus 6 to 8 or 9 or more glasses per day.

Physical Comorbidities

Self-reported symptoms of urinary incontinence, breathing difficulties, indigestion, and constipation over the past 12 months were measured with the 4 possible responses collapsed as "Never" and "Rarely" versus "More than sometimes" and "Often." A previous history in the past 3 years of vaginal, bladder, and/or bowel prolapse repair and hysterectomy were also recorded with a yes or no response. The occurrence of other medical conditions was assessed by yes/no responses to the question, "In the last three years have you been diagnosed/treated for any of the following conditions?" These conditions included hypertension, osteoarthritis, osteoporosis, Parkinson disease, heart disease, diabetes mellitus, asthma, emphysema/bronchitis, stroke, cancer, and dementia/Alzheimer disease. We also measured the number of chronic illnesses a person reported from the list above.

Psychological Variables

We assessed the presence of anxiety and depression by a self-report answer to the question, "In the last three years have you been diagnosed or treated for anxiety/nervous disorders or depression?"[19] Life-event stress was assessed by the proportion of major events experienced in the past 3 years. These events were based on the Norbeck Modification of Life Event Questionnaires for Use with Female Respondents.[20]

Demographic Factors

These included nationality and marital status. Level of education was grouped into less than a high school education (did not complete school certificate) versus high school and above. Socioeconomic status was also assessed with the use of the Socio-Economic Indexes for Areas index for socioeconomic disadvantage by using population census data.[21]

Quality of Life

The Medical Outcomes Study Short Form 36 (SF-36) was used to measure 8 domains of quality of life including physical functioning, role physical, bodily pain, general health, vitality, social functioning, role emotional, and mental health.[22]

Statistical Analysis

Univariate analyses have been conducted primarily as a descriptive reporting of which items differentiate older women with FI from those without. Odds ratios reported in Table 1 are scaled to correspond to a 10-point change in an SF-36 score. Multivariate analyses have been undertaken to determine which items are statistically significant discriminators of FI from non-FI based on unconditional logistic regression, after adjustment for other factors in the model. In the multivariate analyses, modeling commenced with all potentially predictive variables included, and then proceeded via a backward elimination procedure. Backward elimination was selected to determine which potentially predictive variables have statistically independent effects on the odds of FI, because it best captures the full covariance structure among the predictors in this nonorthogonal design. This is important in determining whether a potential discriminator provides discrimination of FI from non-FI over and above all other potential discriminators. Because of a complex pattern of missing values, the final reduced model was refitted by using multiple imputation, which avoids the known bias in single-imputation schemes.[23] Multiple imputation was also applied to the univariate models described earlier but was never found to substantively alter the estimated effect size or statistical significance; hence, these results are not presented here.

Both univariate and multivariate analyses have been undertaken separately among community-dwelling women and those in some form of assisted living or institutional care. Variables that provided statistically independent discrimination of FI from non-FI individuals were identified based on the whole sample (excluding those whose residential status was unknown). The resulting model was then fitted to both the community-dwelling and residential subgroups to determine whether or not it applied equally well to both.

RESULTS

Prevalence of FI

Of the total cohort of 4815, 111 women (2.3%) experienced solid stool leakage only, 207 (4.2%) indicated liquid stool leakage only, whereas a further 192 women (3.9%) experienced both solid and liquid stool leakage, providing a prevalence estimate for FI of 10.4% (95% CI, 9.6–11.3) (510 women). The prevalence of FI among the community-dwelling women was 9.7% versus 14.1% among the women dwelling in institutions, a difference that was significant ($p = 0.0002$).

Correlates of FI

Sociodemographic Characteristics

There were no significant differences between those with FI versus those who did not report FI with respect to marital status or nationality (Table 1). Socioeconomic status was also similar between women reporting FI versus those who did not among community-dwelling women

TABLE 1. Quality of life (using SF-36 subscales) in older women with presence or absence of fecal incontinence, by dwelling status

	Community dwelling (n = 4020)					*Institutional care (n = 795)*				
SF-36 subscale	*FI Mean (SD)*	*No FI Mean (SD)*	*OR*	*(95% CI)*	*p*	*FI Mean (SD)*	*No FI Mean (SD)*	*OR*	*(95% CI)*	*p*
Bodily pain	60.7 (26.8)	51.6 (26.2)	0.99	(0.98–0.99)	<0.0001	58.0 (27.2)	50.1 (25.2)	0.99	(0.98–1.00)	0.0045
General health	63.6 (20.4)	53.4 (21.4)	0.98	(0.97–0.98)	<0.0001	61.2 (20.3)	50.4 (22.7)	0.98	(0.97–0.99)	<0.0001
Mental health	79.8 (15.8)	73.1 (18.2)	0.98	(0.97– 0.98)	<0.0001	78.4 (16.7)	66.3 (23.4)	0.97	(0.96–0.98)	<0.0001
Physical functioning	51.3 (27.6)	40.8 (26.6)	0.99	(0.98–0.99)	<0.0001	44.3 (28.1)	33.1 (27.6)	0.99	(0.98–0.99)	0.0002
Role emotional	72.4 (38.3)	60.2 (41.8)	0.99	(0.99–1.00)	<0.0001	73.1 (37.5)	47.9 (43.8)	0.99	(0.98–0.99)	<0.0001
Role physical	41.2 (40.7)	28.4 (36.0)	0.99	(0.99–0.99)	<0.0001	38.7 (40.7)	23.6 (36.0)	0.99	(0.98–1.00)	0.0004
Vitality	55.3 (20.3)	45.6 (20.9)	0.98	(0.97–0.98)	<0.0001	51.4 (21.0)	40.8 (21.4)	0.98	(0.97–0.99)	<0.0001
Social functioning	77.0 (26.8)	64.8 (29.3)	0.99	(0.98–0.99)	<0.0001	71.4 (30.1)	57.5 (32.9)	0.99	(0.98–0.99)	<0.0001

SF-36 = Medical Outcomes Study Short Form 36; FI = fecal incontinence.

(M = 993.7, SD = 89.9 vs M = 984.3, SD = 115.4; OR, 1.0; 95% CI, 1.0–1.0; $p = 0.12$) and among women living in institutional care (M = 940.9, SD = 208.4 vs M = 946.8, SD = 195.7; OR, 1.0; 95% CI, 1.0–1.0; $p = 0.78$). However, community-dwelling women with FI were significantly more likely to report a lower than high school education (Table 1) than women without FI.

Lifestyle Variables

Results from a univariate analysis of lifestyle factors associated with having FI are shown in Table 2. Community-dwelling women who ate less than 2 serves of fruit per day (OR, 1.32; 95% CI, 1.06–1.64; $p = 0.01$) and drank fewer than 6 glasses of nonalcoholic fluid per day (OR, 0.78; 95% CI, 0.64–0.97; $p = 0.02$) were more likely to report FI (Table 1). Current or past smoking was not associated with FI (Table 1).

Medical Comorbidities

An analysis of self-reported medical comorbidities associated with FI in community-dwelling and institutional-dwelling women is shown in Table 2. Medical conditions that were significantly more commonly reported by women in institutional care who reported FI were urinary incontinence, constipation, stroke, and dementia. Fecal incontinence was also significantly more common among both sets of women who reported having more than 5 chronic illnesses (Table 2).

In addition, we assessed the association between FI and urinary incontinence (UI). Among community-dwelling women with FI (n = 383), 69.0% (n = 268) also reported UI (OR, 2.90; 95% CI, 2.31–3.64; $p < 0.0001$), whereas among women with FI in institutional care (n = 112), 75.0% (n = 85) reported UI (OR, 3.90; 95% CI, 2.47–6.17; $p < 0.0001$).We also assessed the association between FI and recent prolapse repair (bladder, vagina, or bowel, within the past 3 years). Among community-dwelling women with FI (n = 351), 7.0% (n = 26) also reported prolapse repair (OR, 2.35; 95% CI, 1.51–3.66; $p = 0.002$), whereas among women with FI in institutional care (n = 103) 7.0% (n = 8) also reported FI (OR, 1.82; 95% CI, 0.81–4.12; $p = 0.1$).

Psychological Variables

Depression and anxiety were more frequent among women who reported FI (Table 1) than among those without FI in both groups. Also, both community-dwelling women and those residing in institutions reporting FI had experienced a significantly higher percentage of major life events in the previous 3 years compared with non-FI reporters (12.0% vs 10.4%; OR, 3.59; 95% CI, 1.42–9.12; $p = 0.007$) and (17.4% vs 14.3%; OR, 6.39; 95% CI, 1.44–28.32; $p = 0.01$).

Independent Factors Associated With FI

In a multivariate model, we found that reporting diabetes mellitus, depression, osteoarthritis, leaking urine, a greater number of recent life events, and poorer general health as reported on the SF-36 was associated with FI among the total sample (Table 3). Among community-dwelling women, we found that reporting diabetes mellitus, depression, leaking urine, osteoarthritis, and poorer general health as reported on the SF-36, but not recent life events, was associated with FI (Table 3). Among women living in institutional care, however, we only found that leaking urine and poorer general health on the SF-36 was significantly associated with FI. Diabetes mellitus, depression, osteoarthritis, and recent life events were not significantly associated with having FI in the final model (Table 3).

Quality of Life

Quality of life was significantly impaired in women who reported FI for all 8 of the domains of quality-of-life variables in the SF-36 (Table 2).

DISCUSSION

This study examined a large cohort of elderly women in Australia. To our knowledge this is the largest study of its kind that assesses FI among women aged 80 and above in whom the majority (82.2%) were still living in the community. With the use of our definition of FI, 10.4% of women reported having this condition. Among the community-dwelling women, 9% reported FI, which is consis-

TABLE 2. Univariate results, assessing effect of potential correlates on fecal incontinence

	Community (n = 4020)					*Institutional care (n = 795)*				
	FI (390) %	*No FI (3630) %*	*OR*	*(95% CI)*	*p*	*FI (113) %*	*No FI (682) %*	*OR*	*(95% CI)*	*p*
Country of birth										
Australia	78.9	79.7	1			78.3	75.2	1		
Outside Australia	21.1	20.3	1.05	(0.80–1.37)	0.74	21.7	24.8	0.84	(0.52–1.36)	0.49
Education attained										
Less than Senior Certificate	67.7	76.8	1			67.5	67.5	1		
Senior Certificate or better	32.3	23.2	0.64	(0.49–0.82)	0.004	32.3	35.5	1.15	(0.75–1.76)	0.53
Marital status										
Married	31.2	32.8	1			22.4	22.3	1		
Single/widowed/divorced	68.8	67.2	0.93	(0.74–1.16)	0.51	77.6	77.7	1.01	(0.62–1.63)	0.98
BMI										
Underweight (BMI <18)	4.1	5.9	1.61	(0.96–2.69)	0.07	3.8	5.4	1.56	(0.56–4.34)	0.39
Acceptable (18 ≤ BM I≤ 25)	49.4	44.2	1			51.0	46.7	1		
Overweight (25 < BMI ≤ 30)	31.9	35.2	1.23	(0.95–1.60)	0.11	30.1	35.9	1.30	(0.80–2.13)	0.29
Obese (BMI >30)	14.6	14.0	1.20	(0.79–1.58)	0.52	15.1	12.0	0.87	(0.43–1.75)	0.69
Parity										
0	7.7	7.0	1			11.2	6.4	1		
1	8.9	6.8	0.80	(0.52–1.22)	0.29	15.4	10.0	0.62	(0.26–1.47)	0.28
2	24.4	23.8	0.66	(0.43–1.03)	0.06	25.4	29.1	2.04	(0.95–4.39)	0.07
3	24.1	22.5	0.81	(0.62–1.08)	0.15	25.1	24.5	1.07	(0.62–1.85)	0.08
4+	34.8	39.9	0.85	(0.65–1.12)	0.24	32.9	30.0	1.26	(0.74–2.12)	0.40
Vegetable intake										
5+ serves/day	9.4	9.3	1			9.0	8.1	1		
0–4 serves/day	90.6	90.7	1.01	(0.71–1.45)	0.95	91.0	91.9	1.12	(0.54–2.32)	0.77
Fruit intake										
2+ serves/day	70.2	64.2	1			71.5	60.7	1		
0–1 serve/day	29.8	35.8	1.32	(1.06–1.64)	0.01	28.5	39.3	1.62	(1.07–2.45)	0.02
Fluid intake										
0–5 glasses/day	41.2	47.2	1			39.8	49.1	1		
6+ glasses/day	58.8	52.8	0.78	(0.64–0.97)	0.02	60.2	50.9	0.68	(0.46–1.02)	0.06
Alcohol intake										
Nil	59.6	59.2	1			58.1	55.5	1		
Low	36.6	36.9	0.97	(0.55–1.69)	0.90	39.5	35.5	0.24	(0.10–0.56)	0.01
High	3.8	3.9	0.95	(0.55–1.65)	0.86	2.4	9.0	0.25	(0.11–0.58)	0.001
Smoking										
Never	66.8	67.1	1			65.4	61.1	1		
Past	27.4	28.3	1.33	(0.77–2.26)	0.30	30.9	35.2	1.13	(0.37–3.44)	0.83
Current	5.8	4.5	1.29	(0.72–2.15)	0.33	3.7	3.7	0.93	(0.31–2.76)	0.89
Symptoms										
Breathing difficulties	25.0	35.2	0.61	(0.49– 0.77)	<0.0001	29.1	30.8	0.91	(0.59–1.43)	0.71
Indigestion	23.7	34.0	0.60	(0.48–0.76)	<0.0001	27.8	29.2	0.93	(0.59–1.47)	0.76
Leaking urine	28.7	51.3	0.38	(0.31– 0.47)	<0.0001	28.8	67.3			<0.0001
Constipation	31.7	39.5	1.41	(1.13–1.75)	0.002	32.7	49.5	2.02	(1.34–3.04)	0.0007
Medical conditions										
Hypertension	58.1	61.5	1.15	(0.93–1.43)	0.20	59.4	68.2	1.46	(0.95–2.25)	0.08
Osteoarthritis	28.6	9.2	1.03	(0.82–1.30)	0.79	31.2	34.5	1.17	(0.76–1.78)	0.48
Osteoporosis	24.8	27.4	1.15	(0.91–1.45)	0.26	29.9	28.2	0.92	(0.59–1.44)	0.72
Parkinson disease	0.8	2.3	2.93	(1.38–6.24)	0.005	1.5	2.7	1.88	(0.51–6.94)	0.34
Angina	9.3	12.9	1.44	(1.05–1.98)	0.02	11.6	9.1	0.76	(0.38–1.52)	0.44
Heart attack	3.9	7.2	1.90	(1.25–2.89)	0.003	3.8	3.6	0.95	(0.33–2.78)	0.93
Other heart problems	16.3	19.4	1.23	(0.94–1.61)	0.13	17.6	12.7	0.68	(0.38–1.23)	0.20
Diabetes mellitus	11.2	18.9	1.84	(1.40–2.42)	<0.0001	10.4	14.5	1.46	(0.81–2.62)	0.20
Asthma	8.2	11.4	1.43	(1.02–2.00)	0.04	10.1	11.8	1.19	(0.63–2.23)	0.59
Emphysema/bronchitis	6.1	9.0	1.52	(1.05–2.21)	0.03	9.6	5.5	0.55	(0.23–1.29)	0.17
Stroke	4.2	7.0	1.71	(1.12–2.62)	0.01	4.6	10.0	2.33	(1.33–4.78)	0.02
Skin cancer	22.6	24.5	1.12	(0.88–1.43)	0.37	27.1	22.7	0.79	(0.49–1.28)	0.34
Depression	5.7	13.2	2.51	(1.81–3.49)	<0.0001	9.7	20.9	2.46	(1.46–4.16)	0.0008
Anxiety	5.1	8.8	1.80	(1.23–2.64)	0.0026	8.8	16.4	2.02	(1.14–3.58)	0.02
Dementia/Alzheimer disease	1.5	4.1	2.78	(1.58–4.90)	0.0004	4.4	10.9	2.65	(1.31–5.36)	0.007
Chronic illnesses										
5 or more, mean (SD)	2.5	(1.5)	1.23	(1.14–1.32)	<0.0001	2.8	(1.5)	1.27	(1.14–1.32)	<0.0001

FI = fecal incontinence.

TABLE 3. Multivariate model for effects on fecal incontinence (results for the whole sample, women in community dwellings and women in institutional care)

	Whole sample		*Women in community dwellings*		*Women in institutional care*	
	OR	*(95% CI)*	*OR*	*(95% CI)*	*OR*	*(95% CI)*
Diabetes mellitus	1.45	(1.12–1.88)	1.51	(1.14–2.01)	1.26	(0.66–2.40)
Depression	1.77	(1.31–2.39)	1.84	(1.30–2.62)	1.58	(0.86–2.89)
Recent life events	2.29	(1.01–5.19)	1.78	(0.67–4.70)	3.32	(0.65–16.96)
Leaking urine	2.62	(2.16–3.19)	2.29	(1.83–2.86)	4.43	(2.83–6.93)
General health subscale (SF-36)	0.98	(0.98–0.99)	0.98	(0.98–0.99)	0.98	(0.97–0.99)
Osteoarthritis	0.75	(0.61– 0.94)	0.73	(0.57–0.94)	0.81	(0.51–1.29)

SF-36 = Medical Outcomes Study Short Form 36.

tent with the estimates from other studies,[1,3–5] but the 14% self-reported FI in the institutional-dwelling group is lower than some other estimates,[10,11] potentially because of an biased representation of women living in institutional care among the study participants.

This study confirms that many factors identified in previous studies are also important in this population, including dementia. In terms of surgical risk factors, hysterectomy did not appear to be significantly associated with FI in our cohort. However, recent prolapse repair was a significant independent risk factor for FI among community-dwelling women. We observed, as others have,[4–7] that the cumulative number of chronic illnesses is associated with FI. Interestingly, our data indicate that a diagnosis or treatment for osteoarthritis appeared protective against FI, and we hypothesize that this may be due to treatment with opiate-containing analgesics, possibly improving stool form in women with diarrhea who would otherwise be prone to FI.

This study aimed to identify potentially modifiable factors for FI, including fiber and fluid consumption. Although the univariate analysis was positive, the multivariate analysis failed to show an independent relationship. Other investigators have observed a potential role for increased fiber intake being protective,[16] but the study size was considerably smaller. Fiber has been hypothesized to be protective by improving stool form. Abnormally loose stool and diarrhea are now well-recognized risk factors for FI,[24] and increased fiber intake may lead to an easier effort to retain stool. Unfortunately, our study did not capture data on stool form, but our results indicate that dietary fiber intake was not independently correlated with FI in this cohort of elderly, mostly community-dwelling women. Depression was also independently associated with an OR of 1.84 among community-dwelling women, but whether treating depression reduces the frequency and impact of FI is unknown.

Previous studies[4,6,25] have identified increasing BMI as a correlate for FI, but, in this cohort, the only relationship between FI and weight was observed in those who were underweight. Being underweight may simply be a marker of frailty and increasing comorbidities, or it may affect pelvic function. Further studies are required to clarify this. A recent study also found a modestly increased risk of FI among smokers who use at least 25 cigarettes daily.[25] Our study only stratified for current smoking status, without adjusting for the daily dose. This may explain why no correlation with current smoking was observed in our study.

The strengths of this study include its size and the quality of the data collected. The major limitation of this study includes its cross-sectional nature, which prevents conclusions about cause and effect to be confidently made. Also, data on vegetable, fruit, and fluid intake were self-reported, as opposed to the use of validated nutritional assessment tools. Although the use of self-report is useful for diagnosing FI in epidemiological studies, it correlates poorly with physiological and anatomical tests that are needed to guide treatment.[26] Other limitations include the lack of specific data on stool form and obstetric risk factors.

There is also a particular set of limitations around the data for women living in institutional care. Women in the study are likely to underrepresent this population and may provide a biased estimate of the prevalence of FI and associated risk factors. We analyzed these women separately from the community-dwelling women, because their results are different on some factors, but caution should be exercised when generalizing to a broader population of women in institutional care. Another issue for this group is the much smaller sample size and power limitations.

CONCLUSIONS

This large study examined prevalence and risk factors of FI in a large sample of women, mainly community-dwelling women aged 82 to 87. In this population, the independent factors associated with FI do not appear readily modifiable, apart potentially from depression. Our results cast serious doubt on the generalizability to this population of the findings of smaller studies of younger women with FI, in particular, with regard to the impact of BMI, dietary fiber, and smoking as potentially modifiable risk factors.

The consistently observed impact of FI, combined with conflicting data from observational studies, clearly highlights the need for further high-quality studies to help understand the exact pathophysiology and, hopefully, to identify modifiable risk factors.

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