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Incontinence

Population-Based Survey of Urinary Incontinence, Overactive Bladder, and Other Lower Urinary Tract Symptoms in Five Countries: Results of the EPIC Study

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Abstract

Objective: Estimate the prevalence of urinary incontinence (UI), overactive bladder (OAB), and other lower urinary tract symptoms (LUTS) among men and women in five countries using the 2002 International Continence Society (ICS) definitions.

Methods: This population-based, cross-sectional survey was conducted between April and December 2005 in Canada, Germany, Italy, Sweden, and the United Kingdom using computer-assisted telephone interviews. A random sample of men and women aged $\geq$ 18 yr residing in the five countries and who were representative of the general populations in these countries was selected. Using 2002 ICS definitions, the prevalence estimates of storage, voiding, and postmicturition LUTS were calculated. Data were stratified by country, age cohort, and gender.

Results: A total of 19,165 individuals agreed to participate; 64.3% reported at least one LUTS. Nocturia was the most prevalent LUTS (men, 48.6%; women, 54.5%). The prevalence of storage LUTS (men, 51.3%; women, 59.2%) was greater than that for voiding (men, 25.7%; women, 19.5%) and postmicturition (men, 16.9%; women, 14.2%) symptoms combined. The overall prevalence of OAB was 11.8%; rates were similar in men and women and increased with age. OAB was more prevalent than all types of UI combined (9.4%).

Conclusions: The EPIC study is the largest population-based survey to assess prevalence rates of OAB, UI, and other LUTS in five countries. To date, this is the first study to evaluate these symptoms simultaneously using the 2002 ICS definitions. The results indicate that these symptoms are highly prevalent in the countries surveyed.

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1. Introduction

The term lower urinary tract symptoms (LUTS) was introduced in 1994 [1] and consists of storage, voiding, and postmicturition symptoms [2]. Many adults experience LUTS, and the prevalence of these symptoms increases with age [3]. Individuals with LUTS often experience urinary incontinence (UI) or overactive bladder (OAB) symptoms. OAB is a subset of storage LUTS currently defined by the International Continence Society (ICS) as urgency, with or without urgency UI (UUI), usually with frequency and nocturia [2]. LUTS, including UI and OAB, have detrimental effects on health-related quality of life [4–6].

Several population-based studies have estimated the prevalence of UI or subsets of LUTS [7–11], but prevalence estimates differ based on type of UI and country surveyed. Many of these studies were also limited by gender, examining UI in women and LUTS in men. Relatively few published prevalence surveys in the general population have assessed the prevalence of OAB, and these have used different definitions of OAB [6,12–15]. To date, no large population-based study has evaluated the prevalence of all LUTS using the definitions recently approved by the ICS [2]. Therefore, the aim of this study was to estimate the population-based prevalence of UI, OAB, and other LUTS among men and women aged $\geq$ 18 yr using the current ICS (2002) definitions.

2. Methods

This was a population-based, cross-sectional telephone survey of adults aged $\geq$ 18 yr in five countries: Canada, Germany, Italy, Sweden, and the United Kingdom. All interviews were conducted using a computer-assisted telephone interview (CATI) system. All interviewers underwent standardised training and regular quality-control checks. Ethics committee approval was obtained according to national regulations in each country.

2.1. Survey sampling techniques

A two-step sampling method was used to obtain a representative sample of the general population: (1) a random sample of households with a residential telephone number was selected, and (2) within a given household, an individual aged $\geq$ 18 yr was randomly selected. This individual was asked for the number of adults aged $\geq$ 18 yr permanently living in the household. The person with the most recent birthday was selected for the interview. If the person was not present or available, an appointment was made for an interview at a later time. If the selected person was unwilling to participate, no substitution was made in that household.

2.2. Questionnaire development

The CATI questionnaire was developed by a panel of clinical and epidemiologic experts. The original questionnaire was written in English and translated into each country's primary language. The translation was done to ensure that the cultural and linguistic integrity of the questions was conveyed and not just a literal translation. Pilot interviews ($n = 15$) were conducted in each country. Based on the results of these interviews the questionnaire was revised.

All survey participants were asked about the presence of urinary symptoms (see Appendix) and demographics. These initial questions included symptom items from the International Prostate Symptom Score (IPSS) [16].

2.3. Case definitions

The 2002 ICS definitions were used for frequency, nocturia, urgency, OAB, UUI, stress urinary incontinence (SUI), mixed urinary incontinence (MUI), intermittency, slow stream, straining, terminal dribble, postmicturition dribble, and incomplete emptying [2]. Unless otherwise noted, the 2002 ICS definition of nocturia ($\geq$1 episodes/night) is reported. For comparison, when noted, we also report nocturia defined as two or more nocturnal micturitions per night. Participants who reported both UUI and SUI symptoms were classified as having MUI. Those who reported UI without symptoms of UUI or SUI were categorised as having other UI. We categorised LUTS as storage (i.e., frequency, nocturia, urgency, UUI, SUI, MUI, and other UI), voiding (i.e., intermittency, slow stream, straining, and terminal dribble), and postmicturition symptoms (i.e., incomplete emptying and postmicturition dribble).

2.4. Statistical analyses

All statistical analyses were performed using SPSS (Version 14.0; SPSS Inc, Chicago, IL). To account for the underlying sampling frame and to provide representative population prevalence estimates, the sample population was weighted by age (5-yr groups), gender, household size (1, 2, 3, 4, and $\geq$5 persons), and country size. Weighting goals were taken from national published sources and derived for each interview through a two-step process: (1) a weighted factor set was calculated to satisfy the weighting on both age and gender and household size simultaneously (rim-weighting), and (2) the weighting factors resulting from country population sizes were applied. Prevalence data were analysed by country, gender, and 5-yr age cohorts. Three age groups were defined ($\leq$39 yr; 40–59 yr; $\geq$60 yr) for presentation in this paper. Results are presented as numbers (unweighted) and percentages of participants with 95% confidence limits.

3. Results

3.1. Participants

A total of 58,139 individuals were contacted to participate in the study, and 19,165 agreed (33% response rate). Individuals were interviewed

Table 1 – Age and gender distributions of survey participants and the general population of Sweden, Germany, Italy, Canada, and the United Kingdom

Age group, y	Survey participants (n = 19,165)			General population* (n = 192,399,205)		
	Men %	Women %	Total %	Men %	Women %	Total %
18–29	16.4	13.6	14.7	19.2	17.5	18.3
30–34	7.5	7.5	7.5	9.4	8.6	9.0
35–39	10.0	10.2	10.1	10.6	9.7	10.2
40–44	11.1	11.7	11.5	10.3	9.5	9.9
45–49	10.0	10.5	10.3	9.1	8.5	8.7
50–54	9.6	9.7	9.7	8.4	7.9	8.1
55–59	8.9	9.2	9.1	7.6	7.3	7.4
60–64	7.9	8.0	8.0	7.2	7.0	7.1
65–69	7.3	7.0	7.1	6.3	6.5	6.4
≥70	11.4	12.5	12.1	12.0	17.6	14.9

* 2004 estimates.

between April 2005 and December 2005. Demographics for the survey participants and for the general population within the five countries surveyed are summarised in Table 1. Respondents were predominantly white (95.6%), about 26.6% had a university education or higher, and 58.5% were currently married.

3.2. *Prevalence of LUTS*

Table 2 reports the prevalence of LUTS in the survey population. Women (59.2%) reported storage symptoms more frequently than men (51.3%), whereas the opposite was true for voiding (men, 25.7%; women, 19.5%) and postmicturition symptoms (men, 16.9%; women, 14.2%). All symptoms among men increased in prevalence with advancing age, especially for those ≥60 yr of age. This trend was similar among women for urgency, nocturia, UUI, MUI, other UI, intermittency, slow stream, and postmicturition dribble. UI was reported by 13.1% of women and 5.4% of men, with SUI (6.4%) as the most common type (48.9%) for women and other UI (2.9%) for men (53.7%). The overall prevalence of any LUTS was 62.5% in men and 66.6% in women. Approximately 1.4% of men and 1.8% of women with LUTS also reported symptoms of urinary tract infection (UTI).

Overall, storage symptoms were reported more often than voiding or postmicturition symptoms. The most common storage symptom was nocturia (48.6% men; 54.5% women) followed by urgency (10.8% men; 12.8% women). Men reported voiding and postmicturition symptoms more frequently than women. Terminal dribble (14.2% men; 9.9% women) was the most common voiding symptom, and incomplete emptying (13.5% men; 12.3% women) was the most frequently reported postmicturition symptom. Storage and voiding symptoms were the two groups of symptoms that occurred together most often (17.7% men; 14.9% women), and all three types of LUTS were reported simultaneously by 8.8% of men and 6.6% of women.

When nocturia was defined as two or more nocturnal micturitions per night instead of one or more, the prevalence of nocturia decreased to 20.9% in men and to 24.0% in women (Table 2). Similarly, the overall prevalence of any storage symptom decreased (Table 2).

Country-specific prevalence rates for LUTS are shown in Fig. 1. Nocturia was the most commonly reported storage symptom for both men and women in all five countries followed by UI in women (Sweden, Canada, and the United Kingdom) and urgency in men (Germany and Italy). Terminal dribble was the most prevalent voiding symptom in three countries (Italy, Germany, and the United Kingdom) and slow stream was the least prevalent in four of the five countries.

The LUTS that define OAB were reported by 12.8% of women and 10.8% of men. Fig. 2 shows the overlap of OAB symptoms with and without UI. Nearly half of the women who reported symptoms of OAB also reported UI (6.3%/12.8%). Among these women with OAB symptoms and UI, 23.8% experienced UI due to UUI alone, 28.6% due to SUI alone, 38.1% due to MUI, and 9.5% due to other UI. About 28.7% of men with OAB symptoms reported UI, and in 41.6% it was due to UUI alone, 29% due to other UI, 19.4% due to MUI, and 10% due to SUI alone. Among those with other UI, 31.7% of men and 23.0% of women reported symptoms of UI and urgency but did not attribute their UI to UUI or SUI. Similarly, symptoms of postmicturition dribble (34.5% men; 8.5% women) or terminal dribble (32.1% men; 15.9% women) coexisted among those with other UI. The proportion of the other UI population with any one of these three additional symptoms (urgency not attributed to UUI, terminal dribble, or postmicturition dribble)

was 62.1% for men and 36.7% for women (data not shown).

4. Discussion

To date, the EPIC study is the largest of its kind to report population-based prevalence rates of LUTS including OAB and UI, and in five countries. To our knowledge, this is the first study published that evaluated these symptoms simultaneously using the 2002 ICS definitions. Our results demonstrate that LUTS are highly prevalent in men (62.5%) and women (66.6%) $\geq$40 yr of age in the countries surveyed and that the prevalence of LUTS increases with age. Approximately 1.4% of men and 1.8% of women with LUTS also reported symptoms of UTI. The presence of UTI was not clinically confirmed in these individuals, so we cannot be sure what the rates of UTI actually were. However, even if all men and women who reported symptoms of UTI were excluded, the prevalence of LUTS in men and women would still be within the confidence limits of our estimates.

Our findings are consistent with other epidemiologic studies of LUTS conducted in men [7,10], which also showed that the prevalence of all symptoms increased linearly with age. Notably, the prevalence of LUTS in the current study is high compared with some male-specific studies of LUTS that estimated the prevalence of ''moderate to severe'' LUTS, defined as a score of at least 8 on the IPSS [8,17]. This is not surprising, given that the survey used in the current study measured the presence of individual LUTS as defined by the ICS. In contrast, the scoring system of the IPSS is such that a participant could report experiencing any individual LUTS with a frequency of ''almost always'' without being considered to have ''moderate to severe'' LUTS.

The 2002 ICS definition of nocturia (at least one nocturnal micturition per night) is relatively broad, which explains the high prevalence of nocturia (48.6% men; 54.5% women) in our study population. The published prevalence of nocturia using this definition ranges from 30% to 53% [18,19]. When nocturia was defined as two or more micturitions per night, the prevalence rates were reduced substantially in both men (20.9%) and women (24.0%). Similarly, the overall prevalence of any LUTS decreases when the definition of nocturia is changed from at least one micturition per night to two or more micturitions per night, although storage LUTS remained more prevalent than voiding and postmicturition LUTS among both men (storage, 26.9%; voiding, 25.7%; postmicturition, 16.9%) and women (storage, 34.2%; voiding, 19.5%; postmicturition, 14.2%). The clinical relevance of nocturia for individuals who have only one episode per night is yet to be determined. However, given the large decrease in the prevalence of nocturia when the definition was changed from at least one micturition per night to two or more micturitions per night, even among those respondents $\leq$39 yr of age, our data may suggest that experiencing one micturition per night is a part of the normal clinical spectrum.

The published prevalence rates of UI vary greatly across studies. A meta-analysis of UI studies found that prevalence rates among men ranged from 4.6% to 24% with a mean of 14.5%, and rates among women ranged from 4.5% to 44% with a mean of 23.5% [20]. The prevalence rates of UI reported in our study are at the lower end of the ranges reported in these other studies. The wide range of prevalence estimates is likely due to methodologic differences, because the definitions of UI, design of questionnaires, study populations, and survey methods (e.g., postal vs. telephone survey) vary across studies.

Other studies report a lower prevalence of other UI with a proportionately higher prevalence of MUI in women and UUI in men [9,11,20]. This suggests that a larger proportion of our survey respondents were unable to attribute their UI symptoms to SUI or UUI and were thus classified as having other UI. Despite the differences in overall UI prevalence rates, our findings are consistent with other reports regarding the effects of age on UI prevalence [9,20].

To date, few large population-based surveys in Europe and North America have evaluated the prevalence of OAB. Two of these studies used an older definition of OAB [6,13]. Stewart et al. [6] estimated the US prevalence of OAB in adults aged $\geq$18 yr to be 16% in men and 16.9% in women. In Europe, Milsom et al. [13] provided an OAB prevalence rate in adults aged $\geq$ 40 yr of 15.6% for men and 17.4% for women. Given that the older, broader definition of OAB comprised symptoms of frequency, urgency, and UUI, occurring either singly or in combination, it is not surprising that our prevalence estimates are somewhat lower than those reported by Milsom et al. [13]. In addition, our results confirm those of both previous studies [6,13], which suggested that women have a higher prevalence of OAB symptoms compared with men before the age of 60 yr, whereas men have a higher prevalence of OAB symptoms after age 60 yr. Other recent studies report similar results [12,14,15].

The results of the current study should be viewed within the context of its limitations. One limitation involves the use of self-reports to measure LUTS. Evidence indicates that self-reports are vulnerable

Table 2 – Prevalence (%, 95%CI) of LUTS by age and gender

	Men				Women			
	≤39 y	40–59 y	≥60 y	Total	≤39 y	40–59 y	≥60 y	Total
	*n** (%†, 95%CI)	*n** (%†, 95%CI)	*n** (%†, 95%CI)	*n** (%†, 95%CI)	*n** (%†, 95%CI)	*n** (%†, 95%CI)	*n** (%†, 95%CI)	*n** (%†, 95%CI)
Storage symptoms								
Any storage symptom (nocturia ≥ 1 time/night)	964 (37.5, 35.9–39.0)	1469 (50.6, 48.9–52.4)	1413 (73.9, 72.1–75.7)	3846 (51.3, 50.3–52.3)	1916 (48.9, 47.3–50.6)	2780 (56.3, 54.6–58.0)	2434 (74.5, 73.0–76.1)	7130 (59.2, 58.3–60.2)
Any storage symptom (nocturia ≥ 2 times/night)	465 (17.9, 16.6–19.1)	748 (25.0, 23.6–26.5)	864 (43.6, 41.6–45.6)	2077 (26.9, 26.0–27.8)	1025 (26.0, 24.5–27.4)	1638 (32.0, 30.4–33.6)	1577 (46.5, 44.7–48.2)	4240 (34.2, 33.3–35.2)
Nocturia (≥1 time/night)	886 (34.5, 33.0–36.1)	1387 (47.8, 46.1–49.5)	1369 (71.9, 70.0–73.7)	3642 (48.6, 47.6–49.6)	1741 (43.9, 42.3–45.5)	2513 (51.0, 49.3–52.8)	2278 (70.8, 69.2–72.4)	6532 (54.5, 53.5–55.5)
Nocturia (≥2 times/night)	334 (12.9, 11.9–14.0)	576 (19.5, 18.1–20.8)	704 (35.2, 33.3–37.2)	1614 (20.9, 20.0–21.7)	690 (16.9, 15.7–18.1)	1097 (21.0, 19.6–22.4)	1152 (35.6, 33.9–37.3)	2939 (24.0, 23.1–24.8)
Urgency	168 (7.1, 6.3–8.0)	263 (8.9, 7.9–9.8)	362 (19.1, 17.5–20.7)	793 (10.8, 10.1–11.4)	372 (9.7, 8.8–10.7)	577 (11.2, 10.1–12.3)	616 (18.3, 16.9–19.6)	1565 (12.8, 12.2–13.5)
Frequency	122 (4.6, 4.0–5.3)	180 (5.9, 5.1–6.7)	219 (11.4, 10.1–12.7)	521 (6.8, 6.3–7.3)	296 (7.9, 7.0–8.8)	300 (5.8, 5.0–6.6)	280 (8.4, 7.5–9.4)	876 (7.4, 6.9–7.9)
UUI	10 (0.4, 0.2–0.6)	41 (1.3, 0.9–1.7)	52 (2.5, 1.9–3.1)	103 (1.2, 1.0–1.5)	41 (1.0, 0.6–1.3)	62 (1.1, 0.7–1.5)	105 (2.5, 1.9–3.0)	208 (1.5, 1.2–1.7)
MUI	10 (0.4, 0.2–0.6)	12 (0.4, 0.2–0.6)	27 (1.2, 0.7–1.6)	49 (0.6, 0.4–0.7)	36 (1.0, 0.6–1.3)	123 (2.4, 1.9–3.0)	158 (4.1, 3.4–4.8)	317 (2.4, 2.1–2.7)
SUI	3 (0.1, 0.0–0.2)	17 (0.6, 0.3–0.8)	29 (1.6, 1.1–2.1)	49 (0.6, 0.5–0.8)	142 (3.7, 3.1–4.3)	386 (7.9, 7.0–8.8)	293 (8.0, 7.1–9.0)	721 (6.4, 5.9–6.9)
Other UI	44 (1.5, 1.1–1.9)	91 (3.0, 2.4–3.6)	103 (5.2, 4.3–6.1)	238 (2.9, 2.6–3.3)	74 (1.7, 1.3–2.1)	114 (2.3, 1.8–2.8)	141 (4.6, 3.9–5.4)	329 (2.8, 2.5–3.1)
Any UI (UUI, MUI, SUI, Other)	67 (2.4, 1.9–2.9)	161 (5.2, 4.5–6.0)	211 (10.4, 9.2–11.7)	439 (5.4, 4.9–5.9)	293 (7.3, 6.5–8.1)	685 (13.7, 12.6–14.9)	697 (19.3, 17.9–20.7)	1675 (13.1, 12.4–13.8)
Voiding symptoms								
Any voiding symptom	507 (19.9, 18.6–21.2)	708 (24.1, 22.6–25.6)	723 (37.2, 35.3–39.2)	1938 (25.7, 24.9–26.6)	706 (17.4, 16.2–18.7)	907 (17.0, 15.7–18.3)	830 (24.6, 23.0–26.1)	2443 (19.5, 18.7–20.3)
Intermittency	148 (5.5, 4.8–6.2)	238 (7.6, 6.7–8.5)	298 (14.5, 13.1–16.0)	684 (8.5, 8.0–9.1)	240 (6.0, 5.3–6.8)	319 (6.1, 5.3–7.0)	341 (9.8, 8.7–10.8)	900 (7.2, 6.7–7.7)
Slow stream	109 (3.9, 3.2–4.5)	229 (7.4, 6.5–8.3)	377 (18.9, 17.4–20.5)	715 (8.9, 8.3–9.5)	205 (4.9, 4.2–5.6)	269 (4.9, 4.2–5.7)	294 (9.7, 8.6–10.7)	768 (6.4, 5.9–6.8)
Straining	123 (4.5, 3.8–5.1)	205 (6.9, 6.0–7.8)	180 (10.0, 8.8–11.2)	508 (6.7, 6.2–7.2)	167 (3.5, 2.9–4.1)	184 (3.3, 2.7–3.9)	166 (5.2, 4.4–6.0)	517 (4.0, 3.6–4.3)
Terminal dribble	294 (12.2, 11.2–13.3)	380 (13.2, 12.0–14.4)	341 (18.8, 17.2–20.3)	1015 (14.2, 13.5–14.9)	374 (10.1, 9.2–11.1)	473 (8.7, 7.8–9.7)	391 (10.9, 9.8–12.0)	1238 (9.9, 9.3–10.5)

Postmicturition symptoms								
Any postmicturition symptom	337 (12.7, 11.6–13.7)	481 (16.1, 14.8–17.3)	476 (24.7, 22.9–26.5)	1294 (16.9, 16.1–17.7)	521 (13.5, 12.4–14.6)	617 (12.1, 11.0–13.2)	557 (17.4, 16.1–18.7)	1695 (14.2, 13.5–14.9)
Incomplete emptying	257 (9.6, 8.6–10.5)	364 (12.5, 11.4–13.7)	396 (20.9, 19.3–22.6)	1017 (13.5, 12.8–14.2)	468 (11.9, 10.8–12.9)	522 (10.4, 9.3–11.4)	460 (15.0, 13.7–16.2)	1450 (12.3, 11.7–13.0)
Postmicturition dribble	116 (4.5, 3.8–5.2)	179 (5.4, 4.7–6.2)	151 (7.1, 6.1–8.1)	446 (5.5, 5.0–6.0)	89 (2.6, 2.1–3.1)	147 (2.7, 2.1–3.3)	149 (4.2, 3.5–4.9)	385 (3.1, 2.8–3.5)
Any LUTS (nocturia $\geq$ 1 time/night)	1310 (51.3, 49.7–52.9)	1793 (62.0, 60.3–63.6)	1556 (80.7, 79.1–82.3)	4659 (62.5, 61.5–63.5)	2306 (58.7, 57.1–60.3)	3148 (63.5, 61.9–65.2)	2600 (79.3, 77.9–80.8)	8054 (66.6, 65.7–67.5)
Storage and voiding	277 (10.3, 9.3–11.3)	472 (15.8, 14.5–17.0)	609 (31.8, 30.0–33.7)	1358 (17.7, 16.9–18.4)	478 (11.9, 10.9–13.0)	661 (12.4, 11.3–13.5)	716 (21.2, 19.7–22.6)	1855 (14.9, 14.2–15.6)
Storage and postmicturition	196 (7.6, 6.7–8.4)	354 (11.7, 10.6–12.8)	424 (22.3, 20.6–24.0)	974 (12.7, 12.1–13.4)	363 (9.3, 8.4–10.3)	495 (9.7, 8.7–10.7)	490 (15.4, 14.1–16.7)	1348 (11.3, 10.7–11.9)
Voiding and postmicturition	182 (7.0, 6.1–7.8)	303 (9.9, 8.9–11.0)	356 (18.5, 16.9–20.1)	841 (10.9, 10.3–11.5)	257 (6.7, 5.9–7.5)	336 (6.3, 5.5–7.2)	338 (10.5, 9.4–11.5)	931 (7.7, 7.2–8.3)
All 3 symptoms	127 (4.8, 4.1–5.5)	232 (7.5, 6.6–8.4)	318 (16.8, 15.3–18.4)	677 (8.8, 8.2–9.4)	199 (5.1, 4.4–5.8)	284 (5.4, 4.7–6.2)	314 (9.7, 8.7–10.8)	797 (6.6, 6.1–7.1)
Any LUTS (nocturia $\geq$ 2 times/night)	958 (37.6, 36.0–39.2)	1308 (44.7, 43.0–46.5)	1228 (62.9, 61.0–64.9)	3494 (46.5, 45.5–47.5)	1659 (42.0, 40.4–43.6)	2294 (44.9, 43.1–46.6)	1984 (58.7, 57.0–60.5)	5937 (48.1, 47.1–49.0)
Storage and voiding	172 (6.2, 5.4–6.9)	306 (9.9, 8.9–11.0)	441 (22.2, 20.5–23.9)	919 (11.5, 10.9–12.2)	323 (8.1, 7.2–9.0)	477 (8.9, 7.9–9.8)	565 (16.7, 15.4–18.0)	1366 (11.0, 10.4–11.6)
Storage and postmicturition	196 (7.6, 6.7–8.4)	354 (11.7, 10.6–12.8)	424 (22.3, 20.6–24.0)	974 (12.7, 12.1–13.4)	363 (9.3, 8.4–10.3)	495 (9.7, 8.7–10.7)	490 (15.4, 14.1–16.7)	1348 (11.3, 10.7–11.9)
Voiding and postmicturition	182 (7.0, 6.1–7.8)	303 (9.9, 8.9–11.0)	356 (18.5, 16.9–20.1)	841 (10.9, 10.3–11.5)	257 (6.7, 5.9–7.5)	336 (6.3, 5.5–7.2)	338 (10.5, 9.4–11.5)	931 (7.7, 7.2–8.3)
All 3 symptoms	94 (3.4, 2.8–3.9)	167 (5.2, 4.4–5.9)	258 (13.1, 11.8–14.5)	519 (6.5, 6.0–7.0)	161 (4.0, 3.4–4.7)	239 (4.5, 3.8–5.2)	276 (8.4, 7.5–9.4)	676 (5.6, 5.1–6.0)

CI = confidence interval; LUTS = lower urinary tract symptoms; MUI = mixed urinary incontinence; SUI = stress urinary incontinence; UI = urinary incontinence; UUI = urgency urinary incontinence.

* Unweighted.

† Weighted.

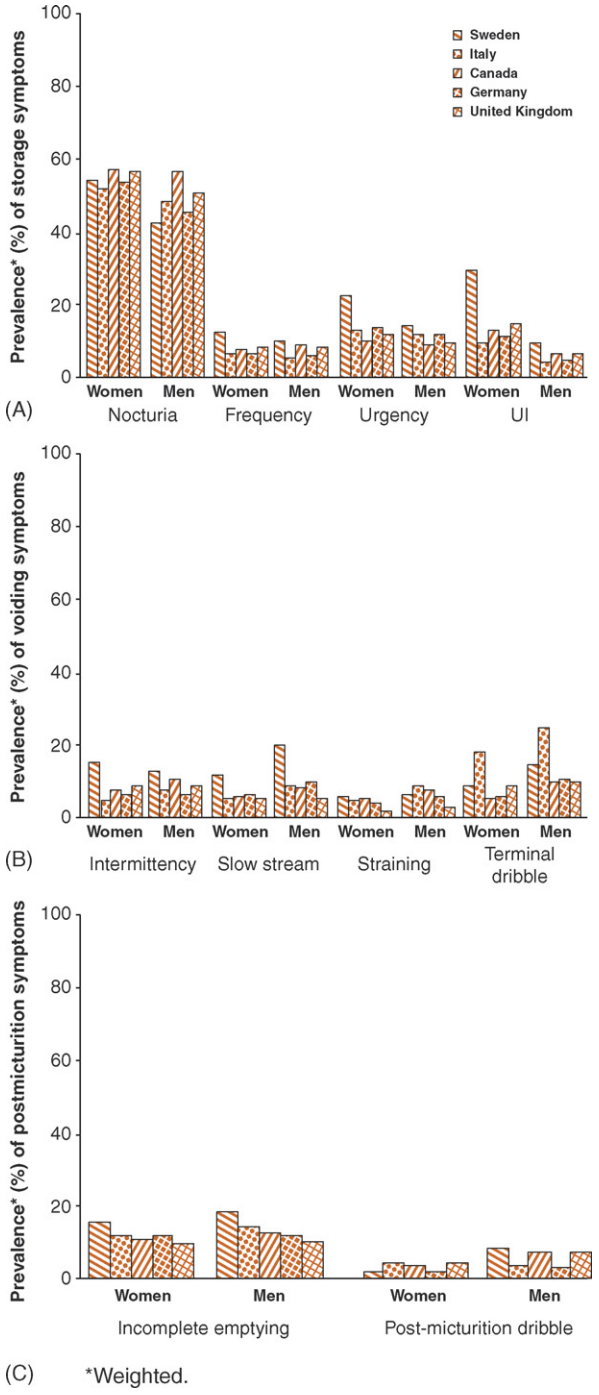

Fig. 1 – Prevalence (%) of LUTS by country and gender. LUTS = lower urinary tract symptoms; UI = urinary incontinence.

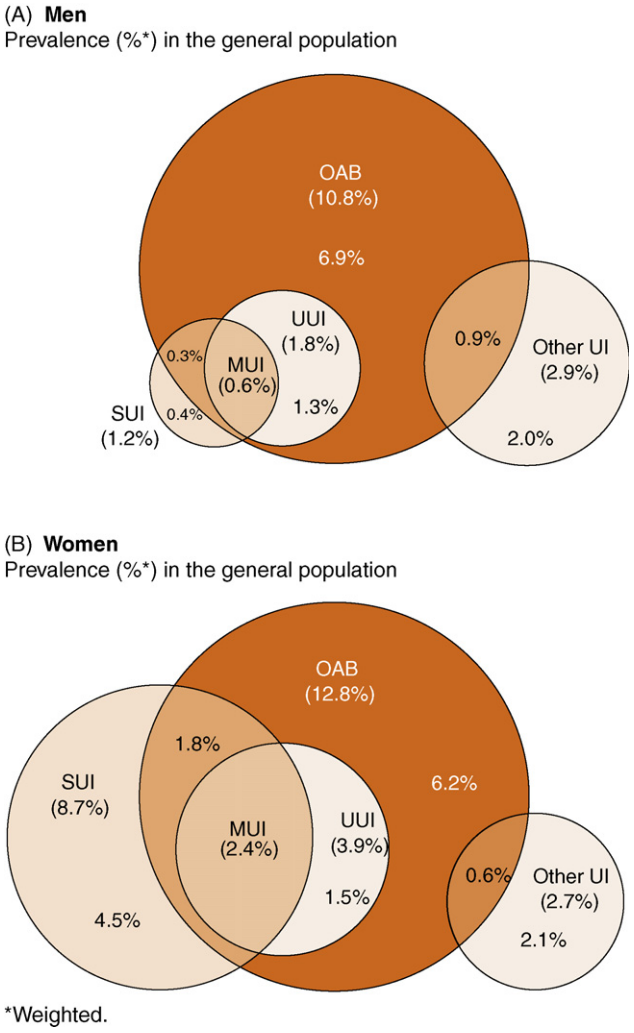

Fig. 2 – Prevalence (%) of UI subtypes among participants with OAB. OAB = overactive bladder; MUI = mixed urinary incontinence; SUI = stress urinary incontinence; UI = urinary incontinence; UUI = urgency urinary incontinence.

to inaccuracy relative to the criterion standard of physician diagnosis based on assessment of patient history and urodynamic evaluation [21,22]. However, the measurement of LUTS based on a rigorous physician examination would not be feasible in a large-scale, multinational epidemiologic study. Moreover, the use of physician diagnosis would introduce a degree of subjectivity. A second limitation is that the results of self-report data may be influenced by the mode of administration of the questionnaire; different modes may differ in terms of sampling error, response rates, data completeness, and measurement error [23]. Evidence suggests this may be true in the measurement of LUTS [24,25]. Thus, our data may have been slightly different if collected via mail or face-to-face interviews, and this should be considered when comparing the EPIC study to studies that collected data via different modalities. However, this limitation is also common to large epidemiologic studies, because there are advantages and disadvantages to each mode of questionnaire administration [23]. A third limitation is that many individuals who were contacted declined to participate in the EPIC study.

This may have affected the results, if the prevalence or distribution of LUTS was different in non-respondents relative to those who did respond. However, when reporting the prevalence estimates, we applied sampling weights to account for the demographic differences between the survey population and the general population.

5. Conclusions

This population-based survey confirms that LUTS are highly prevalent, and the prevalence of LUTS increases with age. The prevalence of LUTS was higher in the EPIC study, which used 2002 ICS definitions, than in many studies that estimated the prevalence of ''moderate to severe'' LUTS, defined as a score of at least 8 on the IPSS. Storage symptoms are more prevalent than voiding or postmicturition LUTS, and nocturia was the most commonly reported symptom. Based on these results, it is anticipated that millions of men and women aged $\geq$ 18 yr experience symptoms of OAB and UI.

Conflict of interest statement

This study was sponsored by Pfizer Inc. D.I. is a paid consultant to Pfizer Inc. I.M. is a member of International Advisory Boards regarding lower urinary tract symptoms for Astellas Pharma, Novartis, and Pfizer Inc; an investigator in the STAR study sponsored by Astellas Pharma; a recipient of research grants for epidemiologic studies on lower urinary tract symptoms from Astellas Pharma and Pfizer Inc to the Department of Obstetrics and Gynecology; and a recipient of honoraria for lectures presented at international meetings from Astellas Pharma, Novartis, and Pfizer Inc. S. Hunskaar has received consultation fees, honoraria for lectures, research grants, and funding for travel from Pfizer Inc, Astellas Pharma, Yamanouchi, Lilly, and Boehringer-Ingelheim. K.R. and Z.K. are employees of Pfizer Inc. S. Herschorn is on advisory boards and has worked on educational programs sponsored by Astellas Pharma, Janssen-Ortho, Pfizer Inc, and Paladin; he has been an investigator in clinical trials sponsored by Lilly and Pfizer Inc; he has been reimbursed by Bayer, Lilly, and Pfizer Inc for attending meetings. K.C. is a paid consultant to Pfizer Inc. C.K. has received research support from Astellas Pharma and Pfizer Inc and has delivered sponsored lectures for Astellas Pharma, Novartis, Pfizer Inc, UCB, and Tena. C.H. has no competing interests to declare. W.A. has been reimbursed by Astellas Pharma and Pfizer Inc for attending international conferences and has been paid by Astellas Pharma and Pfizer Inc to deliver lectures at sponsored symposia. P.A. is a paid consultant for Novartis, Pfizer Inc, and Plethora; a principal investigator for Diagnostic Ultrasound, Ferring, Pfizer Inc, Plethora, and Schwarz-Pharma; and a lecturer for Novartis.

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Appendix. Urinary symptom questions

Symptom/ condition	Defining question
Frequency	In your opinion, do you feel that you urinate too often during the day?
Nocturia	Over the last week, how many times did you typically get up to urinate from the time you went to bed at night until the time you got up in the morning?
Urgency	Do you experience a sudden compelling desire to urinate which is difficult to put off? What I mean is a sudden intense feeling of urgency where you feel you must urinate immediately?
Urinary incontinence (UI)	How often do you experience urinary leakage?
Urgency urinary incontinence (UUI)	Do you leak urine in connection with a sudden compelling desire to urinate? By that, I mean in connection with a sudden intense feeling of urgency?
Stress urinary incontinence (SUI)	Do you leak urine in connection with sneezing, coughing, or when doing physical activities such as exercising or lifting a heavy object?
Intermittency	Over the past month, how often have you found you stopped and started again several times when you urinated?
Slow stream	Over the past month, how often have you had a weak urinary stream?
Straining	Over the past month, how often have you had to push or strain to begin urination?
Terminal dribble	Do you experience prolonged trickle or dribble at the end of your urine flow?
Incomplete emptying	Over the past month, how often have you had a sensation of not emptying your bladder completely after you finish urinating?
Postmicturition dribble	Do you experience urine leakage almost immediately after you have finished urinating and walked away from the toilet?

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Editorial Comment

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This article reports the results of the EPIC study, which is the largest population-based survey to assess prevalence rates of urinary incontinence, overactive bladder (OAB), and other urinary tract symptoms in five selected countries, representative of Europe and North America, using the 2002 International Continence Society (ICS) definitions. Although urinary incontinence has received the greatest attention in population-based surveys, it is not the most common problem associated with OAB. Few published prevalence studies in the general population have assessed the prevalence of OAB, and these have used different definitions of OAB. Using a standardised terminology, as that suggested by the ICS, may help us to reach a clearer and more unique definition of the problem.

Because lower urinary tract symptoms (LUTS), and particularly OAB, are symptom-defined conditions, patient input is needed to evaluate responses

and valid and reliable patient-reported outcome measures are needed. Developing such measures and ensuring their validity is usually a time-consuming, multistep process.

The authors of this article have made a great effort to conduct this population-based survey, and they present new epidemiologic data according to the recent ICS definitions of OAB, for which I offer my congratulations. Despite of some limitations due to the validity of a survey, which may depend on the accuracy of the responses given by the interviewed subjects, the authors have been able to give country-specific prevalence rates for LUTS and OAB and new epidemiologic data that induce us to open a debate, particularly on the new definition of nocturia. Their research surely represents an impetus for a large series of speculations, studies, and publications.