

Platinum Priority – Review – Incontinence

Editorial by Piotr Radziszewski and Bartosz Dybowski on pp. 96–98 of this issue

Global Prevalence and Economic Burden of Urgency Urinary Incontinence: A Systematic Review

Ian Milsom^{a,*}, Karin S. Coyne^b, Sean Nicholson^c, Marion Kvasz^d, Chieh-I Chen^e, Alan J. Wein^f

^a Department of Obstetrics and Gynecology, Sahlgrenska Academy at Gothenburg University, Gothenburg, Sweden; ^b United BioSource Corporation, Bethesda, MD, USA; ^c Department of Policy Analysis and Management, Cornell University, Ithaca, NY, USA; ^d Pfizer International, Paris, France; ^e Pfizer Inc., New York, NY, USA; ^f Hospital of the University of Pennsylvania, Philadelphia, PA, USA

Article info

Article history:

Accepted August 13, 2013

Published online ahead of
print on August 27, 2013

Keywords:

Costs
Epidemiology
Health economics
Urgency urinary incontinence
Prevalence

Abstract

Context: The prevalence and economic burden of urgency urinary incontinence (UUI) are difficult to ascertain because of overlap with data on overactive bladder and other types of incontinence.

Objective: To summarize the evidence on the global prevalence and economic burden of UUI.

Evidence acquisition: A PubMed search was performed used the following terms: (urgency urinary incontinence OR urge incontinence OR mixed incontinence OR overactive bladder) AND (burden OR cost OR economic OR prevalence). A similar search was conducted using Embase. English-language articles published from 1991 through 2013 on non-neurogenic UUI were retained.

Evidence synthesis: We retained 54 articles (50 studies); 22 large-scale, population-based surveys indicated varying UUI prevalence estimates with ranges of 1.8–30.5% in European populations, 1.7–36.4% in US populations, and 1.5–15.2% in Asian populations, with prevalence dependent on age and gender. Nineteen smaller-scale studies supported these findings. Despite varying methods, 11 studies estimating the costs of UUI worldwide consistently concluded that the economic burden is substantial and will increase markedly as the population ages. In a 2005 multinational study, the annual cost-of-illness estimate for UUI in Canada, Germany, Italy, Spain, Sweden, and the United Kingdom was €7 billion. A US cost-of-illness study reported a total cost of \$66 billion in 2007 US dollars. The costs of routine care and nursing home admissions for UUI were major contributors to the cost.

Conclusions: UUI affects millions of men and women worldwide. Current evidence demonstrates the substantial economic burden of UUI to patients and society. Worldwide public health and clinical management programs are needed to improve UUI awareness and highlight the need for early diagnosis and management.

© 2013 European Association of Urology. Published by Elsevier B.V. All rights reserved.

* Corresponding author. Department of Obstetrics and Gynecology, Sahlgrenska Academy at Gothenburg University, Sahlgrenska University Hospital, SE-416 85 Gothenburg, Sweden. Tel. +46 70 5371602; Fax: +46 31192940. E-mail address: ian.milsom@obgyn.gu.se (I. Milsom).

1. Introduction

Urinary incontinence (UI) is defined by the International Continence Society (ICS) as the complaint of involuntary

loss of urine, with three primary subtypes of UI identified: urgency UI (UUI), stress UI (SUI), and mixed UI (MUI; both UUI and SUI) [1,2]. UUI is defined as involuntary loss of urine associated with urgency; SUI is defined as involuntary loss

of urine associated with effort, physical exertion, sneezing, or coughing; and *MUI* is defined as involuntary loss of urine associated with urgency and with effort, exertion, sneezing, or coughing [1,2].

UUI is a symptom of the *overactive bladder (OAB) syndrome*, defined as urinary urgency usually accompanied by frequency and nocturia, with or without UUI, in the absence of urinary tract infection or other obvious pathology [1,2]. OAB symptoms, including UUI, can have detrimental effects on an individual's physical, mental, and social well-being and are associated with increased morbidity and mortality [3–6]. The prevalence of UUI specifically has been less well studied than that of OAB, and available study results are often difficult to compare because of differing populations, UUI definitions, and methodologies. Because prevalence rates are an important factor in models used to calculate the economic costs associated with UUI, economic data also vary across studies. The purpose of this review is to summarize the published medical literature on the worldwide prevalence and economic burden of UUI to provide health care providers with a current overview of the data and to increase awareness of the toll that UUI exacts from patients and society.

2. Evidence acquisition

This systematic review was conducted based on the recommendations of the Preferred Reporting Items for Systematic Reviews and Meta-analyses statement [7]. A PubMed search of the literature on the prevalence and economic burden of UUI was conducted on September 7, 2012, and updated March 6, 2013, using the following search terms: (*urgency urinary incontinence* OR *urge incontinence* OR *mixed incontinence* OR *overactive bladder*) AND (*burden* OR *cost* OR *economic* OR *prevalence*). The search was limited to English language; published from January 1, 1991, to March 1, 2013 (electronically or print); humans; adults (≥ 19 yr); and text words. An Embase search was conducted using the terms 'urge incontinence'/exp OR 'mixed incontinence'/exp OR 'overactive bladder'/exp AND ('cost of illness'/exp OR burden OR 'prevalence'/exp) AND [english]/lim AND [[1991–2013]/py]. Criteria for inclusion or exclusion of retrieved articles were determined prior to the literature search.

The literature search was conducted by two independent reviewers, and evaluation of the studies against the inclusion criteria was conducted by three independent reviewers. Any discrepancies in the evaluation of articles, which were rare, were discussed among the three reviewers, with majority opinion presiding. Articles were included if they contained prevalence or economic data for (1) adults with UUI only, (2) adults with OAB with UUI and adults with OAB without UUI, or (3) adults with MUI and adults with SUI only. Articles were excluded if they were (1) reviews or comments; (2) primarily assessed neurogenic UUI, UUI diagnosis, UUI treatment/management outcomes, pregnancy-associated UUI, surgery-associated or surgically treated UI, or questionnaire validity; (3) duplicate articles;

or (4) updated in a more recent article. These criteria were established to include only articles that provided data specifically for UUI, OAB with and without UUI, or MUI and SUI, so the contribution of UUI only could be ascertained without confounding from other OAB symptoms, other types of UI, pregnancy, or neurologic conditions. References cited in the retained articles were reviewed for additional relevant articles. To focus on prevalence studies with low error margins and high confidence levels, it was decided a priori that only studies from population-based or random sample studies of UUI prevalence estimates for ≥ 2500 adults would be retained. This criterion was not applied to studies of the cost associated with UUI.

A total of 54 relevant articles (50 studies), including 43 prevalence articles and 11 economics articles, were retained (Fig. 1). Data were summarized qualitatively.

3. Evidence synthesis

3.1. Global prevalence of urgency urinary incontinence

Twenty-one large-scale (≥ 5000 adults), population-based, telephone, mail, interview, and Internet surveys (22 articles) assessed the prevalence of UUI in different samples of adults from Europe, the United States, Asia, and Africa (Table 1). In large-scale studies of adults aged ≥ 18 –20 yr, the prevalence of any UUI ranged from 1.5% to 14.3% for men and from 1.6% to 22.8% for women, whereas in studies of adults aged ≥ 30 –40 yr, the prevalence of any UUI ranged from 1.7% to 13.3% for men and from 7.0% to 30.3% for women.

The estimated prevalence of UUI can vary markedly from study to study (Tables 1 and 2). UUI prevalence estimates generally are based on self-reports of UUI with no clinical substantiation. Methodological differences among UUI prevalence studies may have substantial impacts on the results, including the way UUI is defined, the recall period, the modality by which participants are surveyed, the response format used, and participant characteristics (age, gender, ethnicity/geographic location).

For example, the Epidemiology of Lower Urinary Tract Symptoms (EpiLUTS) study reported relatively high UUI prevalence rates of 13.3% for men and 30.3% for women in the United Kingdom, Sweden, and the United States (Table 1) [3]. In EpiLUTS, the presence of UUI was assessed by asking participants (1) whether they had leaked urine in connection with a sudden need to rush to urinate during the past 4 wk and (2) how often they leaked urine in connection with a sudden need to rush to urinate using a six-point Likert scale ranging from “never” to “many times a day.” Participants who answered (1) “yes” and (2) at least “a few times a month” were considered to have UUI. Participants were required to be ≥ 40 yr; thus, higher rates of UUI would be expected compared with studies that included younger participants. The EpiLUTS survey was administered by way of the Internet with self-administered questionnaires, which may have afforded participants more time to reflect on their symptoms, less embarrassment and greater anonymity when reporting symptoms, and the option to complete the survey at a later

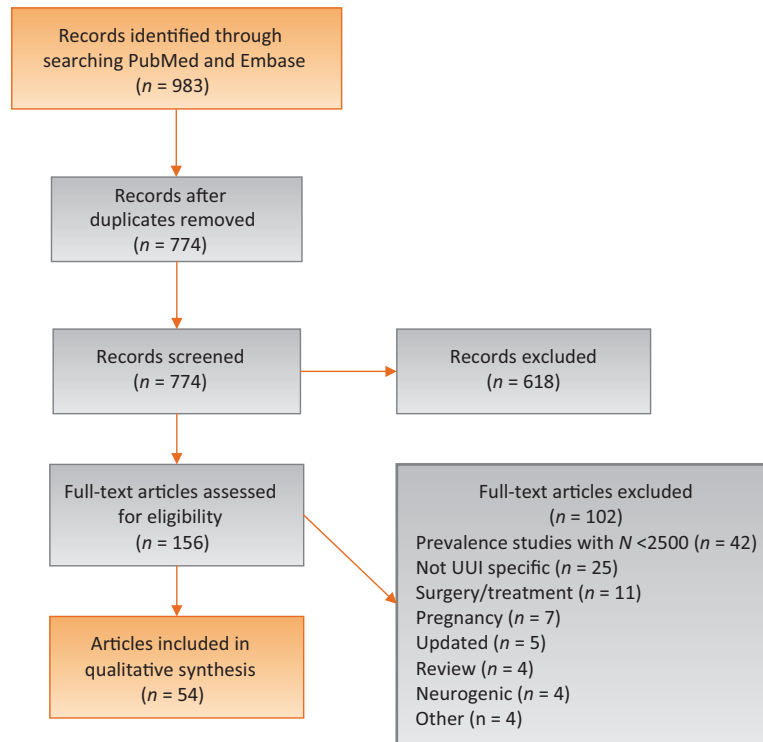


Fig. 1 – Preferred Reporting Items for Systematic Reviews and Meta-analyses flow diagram of article identification and selection. UUI = urgency urinary incontinence.

time; however, the study population was restricted to individuals with Internet access.

In contrast, a study conducted by Wang and associates reported UUI prevalence rates of 1.5% for men and 2.0% for women in China (Table 1) [8]. Among participants with one or more urgency episodes per week, UUI was assessed by asking participants how often they leak urine because they cannot defer the sudden desire to urinate. Participants who answered “less than once a week” or more were considered to have UUI. Eligible participants were ≥ 18 yr, and the field survey was administered by way of verbal guidance interviews with self-administered questionnaires. These methodologic differences likely account, at least in part, for differences in findings between the two studies.

Despite population and methodology differences among the 21 large-scale studies (study details described in Table 1) and 19 smaller-scale studies (study details described in Table 2), the results provide convincing evidence that UUI is a common condition in men and women worldwide. The unadjusted mean prevalence of any UUI (ie, UUI only and/or MUI) from included studies that reported prevalence data by gender and age interval (Supplementary Table 1) is shown in Figure 2. The individual study data and the unadjusted mean prevalence estimates across studies demonstrate that the prevalence of UUI increases with age. Because of the methodological differences among the studies, unadjusted mean estimates of UUI prevalence should be interpreted cautiously.

UUI prevalence also may vary across different races/ethnicities and countries. Some of these differences among

countries may be attributable to methodological differences among studies, as previously described. However, it appears that not all the observed intercountry differences in UUI rates are artifactual in nature, as multinational studies have found notable differences among countries using identical UUI definitions/questionnaires, survey and response formats, and study populations [3,9,10]. After adjusting the data from studies that met our inclusion criteria for current age distributions, we plotted UUI prevalence rates for adult men and women for each country for which data were available (Fig. 3). When multiple studies reported UUI prevalence for a given country, data from those studies were combined. For women, UUI prevalence rates ranged from 0.51% (Nigeria) to 14.3% (Germany), whereas rates for men ranged from 1.2% (China) to 8.7% (Finland). Rates of UUI were relatively high for both men and women in Germany, Sweden, and Finland compared with other countries. UUI prevalence was higher in women than in men in all countries for which data were available, except for Japan (men: 4.0%; women: 3.6%). From studies meeting our inclusion criteria, data for men were available in fewer Asian countries than for women. There were few or no data from large-scale studies on UUI prevalence in men and women from Africa, Australia, western Asia, Central America, eastern Europe, and South America.

Because the prevalence of UUI increases with age and the age of the population is expected to increase over the next decade, projected prevalence data are needed to calculate the future economic burden of this bothersome condition. An analysis based on ICS definitions, EPIC prevalence data,

Table 1 – Large-scale studies (≥ 5000 adults) evaluating the prevalence of urgency urinary incontinence

Study	Country	Sample	Survey (response rate)	UII definition	UII prevalence
de Ridder et al. [26]	Belgium	7193 women aged ≥ 40 yr visiting general practitioners	Population-based survey of women visiting their general practitioners for any reason in 2011	Presence of UII on the Bladder Control Self-Assessment Questionnaire (0: not at all; 1: a little; 2: moderately; 3: a great deal)	Overall: UII: 38.8% (any) and 10.2% (moderate/severe) for women aged ≥ 40 yr. By age: 40–50 yr: 25.2% (any) and 4.8% (moderate/severe); 50–60 yr: 34.7% (any) and 6.9% (moderate/severe); 60–70 yr: 42.6% (any) and 9.4% (moderate/severe); 70–80 yr: 47.6% (any) and 14.2% (moderate/severe); ≥ 80 yr: 56.2% (any) and 28.4% (moderate/severe).
Coyne et al. [3]	United Kingdom, Sweden, United States	30 000 (7500 United Kingdom; 2500 Sweden; 20 000 United States) adults aged ≥ 40 yr	Population-based, cross-sectional, Internet survey in 2007–2008 (52–61%)	2002 ICS (1) During past 4 wk, did you leak urine in connection with sudden need to rush to urinate? (yes/no) (2) During past 4 wk, how often have you leaked urine in connection with a sudden need to rush to urinate? (never, less than once a month/a few times a month/a few times a week/daily/many times a day) UII = (1) yes and (2) at least a few times a month	Overall: 13.3% for men and 30.3% for women aged ≥ 40 yr. United Kingdom: In the total UK EpiLUTS population of 3517 men and 3983 women aged ≥ 40 yr, the prevalence of UII was 11.7% for men and 29.0% for women. Sweden: In the total Swedish EpiLUTS population of 1207 men and 1293 women aged ≥ 40 yr, the prevalence of UII was 10.9% for men and 30.5% for women. United States: In the total US EpiLUTS population of 9416 men and 10 584 women aged ≥ 40 yr, the prevalence of UII was 14.2% for men and 30.8% for women.
Foley et al. [27]	United Kingdom	5091 adults (1969 men; 3122 women) aged ≥ 70 yr	Random sample, cross-sectional, postal survey of 23 000 community-dwelling adults from general practitioners' lists in 1998–1999 (58%)	(1) Do you ever leak urine when you don't mean to? (2) Does any urine leak when you laugh, cough or sneeze? (SUI) (3) Do you have such a strong desire to pass urine that you leak before reaching the toilet? (UII)	Overall: 24.9% (24.1% men; 25.4% women) reported UII (UII only or MUI) among adults aged ≥ 70 yr.
Felde et al. [28]	Norway	5321 women aged 40–44 yr born between 1953 and 1957 who lived in the county of Hordaland	Population-based, cross-sectional, mail survey in 1997–1999 (76% of women who received UI questionnaire)	(1) An entry question about experiencing involuntary loss of urine or not. If yes, (2) Is leakage accompanied by sudden and strong urgency to void? (yes/no) (3) Do you leak when coughing, sneezing, laughing, lifting heavy items? (yes/no)	Overall: 10.2% of women aged 40–44 yr reported UII (2.4% reported UII only; 7.8% reported MUI); 14.0% reported SUI.
Wang et al. [8]	China	14 844 adults (7614 men; 7230 women) aged ≥ 18 yr from six geographic regions in China	Population-based, cross-sectional, field interview survey in 2009–2010 (69%)	2002 ICS How often do you leak urine because you cannot defer the sudden desire to urinate? UII = "Less than once a week" or more; OAB = urgency occurring once a week or more; OAB-wet = OAB with UII; OAB-dry = OAB without UII	Overall: OAB-wet: 1.8% (1.5% men; 2.0% women); OAB-dry: 4.2% (4.4% men; 4.0% women). By age: OAB-wet: men: $<1\%$ at <40 yr but increased to 9.4% at >70 yr; women: $<1\%$ at <50 yr but increased to 15.1% at >70 yr ($p < 0.01$ men vs women); OAB-dry: increased in both men and women ≥ 50 yr.
Ojengbede et al. [29]	Nigeria	5001 women aged ≥ 18 yr from Ibadan	Community-based, cluster sample, interview survey in 2009	UII = current leakage associated with an urge to void or leakage before reaching the bathroom; SUI = current incontinence complaint associated with cough, laughing, walking, lifting a heavy object, sneezing, climbing/standing up, deep breathing and whistling	Overall: UII: 1.0%; MUI: 0.6%; SUI: 2.3% for women aged ≥ 18 yr.

Zhu et al. [30]	China	19 024 women aged ≥ 20 yr from Beijing and seven provinces	Random sample, cross-sectional, interview survey	2002 ICS UUI = complaint of involuntary leakage accompanied by or immediately preceded by urgency; Modified Bristol Female LUTS questionnaires	Overall: 2.6% for women aged ≥ 20 yr. By age: UUI prevalence increased from 1.3% in women aged 20–30 yr to 5.7% in women aged 60–70 yr. Increased age was independent risk factor for UUI in multivariate analysis (OR: 2.3; 95% CI, 1.4–3.8 for ≥ 60 vs 20–40 yr).
Lee et al. [31]	Korea	13 484 household women aged ≥ 19 yr	Population-based, nationally representative, interview survey in 2005 (100%)	2002 ICS In previous 30 d: (1) Leakage or loss of urine due to an urge to urinate but unable to get to the toilet before losing urine, and/or (2) A strong sudden urge to get to a toilet to urinate with no advanced warning	Overall: 1.9% of women aged ≥ 19 yr reported UUI only; 10.1% reported MUI; 11.9% reported SUI only. By age: UUI only prevalence lowest in women aged 45–59 yr; MUI prevalence increased with age; SUI only prevalence lowest in women aged ≥ 60 yr.
Tennstedt et al. [32]	United States	5506 adults aged 30–79 yr (2301 men; 3205 women; 1770 blacks; 1877 Hispanics; 1859 whites)	Population-based, random sample, in-person interview survey in 2002–2005 (63%)	(1) During the last 7 d, how many times did you accidentally leak urine (a) When performing physical activity such as coughing, sneezing, lifting, or exercise? (b) When you had strong feeling of need to empty your bladder but couldn't get to toilet fast enough? (c) Without any particular activity or warning? UUI = one or more times to question b only; MUI = one or more times to questions a and b	Overall: Men: 0.9% reported weekly UUI; 0.8% reported weekly MUI; 0.5% reported weekly SUI. Women: 1.1% reported weekly UUI; 5.9% reported weekly MUI; 2.7% reported weekly SUI. By race: Men: weekly UUI reported by 1.4% blacks, 1.0% Hispanics, 0.6% whites; weekly MUI reported by 1.3% blacks, 0.6% Hispanics, 0.7% whites; weekly SUI reported by 0.4% blacks, 0.4% Hispanics, 0.6% whites. Women: weekly UUI reported by 0.3% blacks, 1.0% Hispanics, 1.6% whites; weekly MUI reported by 7.7% blacks, 5.0% Hispanics, 5.2% whites; weekly SUI reported by 0.9% blacks, 1.1% Hispanics, 4.1% whites.
Zhu et al. [33]	China	5221 women aged ≥ 20 yr in Beijing	Population-based, cross-sectional, random sample, in-person interview survey in 2005 (99%)	UI = any leakage or involuntary loss of urine within the previous 1 mo; UUI = an urge to urinate but being unable to reach the toilet before leaking or having a strong sudden urge to go to the toilet to urinate with no advance warning; SUI = leak or loss of urine caused by sneezing, coughing, exercising, lifting, or physical activity	Overall: UUI: 2.8%; MUI: 12.4%; SUI: 22.9% of women aged ≥ 20 yr. By age: UUI only prevalence increased with age until 70–80 yr and then decreased; MUI prevalence increased with age; SUI prevalence increased with age until 50–60 yr and then decreased through 80–90 yr.
Diokno et al. [34]; Benner et al. [35]	United States	21 590 male heads of household aged ≥ 18 yr matched to 2000 US census for age, geographic region, income, household size 162 906 men and women aged ≥ 18 yr matched to 2000 US census for age, geographic region, income, household size	Random sample, cross-sectional, mail survey in 2001 (67%) Population-based, cross-sectional, mail survey in 2005 (63%)	UUI = yes to at least one of two questions on leakage or loss of urine because of an urge to urinate with no advanced warning during last 30 d; MUI = reported at least one UUI and at least one SUI symptom	Overall: 5.7% of men aged ≥ 18 y reported UUI; 2.4% reported MUI; 3.1% reported SUI. By age: UUI prevalence increased with age in men; bothersome UUI prevalence increased with age in men and women aged ≥ 18 yr.
Irwin et al. [9]	Canada, Germany, Italy, Sweden, United Kingdom	19 165 men and women aged ≥ 18 y	Population-based, cross-sectional, computer-assisted telephone interview survey in 2005 (33%)	2002 ICS UUI = involuntary leakage accompanied or immediately preceded by urgency	Overall: Men: 1.8% of men aged ≥ 18 yr reported UUI (1.3% UUI only; 0.6% MUI). Women: 3.9% of women aged ≥ 18 yr reported UUI (1.5% UUI only; 2.4% MUI). By age: UUI alone and MUI prevalence in men and women increased with increasing age, especially ≥ 60 yr.

Table 1 (Continued)

Study	Country	Sample	Survey (response rate)	UII definition	UII prevalence
Perry et al. [36]	United Kingdom	12 568 women aged ≥ 40 yr at baseline and 9596 at 1-yr follow-up	Random sample, cross-sectional, postal survey of community-dwelling women from general practitioners' lists in 1998 (65%); 1-yr follow-up survey in 1999 (80%)	1988 ICS UI = a clinically significant case if it occurred at least several times a month; UII = Do you have such a strong desire to pass urine that you leak before reaching the toilet? SUI = Does any urine leak when you laugh, cough, or exercise?	Overall: UII: 15.3%; SUI: 17.8% for women aged ≥ 40 yr. By age: A 1-yr increase in age was a significant predictor of UII in multivariate analysis (OR: 1.02; 95% CI, 1.01–1.03).
Rohr et al. [37]	Denmark	5221 women aged ≥ 46 yr from three surveys using same questionnaire	Population-based, cross-sectional, interview surveys in 1995–1999 (63–83%)	2002 ICS During the past month, have you experienced such a strong urge to pass water that you had trouble getting to the toilet in time? (once during the past month/several times but less than once a week/once or several times a week but not daily/daily) UII = more than once a month	By age: UII: 9.1% (95% CI, 7.6–10.7) for women aged < 60 yr; 16.4% (95% CI, 14.9–18.0) for women aged 60–80 yr; 29.7% (95% CI, 27.8–31.7) for women aged > 80 yr; MUI: 20.1% (95% CI, 18.0–22.3) for women aged < 60 yr; 29.8% (95% CI, 27.9–31.8) for women aged 60–80 yr; 43.7% (95% CI, 41.5–45.8) for women aged > 80 yr. Increased age was independent risk factor for UII and MUI in multivariate analyses.
Tegerstedt et al. [38]	Sweden	5489 women aged 30–79 yr from Swedish population register for Stockholm	Representative sample, cross-sectional, mail survey (69%)	Do you suddenly feel the urge to go to the toilet and then accidentally leak urine? (often/sometimes-infrequently/never)	Overall: UII only (often): 2.7% (95% CI, 2.3–3.1) for women aged 30–79 yr; MUI (often): 5.8% (95% CI, 5.2–6.5); SUI only (often): 3.2% (95% CI, 2.7–3.6). By age: UII increased monotonically with increasing age.
Stewart et al. [5]	United States	5204 adults aged ≥ 18 yr (2469 men; 2735 women) in initial survey	Population-based, cross-sectional, telephone survey in 2000–2001 (68%)	(1) At least four urgency episodes in the last 4 wk (2) Either at least eight micturitions per day or use of a coping strategy (3) At least three episodes of urinary leakage in the past 4 wk not due exclusively to SUI	Overall: UII: 6.1% (2.6% for men; 9.3% for women; did not vary by race) for adults aged ≥ 18 yr. By age and gender: significantly steeper age-related increase in UII in women compared with men (eg, 19.1% for women aged 65–74 yr vs 8.2% for men aged 65–74 yr).
Goepel et al. [39]	Germany	211 648 men and women aged ≥ 20 yr consecutively visiting gynecologists or ≥ 40 yr visiting primary care physicians/urologists for any reason	Representative random sample survey of patients visiting a physician's office in 1999	Self-designed question: Do you sometimes have a strong feeling of uncontrollable urgency and lose urine before reaching a toilet?	Overall: 20.2% (14.3% for men; 22.8% for women aged ≥ 20 yr) Women compared with men: OR: 2.3 (95% CI, 2.3–2.4). By age: UII prevalence increased with increasing age: OR: 41.1 (95% CI, 36.3–46.6) for > 80 yr compared with 20–29 yr.
Milsom et al. [10]	France, Germany, Italy, Spain, Sweden, United Kingdom	16 776 adults (7048 men; 9728 women) aged ≥ 40 yr	Population-based, random sample, telephone or interview survey	(1) Am unable to get to the bathroom in time to urinate (2) Have wetting accidents at night while asleep (3) Have a sudden and uncontrolled loss of urine (4) Leak urine during the day without being able to control it OAB = frequency, urgency, or UII either singly or in any combination	Overall: 6.0% reported UII (ie, 36% of 16.6% with OAB) for adults aged ≥ 40 yr; more prevalent in women than in men.
Lapitan et al. [40]	Thailand, Philippines, Taiwan, India, Pakistan, South Korea, Hong Kong, Malaysia, Indonesia, Singapore, China	5502 women aged ≥ 18 yr visiting outpatient clinics	Clinic-based, random sample survey of women consulting at outpatient clinics for nonurologic or nongynecologic problems	Urinary leakage associated with urgency	Overall: 11.4% for women aged ≥ 18 yr.

Hannestad et al. [41]	Norway	27 936 community-dwelling women aged ≥ 20 yr	Community-based mail survey in 1995–1997 (80%)	(1) Do you have involuntary loss of urine? (2) Do you have involuntary loss of urine in connection with coughing, sneezing, laughing, lifting heavy items? (3) Do you have involuntary loss of urine in connection with sudden and strong urge to void?	Overall: 2.7% of women aged ≥ 20 yr reported UUI; 8.9% reported MUI; 12.3% reported SUI. By age: UUI most prevalent among women < 35 and > 65 yr; MUI prevalence generally increased with age.
Brown et al. [42]	United States	6049 community-dwelling white women aged 72–99 yr from population-based listings at four clinical centers who provided UI information and one follow-up on falls	Population-based longitudinal survey in 1994–1996	(1) During the last 12 mo, have you ever leaked or lost control of your urine? If yes, (2) How often does this leakage of urine usually occur? (daily/one or more times per week but not every day/at least once per month but not every week/less than once per month) (3) Under what circumstances does your leakage of urine usually occur? (when I cough/sneeze/laugh/lift/stand up/exercise and so on (SUI); when I have the urge to urinate and can't get to the toilet fast enough (UUI); when I am sleeping/napping/dozing (other) UUI = (1) yes and (2) at least weekly and (3) UUI Arriving too late at the toilet	Overall: 24.7% of women aged 72–99 yr reported weekly UUI; 11.7% reported weekly MUI; 18.8% reported weekly SUI.
Schulman et al. [43]	Belgium	5269 adults (2499 men and 2770 women) aged ≥ 30 yr	Population-based home survey of community-dwelling adults in 1994–1995 (89%)	UUI = (1) yes and (2) at least weekly and (3) UUI Arriving too late at the toilet	Overall: UUI: 2.6%; MUI: 1.0%; SUI: 5.5% for adults aged ≥ 30 yr. By age: UUI and MUI prevalence increased markedly with age.

CI = confidence interval; EpiLUTS = Epidemiology of Lower Urinary Tract Symptoms; ICS = International Continence Society; LUTS = lower urinary tract symptoms; MUI = mixed urinary incontinence; OAB = overactive bladder; OR = odds ratio; SUI = stress urinary incontinence; UI = urinary incontinence; UUI = urgency urinary incontinence.

Studies are listed chronologically by publication year according to number of adults assessed.

Table 2 – Smaller-scale studies (<5000 to ≥ 2500 adults) evaluating the prevalence of urgency urinary incontinence

Study	Country	Sample	Survey (response rate)	UUI definition	UUI prevalence
Pöyhönen et al. [44]	Finland	4384 men aged 30–80 yr	Population-based mail survey in 2004 (59%)	DAN-PSS-1 questionnaire; symptom severity rated by respondent on scale from 0 (no symptoms) to 3 (severe)	Overall: UUI: 18.2% (16.5% mild or moderate; 1.7% severe); SUI: 8.7% (8.0% mild or moderate, 0.7% severe); other UI: 7.0% (6.1% mild or moderate; 0.9% severe).
Vaughn et al. [45]	Finland	3535 adults (1682 men; 1853 women) aged 18–79 yr	Population-based survey in 2003–2004	Question from the DAN-PSS on UUI frequency: (1) Is the compulsion to pass urine so strong that urine starts to flow before you reach the toilet? (never/rarely/often/always) UUI = rarely, often, or always	Overall (any UUI for adults aged 18–79 yr): men: 10.7% (95% CI, 8.9–12.4); women: 25.7% (95% CI, 22.8–28.7).
Ge et al. [46]	China	3058 women aged 20–96 yr from Beijing	Population-based, face-to-face interview survey in 2009 (99%)	ICS 2002 Complaint of involuntary leakage accompanied by or immediately preceded by urgency	Overall: UUI: 1.7%; MUI: 7.5%; SUI: 12.9%. By age: UUI increased with age, with highest rate for women aged ≥ 70 yr (approximately 5%).
Qiu et al. [47]	China	2603 women aged ≥ 20 yr	Population-based, cross-sectional, interview survey in 2006 (96%)	ICS 2002 Complaint of involuntary leakage accompanied by or immediately preceded by urgency	Overall: UUI: 2.7%; MUI: 18.6%; SUI: 19.9% for women aged 18–79 yr.

Table 2 (Continued)

Study	Country	Sample	Survey (response rate)	UUI definition	UUI prevalence
Dooley et al. [48]	United States	4229 community-dwelling women (2449 white; 869 black; 911 Mexican American) aged ≥ 20 yr	NHANES 2001–2004 representative sample, interview survey	During the past 12 mo have you leaked or lost control of even a small amount of urine with an urge or pressure to urinate and you could not get to the toilet fast enough? UUI = UUI only; MUI = UUI and SUI	Overall: UUI only: 7.9%; MUI 17.0%; SUI only: 24.7% for women aged ≥ 20 yr. By age: UUI: 4.6% for 20–39 yr; 8.7% for 40–59 yr; 11.7% for ≥ 60 yr. MUI: 7.7% for 20–39 yr; 18.6% for 40–59 yr; 28.7% for ≥ 60 yr. By race: UUI: 7.5% for whites; 11.0% for blacks; 7.5% for Mexican Americans (white women: OR: 0.6; 95% CI, 0.4–0.8 for UUI vs black women in multivariate analysis). MUI: 17.8% for whites; 14.3% for blacks; 13.2% for Mexican Americans (white women: OR: 1.5; 95% CI, 1.1–2.0 for UUI vs black women in multivariate analysis). SUI: 26.5% for whites; 7.1% for blacks; 21.2% for Mexican Americans (white women: OR: 2.8; 95% CI, 2.1–3.8 for UUI compared with black women; Mexican American women: OR: 2.5; 95% CI, 1.9–3.4 vs black women in multivariate analysis).
Fenner et al. [49]	United States	2814 community-dwelling women (892 white; 1922 black) aged 35–64 yr	Population-based, cross-sectional, telephone survey in 2002–2004 (69%)	Report of losing urine at least 12 times in the last 12 mo: were asked additional questions regarding their urine loss, including frequency, amount, and instigating situations and activities UUI = often losing urine for at least one question that factored with urge component	Overall: UUI only: 3.6% for women aged 35–64 yr (black: 6.4%; white: 2.9%; $p < 0.001$). MUI: 6.0% (black: 7.4%; white: 5.7%; $p = 0.10$). SUI only: 9.6% (black: 6.6%; white: 10.3%; $p < 0.01$).
Tikkinen et al. [50]	Finland	3349 adults (1602 men; 1747 women) aged 18–79 yr	Population-based, age-standardized, mail survey in 2003–2004 (62%)	2002 ICS DAN-PSS: Is the urge so strong that urine starts to flow before you reach the toilet? (never, rarely, often, always) UUI = often or always; excluded subjects with UTI	Overall: Men: 0.7% (11% of 6.5% with OAB) aged 18–79 yr; women: 2.5% (27% of 9.3% with OAB).
Waetjen et al. [51]	United States	3301 women aged 42–52 yr from seven sites (450 women per site to include a Caucasian group and one designated minority group; African American at four sites and Chinese, Japanese, and Hispanic at one site each)	Longitudinal, community-based, prospective cohort study of women from five different racial/ethnic groups	At least monthly leakage when you have the urge to void and can't reach the toilet fast enough (at baseline)	Overall: UUI (at least monthly): 7.6% for women aged 42–52 yr; MUI (at least monthly): 12.4%; SUI (at least monthly): 25.2%. By race: White: UUI: 7.8%; MUI: 15.5%; SUI 31.8%. African American: UUI: 11.8%; MUI: 12.9%; SUI 13.1%. Chinese: UUI: 3.2%; MUI: 7.2%; SUI 23.3%. Japanese: UUI: 3.8%; MUI: 6.8%; SUI 31.1%. Hispanic: UUI: 1.4%; MUI: 4.8%; SUI 21.3%. $p = 0.02$ for UUI across racial groups; $p = 0.60$ for MUI; $p < 0.01$ for SUI.
Zhang et al. [52]	China	4684 women aged ≥ 20 yr from Fuzhou (3% of national census record)	Random sample mail survey in 2002 (77%)	Involuntary urine loss \geq preceded by a sudden urge to void or uncontrollable voiding with little or no warning (in the last month)	Overall: UUI: 10.0% for women aged ≥ 20 yr. By age: UUI increased with age, especially after 40–49 yr.
Homma et al. [53]	Japan	2100 men and 2380 women aged ≥ 40 yr	Random sample, self-administered, mail survey in 2002–2003 (45%)	2002 ICS	Overall: UUI (at least weekly): 9% (7% men; 10% women) for adults aged ≥ 40 yr (extrapolated to Japanese population: 6%). UUI (at least daily): 5% (5% men; 6% women) (extrapolated to Japanese population: 3%). By age: UUI increased with increasing age ($r = 0.29$).
Song et al. [54]	South Korea	3371 women aged 30–89 yr	Community-based cross-sectional survey in 2000 (75%)	(1) Complaint of involuntary loss of urine once a month (2) During the last year, when leakage of urine has occurred, were you aware of the need to urinate before the leakage occurred?	Overall: UUI (at least monthly): 0.4% for women aged 30–89 yr; MUI (at least monthly): 15.5%; SUI (at least monthly): 47.5%.

Thom et al. [55]	United States	2109 women aged 40–69 yr as of 1999 with goal of approximately 20% black, approximately 20% Hispanic, approximately 20% Asian American, approximately 40% white	Population-based cohort study with self-report questionnaires and interviews	At least one episode in last 12 mo (with a physical sense of urgency), by less than monthly, monthly, weekly, or daily frequency UII = UII only or MUI with the majority of episodes being urge (rather than stress)	By race: UII only (at least weekly, adjusted for age): 4.8% for whites; 7.6% for blacks; 5.8% for Hispanics; 3.0% for Asian Americans ($p < 0.03$). MUI (predominantly urge; at least weekly; adjusted for age): 4.0% for whites; 6.0% for blacks; 4.2% for Hispanics; 4.4% for Asian Americans (not significant). MUI (equal urge and stress; at least weekly; adjusted for age): 3.3% for whites; 1.9% for blacks; 5.3% for Hispanics; 3.2% for Asian Americans (not significant). UII only or MUI with the majority of episodes being urge (at least weekly); OR similar in black, Hispanic, and Asian American women compared with white women after adjusting for age, parity, hysterectomy, estrogen use, BMI, menopausal status, diabetes. Overall: UII: 2.0%; MUI: 1.7%; SUI: 12.1% for female nurses aged 20–64 yr. By age: UII prevalence increased with age; SUI prevalence increased with age until 40–49 yr.
Araki et al. [56]	Japan	3734 female nurses aged 20–64 yr from 52 hospitals	Mail survey in 2003 (52%)	International Consultation on Incontinence questionnaire	Overall: UII (at least monthly): 5.4%; MUI (at least monthly): 21.3%; SUI (at least monthly): 14.0% for women aged 30–90 yr. By age: UII and MUI prevalence increased with age; SUI prevalence decreased with age.
Melville et al. [57]	United States	3438 women aged 30–90 yr from a health maintenance organization in Washington State	Population-based mail survey in 2002 (64%)	Leaking or losing urine associated with an urge to urinate so strong and sudden that the participant could not reach the toilet fast enough	Overall: OAB with UII: 2.3% (2% in men; 2.6% in women) for adults aged ≥ 35 yr. OAB without UII: 13.6% (11.7% in men; 15.6% in women). By age and gender: increase in prevalence of OAB with UII in men with increasing age; stable prevalence of OAB with UII (at least monthly) in women aged ≥ 55 yr.
Corcos et al. [58]	Canada	3249 adults aged ≥ 35 yr	Population-based, computer-assisted, telephone interview survey (54%)	ICS 2002 OAB-wet = OAB with UII; OAB-dry = OAB without UII	Overall: UII baseline (1995): 15.1% for men aged 50–70 yr; 5-yr follow-up (1999): 23.3%.
Hakkinen et al. [59]	Finland	2198 men in 1995 aged 50–70 yr and 2133 men at 5-yr follow-up in 1999 (mean: 63 yr)	Representative, random sample, mail survey in 1995 (70%) and 1999 (75%)	DAN-PSS	Overall: UII: 8.7% for women aged 18–49 yr.
Siracusano et al. [60]	Italy	3557 women aged 18–49 yr	Representative sample survey (36%)	Have you ever released urine as soon as you felt an uncontrollable stimulus before reaching the bathroom?	Overall: UII (at least weekly): 7.2% (95% CI, 6.2–8.2) for women aged 40–60 yr. By age: UII significantly increased with age (OR: 1.6 at 45 yr; 2.1 at 50 yr; 2.4 at 55 yr; 2.7 at 60 vs 40 yr).
Moller et al. [61]	Denmark	2757 women aged 40–60 yr	Random sample cohort study with mail survey in 1996 (72%)	1990 ICS (leakage associated with urgency) Do you leak urine if suddenly you need to rush to the toilet? (no/sometimes/weekly or more often/daily or more often)	Overall: Any UII (weekly): 42.5% for women aged < 80 yr. UII only (weekly): 14.4%. UII-predominant MUI (weekly): 5.9%. Equal UII/SUI (weekly): 12.3%. SUI-predominant MUI: 10.2%. By age: UII significantly associated with age (OR: 1.2 for each 5-yr increase; 95% CI, 1.1–1.3) in multivariate analysis.
Brown et al. [62]	United States	2763 women at 20 clinical centers aged < 80 yr, had proven coronary heart disease, and had a uterus	4-yr, multicenter, randomized, blinded trial	During the prior week, how many times, on average, have you unintentionally leaked some urine before you could get to the bathroom?	Overall: UII: 8.3%; MUI: 6.8%; SUI: 14.7% for women aged 30–59 yr.
Foldspang et al. [63]	Denmark	2613 women aged 30–59 yr	Random sample, cross-sectional, mail survey in 1988 (85%)	If present, were urinary incontinence episodes generally provoked by physical stress, for example, lifting, coughing, sneezing or laughing (stress incontinence), or accompanied by a feeling of urge to void (urge incontinence) or both (mixed incontinence)?	

BMI = body mass index; CI = confidence interval; DAN-PSS = Danish Prostatic Symptom Score; ICS = International Continence Society; MUI = mixed urinary incontinence; NHANES = National Health and Nutrition Examination Survey; OAB = overactive bladder; OR = odds ratio; SUI = stress urinary incontinence; UI = urinary incontinence; UTI = urinary tract infection; UII = urgency urinary incontinence; WTP = willingness to pay. Studies are listed chronologically by publication year according to number of adults assessed.

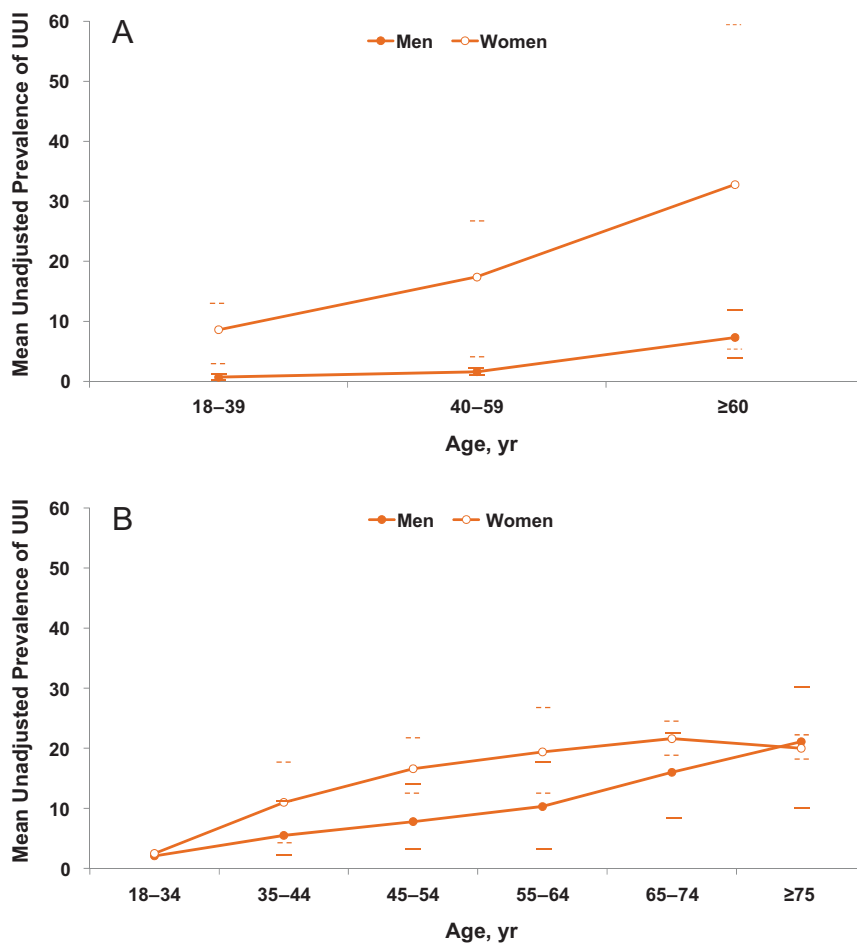


Fig. 2 – Unadjusted mean prevalence estimates of urgency urinary incontinence (UUI; ie, UUI only and/or mixed urinary incontinence [MUI]) for men and women according to age. The population-based or random sample studies included were published in peer-reviewed journals in the English language and included ≥ 2500 adults, with prevalence data either directly reported as or imputed from broader age intervals to (a) 20-yr age intervals (20 studies) or (b) 10-yr age intervals (5 studies) shown. For studies that reported separate rates for UUI, MUI, and stress urinary incontinence, the UUI prevalence rate was calculated based on the sum of UUI and MUI rates. Solid range bars (men) and dashed range bars (women) indicate the minimal and maximal values for each age interval.

and population estimates from the US Census Bureau International Data Base estimated that the worldwide number of adults aged ≥ 20 yr with either UUI alone or MUI was 103 million in 2008, with projected increases to 115 million in 2013 and 127 million in 2018 [11]. These projections further indicate the high and increasing prevalence of UUI worldwide. The authors of this analysis suggested that the results should lead to the development of education and intervention programs to increase awareness, acceptance, prevention, diagnosis, and effective management of UUI and other lower urinary tract symptoms (LUTS) [11].

3.2. Economic burden of urgency urinary incontinence

The economic burden of a disease is the total cost of all resources used or lost by patients and society as a result of the disease. The total costs associated with UUI include direct costs (eg, incontinence pad costs, diagnosis and treatment costs, and costs associated with comorbid conditions), indirect costs (eg, lost wages for patients and caregivers,

costs from lost productivity due to absenteeism and presenteeism, and mortality costs), and intangible costs (eg, costs of pain and suffering) [12]. The percentage of adults who have a disease must be determined to estimate the direct and indirect costs to society. The exact economic burden of UUI on individuals and society may be difficult to estimate, as many prevalence studies do not report the severity and frequency of UUI or the level of symptom bother. Eleven retained articles from the literature search that describe national and patient-based studies of the economic burden of UUI in Europe and Canada, the United States, and Australia are summarized in Table 3.

3.2.1. National studies in Europe and Canada

In the most recent study, which estimated costs in 2005 euros, the total direct costs (ie, medical visits, medical treatments, incontinence pads, diagnostics, and depression treatments, excluding nursing home and work absenteeism costs) of OAB with UUI for subjects aged ≥ 18 yr from six Western countries (Canada, Germany, Italy, Spain, Sweden, and the United Kingdom) were

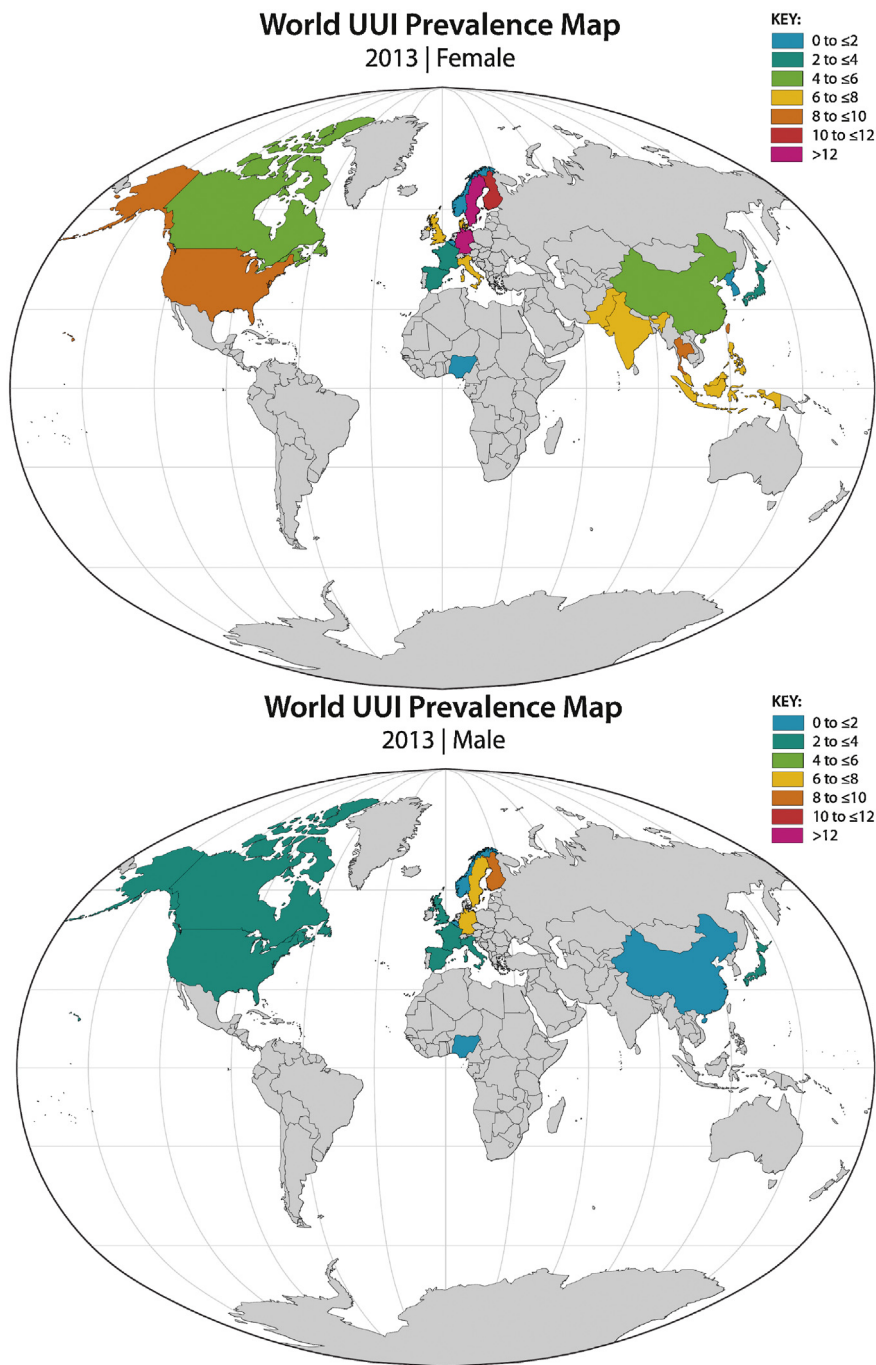


Fig. 3 – World map illustrating urgency urinary incontinence (UUI) prevalence rates for adult men and women. Prevalence rates reported in each captured study were adjusted for the current age distribution of the country's population obtained from the International Data Base of the US Census Bureau [64]. Age-adjusted prevalence rates were averaged when more than one study had been performed in a single country. For studies that reported separate rates for UUI, mixed urinary incontinence (MUI), and stress urinary incontinence, the UUI prevalence rate was calculated based on the sum of UUI and MUI rates.

estimated to be approximately €2.1 billion per year (OAB without UUI: €1.8 billion per year) (Table 3) [13]. Of note, the estimated nursing home costs attributable to OAB with UUI for subjects >60 yr from these same countries was €4.7 billion per year (OAB without UUI: not assessed), and the estimated cost of work absenteeism attributable to OAB with UUI was €238 million per year (OAB without UUI: €858 million per year) [13]. The cost of lost

productivity due to absenteeism and intangible costs were not assessed in the study. The assessed total cost of OAB with UUI was estimated at approximately €7.0 billion in 2005 for the six Western countries, with nursing home admission costs for subjects with UUI a major contributor [13].

The annual total direct cost, in 2000 euros, of OAB with or without UUI for patients aged ≥40 yr from five European

Table 3 – Studies of urgency urinary incontinence economic costs

Study	Sample	Cost components	Model and data used in cost assessments	Costs per year
Europe/Canada Irwin et al. [13]	EPIC study prevalence data for OAB and UUI (adults ≥ 18 yr from Canada, Germany, Italy, Spain, Sweden, United Kingdom)	Direct costs: prescription medications, medical visits, diagnostics, pads, depression, UTIs, skin infections, fractures from fall Indirect costs: nursing home admission (UUI), lost work productivity due to absenteeism (OAB)	Cost-of-illness, prevalence-based model using 1-yr time frame Limitations: lost productivity due to absenteeism and intangible costs not included	Overall costs (2005 euros) for six countries: OAB with UUI: approximately €7.0 billion/yr Canada: €252 million/yr Germany: €543 million/yr Italy: €290 million/yr Spain: €172 million/yr Sweden: €206 million/yr UK: €595 million/yr Direct costs: OAB with UUI: €2.1 billion/yr OAB without UUI: €1.8 billion/yr Indirect costs (€2005): Nursing home: €4.7 billion/yr (all attributable to OAB with UUI) Lost productivity: OAB with UUI: €238 million/yr OAB without UUI: €858 million/yr
Reeves et al. [14]	Prevalence data for OAB and UUI (adults ≥ 40 yr from Germany, Italy, Spain, Sweden, United Kingdom) [10]	Direct costs: drug treatment, physician visits, diagnostics, pads, UTIs, skin conditions, falls/fractures	Cost-of-illness, prevalence-based model Limitations: indirect and intangible costs not included; prevalence data not based on current ICS definition	Direct costs (2000 euros) for five countries: Total OAB: €4.2 billion/yr OAB with UUI: approximately €2.9 billion/yr (70% of total direct costs; country range: 26–91%) Incontinence pad use: 63% of total per-patient costs (country range: 19–88%)
Papanicolaou et al. [15]	PURE study subpopulation with prevalence data for UUI/MUI/SUI (under treatment or treatment-seeking women ≥ 18 yr from Germany, Spain, United Kingdom/Ireland)	Direct costs: UI medication, conservative treatment, health care provider visits, diagnostics, incontinence products	Cost-of-illness, prevalence-based model Limitations: data collected retrospectively; only women who sought treatment included in analysis; indirect and intangible costs not included	Mean per capita direct costs of UI treatment: Germany: UUI: €398/yr; MUI: €498/yr; SUI: €349/yr Spain: UUI: €615/yr; MUI: €600/yr; SUI: €464/yr United Kingdom/Ireland: UUI: €300/yr; MUI: €365/yr; SUI: €271/yr Incontinence pad use was most costly component (51%) of direct costs
Johannesson et al. [16]	437 patients in Sweden with UUI or MUI	Intangible costs: WTP for reduction in micturitions and urine leakages for patients with UUI	Regression analysis with the probit model	Median (mean) WTP per month: 240 (530) Swedish kronor for a 25% reduction in micturitions and urine leakages; 470 (1030) Swedish kronor for a 50% reduction in micturitions and urine leakages WTP significantly correlated with degree of reduction
United States Ganz et al. [17]	All subjects aged ≥ 25 yr with OAB (urgency with UUI) from community and institutions	Direct costs: physician visits, diagnostic laboratory tests, anticholinergic medications, OTC medications, physical therapy, surgical procedures, ER visits, UTI treatment, falls/fractures costs, OAB-related depression costs, OAB-related nursing home costs, pantliners, pads, diapers, latex gloves, bedside toilet, skin protection Indirect costs: lost work productivity of patient	Cost-of-illness, prevalence-based model, using NOBLE study age- and gender-specific prevalence data for OAB with UUI, US Census Bureau data, usage data, and NOBLE study work productivity data Limitations: intangible costs not included	Overall costs (2007 US dollars): Annual per capita: \$1925 Total annual: \$65.9 billion Direct costs (2007 US dollars): Annual per capita: \$1499 Total annual: \$51.4 billion Indirect costs (\$2007): Annual per capita: \$426 Total annual: \$14.6 billion Projected costs: Annual per capita: \$1944 in 2015; \$1969 in 2020 Total annual: \$76.2 billion in 2015; \$82.6 billion in 2020
Subak et al. [21]	Population-based study conducted from 1999 to 2003 of 528 community-dwelling women aged 40–69 yr with at least weekly UUI, MUI, or SUI	Direct costs: routine care (pads, diapers, laundry, dry cleaning, other)	Direct costs of routine care of UI Limitations: other direct costs, indirect costs, and intangible costs not included	Direct costs of routine care (2005 US dollars): Mean cost per week: \$6.35 for MUI; \$6.02 for UUI; \$3.91 for SUI Mean annual cost: \$330 for MUI; \$313 for UUI; \$203 for SUI Among women with UI-related cost in multivariate analysis: routine care cost was 42% higher for MUI compared with SUI ($p = 0.05$)

Subak et al. [22]	Cross-sectional survey of 293 community-dwelling women aged ≥ 40 yr with at least three UI episodes per week, seeking treatment, not treated in prior 3 mo; conducted in 2005 at five sites	Direct costs: routine care (pads, diapers, toilet paper, paper towels, laundry, dry cleaning) Intangible costs: WTP for improvement in incontinence episode frequency	Direct costs of routine care of UI (pads, diapers, toilet paper, paper towels, laundry, dry cleaning) and WTP for UI improvement were assessed by UI type Limitations: other direct costs and indirect costs not included; assessed only untreated women seeking treatment; WTP can be sensitive to survey methodology and statistical analyses used	Direct costs of routine care (2005 US dollars): Median cost per week: \$6.57 for UUI; \$3.96 for MUI; \$2.31 for SUI In multivariate analysis: Cost ratio (95% CI) compared with SUI: 1.7 (1.3–2.1) for UUI ($p < 0.001$) 1.5 (1.0–2.1) for MUI ($p = 0.05$) Intangible costs (2005 US dollars): Women WTP mean of \$28/mo (\$336/yr) for 25% improvement in UI frequency, \$39/mo (\$468/yr) for 50% improvement, \$49/mo (\$588/yr) for 75% improvement, \$70/mo (\$840/yr) for 100% improvement ($p < 0.001$); WTP not significantly associated with UI type
Hu et al. [19]	Adults with OAB and UUI in a nursing home	Direct costs: diagnostic costs, treatment costs, routine care costs, consequences costs	Method of aggregating individual-level data pertaining to the average cost of treatment or supply use, multiplied by the average amount of health care use, to determine the cost of illness	Total direct costs of OAB with UUI in institutional setting (2000 US dollars): \$2.85 billion Routine care costs: \$2.77 billion Other costs: \$0.08 billion Per capita: \$5635/yr
Wilson et al. [20]	Adults of all age groups from community and institutions	Direct costs: pharmacologic treatment	Prevalence-based model, using UI prevalence data from published studies, US Census Bureau data, diagnosis and treatment algorithms, and mean Medicare reimbursement data Limitations: assumptions regarding individuals residing in community compared with institution and type of UI in community; indirect and intangible costs not included; only pharmacologic treatment cost reported by type of UI	Total UI treatment (1995 US dollars): \$1.3 billion (SUI: 82%; MUI: 12%; UUI: 4%)
O'Connor et al. [23]	257 nonrandomly selected patients with UUI or MUI who completed a self-administered mail survey in 1997	Intangible costs: WTP for reduction in micturitions and urine leakages	Contingent valuation method Limitations: nonrandom sample; WTP can be sensitive to survey methodology and statistical analyses used	Intangible costs: For a 25% reduction in UUI/MUI symptoms, 70% of respondents willing to pay \$10/mo and 4% willing to pay \$400/mo; for a 50% reduction in UUI/MUI symptoms, 95% of respondents willing to pay \$10/mo and 13% willing to pay \$400/mo; median willingness to pay was \$27/mo for 25% reduction and \$76 for 50% reduction in symptoms
Australia Dowell et al. [24]	97 community-dwelling women aged 24–88 yr with UUI, MUI, or SUI	Direct costs: personal costs (pads, other protection products, laundry, miscellaneous), treatment costs (health care visits, diagnostics, medications, surgery)	Dowell-Bryant Incontinence Cost Index	Per capita direct costs (1999 Australian dollars): UUI: A\$16.4/wk (A\$853/yr) MUI: A\$9.6/wk (A\$499/yr) SUI: A\$19.1/wk (A\$993/yr) Direct costs significantly correlated with severity and weekly frequency of UI (both $p \leq 0.005$)

ER = emergency room; ICS = International Continence Society; NOBLE = National Overactive Bladder Evaluation; MIU = mixed urinary incontinence; OAB = overactive bladder; OTC = over-the-counter; PURE = Prospective Urinary Incontinence Research; SUI = stress urinary incontinence; UI = urinary incontinence; UTI = urinary tract infection; UUI = urgency urinary incontinence; WTP = willingness to pay.

countries (Germany, Italy, Spain, Sweden, and the United Kingdom) was estimated to increase from €4.2 billion in 2000 to €5.2 billion by 2020 (mean 26% increase; country range: 21–33%) (Table 3) [14]. The cost of managing OAB patients with UUI was estimated at a mean of 70% (country range: 26–91%) of the €4.2 billion total cost of managing all OAB patients (ie, approximately €2.9 billion). The per-patient per-year cost of managing OAB ranged from €269 in the United Kingdom to €706 in Italy. The largest driver of these costs was the cost of incontinence pad use, which accounted for a mean of 63% of the total annual per-patient cost of OAB (country range: 19–88%) [14].

The total direct costs of treatment (ie, costs of medication, conservative treatment, health care provider visits, diagnostics, and incontinence products) were estimated for women seeking treatment of UI in three European countries (Germany, Spain, and the United Kingdom/Ireland) from the Prospective Urinary Incontinence Research study, stratified by UI subtype [15]. The mean annual per capita cost of UUI treatment varied in the three countries: €300 in the United Kingdom/Ireland, €398 in Germany, and €615 in Spain. In each country, the mean annual per capita cost of UUI was higher than that of SUI and was generally lower than that of MUI (Table 3). The cost of incontinence pads was the largest contributor (51%) to the treatment cost [15].

Intangible costs associated with UUI were assessed with willingness-to-pay questions regarding a 25% or 50% reduction in micturitions and urinary leakages in Swedish patients [16]. Patients with UUI or MUI reported that they were willing to pay a median of 240 Swedish kronor (approximately €28.80) monthly for a 25% reduction in UUI symptoms and 470 Swedish kronor (approximately €64.80) monthly for a 50% reduction in UUI symptoms.

3.2.2. National studies in the United States

National direct and indirect costs of OAB in the United States were examined using data on the prevalence of OAB with UUI from the National Overactive Bladder Evaluation (NOBLE) study (Table 3) [17]. In 2007, the annual per capita cost of OAB was estimated to be \$1925 (75% direct medical costs, 22% lost productivity, 4% direct nonmedical costs), which corresponds to \$65.9 billion for the estimated 34 million individuals with OAB (of the total 2007 US population of approximately 302 million) [18]. Per capita costs of OAB were projected to increase to \$1970 by 2020, with direct medical costs accounting for 77% of this increase. The total national costs of OAB were projected to increase to \$76.2 billion in 2015 and to \$82.6 billion in 2020. The national costs of OAB in the United States according to age group indicate higher costs for patients aged 45–54 yr and 75–84 yr relative to other age groups. The authors stated that their cost-of-illness estimates were approximately five times higher than previous estimates because of their more comprehensive and detailed analytical model [17].

The total direct costs (ie, diagnostic costs, treatment costs, routine care costs, and consequences costs) for the management of OAB with UUI for institutional residents in the United States were \$2.85 billion in 2000, with routine

care costing \$2.77 billion and other costs accounting for only \$0.08 billion (Table 3) [19]. The per capita direct cost of OAB with UUI was estimated at \$5635 per year [19]. The annual direct cost of treatment of UI (SUI: 82%; MUI: 12%; UUI: 4%) in adults in the United States was \$1.3 billion, as measured in 1995 US dollars [20].

3.2.3. Patient-based studies in the United States

For 528 US women (mean age: 58 yr) with UI, the mean weekly direct cost of routine care per patient in 2005 was \$6.02 for UUI, \$3.91 for SUI, and \$6.35 for MUI [21] (Table 3). In another study of 293 US women with UI, 74% reported using pads, 57% had additional laundry loads, and 18% had additional dry cleaning each week because of UI [22]. Among the 262 women reporting any UI-associated costs, the mean cost of routine care was \$10.59 per week, which represents an annual mean cost of \$550.

Patients in the United States with UUI or MUI indicated that they were willing to pay a substantial amount for a 25–50% reduction in micturitions and leakages [23], although the extent to which a hypothetical willingness-to-pay approach reflects real-world behavior is unclear. For a 25% reduction in symptoms, 70% of respondents were willing to pay the lowest price of \$10 per month, and 4% were willing to pay the highest price of \$400 per month. For a 50% reduction in symptoms, 95% of respondents were willing to pay \$10 per month, and 13% were willing to pay \$400 per month [23] (Table 3).

3.2.4. Patient-based study in Australia

The weekly direct personal costs (eg, incontinence pads, laundry, other costs) and treatment costs (health care visits, diagnostics, medications, surgery) were estimated (in 1999 Australian dollars) at A\$6.40 for UUI, A\$9.60 for MUI, and A\$19.10 for SUI, based on 97 community-dwelling ambulatory women from Australia attending continence clinics [24] (Table 3). In this study, the annual direct costs of treatment and routine care exacted a considerable toll on society, with these costs significantly correlated with the severity and weekly frequency of UI [24].

3.3. Discussion

UUI is a common condition that affects millions of men and women worldwide. Prevalence estimates differ across studies because of different UUI definitions, survey methods, questionnaires and response options, frequency criteria, and samples evaluated. Despite these differences, the available evidence indicates that UUI is a highly prevalent condition among men and women worldwide, particularly those aged ≥ 40 yr [3,9,10]. Studies suggest a strong influence of age and gender on the prevalence of UUI. In fact, a steep age-related increase in the prevalence of OAB with UUI occurs in women compared with men, which is particularly evident in individuals aged ≥ 45 yr. Worldwide, the prevalence rates of UUI alone and MUI (ie, UUI and SUI) have been projected to increase by 22.5% and 23.6%, respectively, from 2008 to 2018, based on EPIC study prevalence data for adults aged ≥ 18 yr [11].

Despite the use of varying methods, studies estimating the costs of UUI in countries worldwide consistently indicate that the economic burden is substantial and will increase markedly in the future as the population ages. In multinational studies, the annual cost-of-illness estimates for UUI ranged from €2.9 billion (direct costs for five European countries in 2000) to €7.0 billion (direct and indirect costs for Canada and five European countries in 2005). The most recent national cost-of-illness study for the United States reported total indirect costs (in 2007 US dollars) of UUI of \$66 billion, based on a prevalence-based economic model using NOBLE prevalence data [17]. This difference highlights the importance of the prevalence and cost data used in the analysis model. The costs of incontinence pads [14,15] and nursing home admissions [13] for subjects with UUI were major contributors to the costs of UUI.

The costs of UUI are borne by both society and individual patients. Ganz and associates suggested that direct costs, particularly nursing home costs, will be primarily responsible for raising the costs associated with OAB and UUI in the future, whereas the cost of lost work productivity will contribute less [17]. As a result, the costs will shift from the private to the public sector in the future to the extent that nursing home costs are borne by public payers, such as Medicaid in the United States. Some authors have suggested that the true economic burden is higher than many studies estimate, because the available studies do not use the most current prevalence and cost data, do not provide an estimate of all costs (direct, indirect, and intangible costs) associated with UUI, exclude certain subpopulations (eg, adults aged <40 yr, institutionalized adults, and men), and do not include the costs of all associated comorbid conditions [17].

The prevalence of UUI appears to vary substantially among countries. Some of the observed differences among countries are likely attributable to methodological differences among studies. However, there is notable intercountry variability even in studies in which the prevalence of UUI is assessed in multiple countries using identical methodology. These differences may result from many sociocultural and environmental factors that can affect bladder health and LUTS prevalence, in addition to genetic factors [25]. This area requires further study to distinguish among methodological differences and true cultural and ethnic differences. Data from large-scale studies are missing for many countries, particularly countries in South America, Africa, eastern Europe, western Asia, and Australia. Data for some of these regions were available from studies that did not meet our inclusion criteria of >2500 respondents, although these studies were often highly localized (eg, from residents of one small village or town). Currently, estimates of UUI in these regions are based only on data collected in Europe and North America [11].

This review should be considered within the context of its limitations. First, as mentioned, differences in study methodology and populations may have considerable effects upon the results. These effects no doubt contribute to the substantial variability in reported UUI rates, and it is difficult to separate these effects from true geographic differences. Second, we restricted our literature search to

articles written in English; thus, there are likely data available that are not included in our review. We also did not search the “gray literature,” as we deemed it unlikely we would find usable data, and given the variability in study methodology and its impact on results, we felt more comfortable citing only peer-reviewed reports. Also, we did not review studies on the impact of treatment on the cost of UUI, as that topic was beyond the scope of this review.

4. Conclusions

Current evidence demonstrates the substantial economic burden of UUI, which likely will increase over time in parallel with the projected 25% increase in UUI prevalence in the next decade because of the aging of the population. Data on the costs of UUI are highly dependent on the accuracy and comprehensiveness of prevalence and cost data, making it difficult to accurately estimate the economic burden of UUI. The increasing prevalence of UUI, together with the comorbidities associated with UUI, elevates the economic burden of this disease in terms of resource utilization and disease management on both a national basis and an individual patient basis. Worldwide public health and clinical management programs are needed over the next decade to improve patient and clinician awareness of UUI and to highlight the importance of early UUI diagnosis and management. Additional research on the relationship between UUI severity and economic parameters is needed.

Author contributions: Ian Milsom had full access to all the data in the study and takes responsibility for the integrity of the data and the accuracy of the data analysis.

Study concept and design: Milsom, Coyne, Nicholson, Kvasz, Chen, Wein.

Acquisition of data: Milsom, Coyne, Nicholson, Kvasz, Chen, Wein.

Analysis and interpretation of data: Milsom, Coyne, Nicholson, Kvasz, Chen, Wein.

Drafting of the manuscript: Milsom, Coyne, Nicholson, Kvasz, Chen, Wein.

Critical revision of the manuscript for important intellectual content: Milsom, Coyne, Nicholson, Kvasz, Chen, Wein.

Statistical analysis: Milsom, Coyne, Nicholson, Kvasz, Chen, Wein.

Obtaining funding: Kvasz, Chen.

Administrative, technical, or material support: Milsom, Coyne, Nicholson, Kvasz, Chen, Wein.

Supervision: Milsom, Coyne, Nicholson, Kvasz, Chen, Wein.

Other (specify): None.

Financial disclosures: Ian Milsom certifies that all conflicts of interest, including specific financial interests and relationships and affiliations relevant to the subject matter or materials discussed in the manuscript (eg, employment/affiliation, grants or funding, consultancies, honoraria, stock ownership or options, expert testimony, royalties, or patents filed, received, or pending), are the following: Karin Coyne is an employee of United Biosource Corporation, which was a scientific consultant to Pfizer. Ian Milsom is a scientific consultant for Pfizer and United Biosource; has been an investigator for Pfizer and Astellas and a lecturer for Pfizer, Astellas, Recordati, SCA, and Novartis; and has received grant support from Pfizer and Astellas. Sean Nicholson has been a consultant to Pfizer in connection with developing economic models of the costs associated with diabetes, cardiovascular disease, smoking, and urinary incontinence and has received grant support from Pfizer, Merck, J&J, and AstraZeneca. Alan Wein consults/advises for Astellas, Allergan, Endo,

Medtronic, Theravida, Pfizer, Ferring, Opko, Ethicon, Uroplasty, and Merck. Marion Kvasz and Chieh-I Chen are full-time employees of Pfizer Inc.

Funding/Support and role of the sponsor: Funding for the design and conduct of this study; collection, management, analysis, and interpretation of the data; and preparation, review, and approval of the manuscript were provided by Pfizer Inc. Editorial and literature-searching assistance were provided by Patricia B. Leinen and Colin P. Mitchell at Complete Healthcare Communications, Inc., and were funded by Pfizer Inc.

Appendix A. Supplementary data

Supplementary data associated with this article can be found, in the online version, at <http://dx.doi.org/10.1016/j.eururo.2013.08.031>.

References

- Abrams P, Cardozo L, Fall M, et al. The standardisation of terminology of lower urinary tract function: report from the Standardisation Sub-committee of the International Continence Society. *Neurourol Urodyn* 2002;21:167–78.
- Haylen BT, de Ridder D, Freeman RM, et al. An International Urogynecological Association (IUGA)/International Continence Society (ICS) joint report on the terminology for female pelvic floor dysfunction. *Neurourol Urodyn* 2010;29:4–20.
- Coyne KS, Kvasz M, Ireland AM, Milsom I, Kopp ZS, Chapple CR. Urinary incontinence and its relationship to mental health and health-related quality of life in men and women in Sweden, the United Kingdom, and the United States. *Eur Urol* 2012;61:88–95.
- Coyne KS, Zhou Z, Thompson C, Versi E. The impact on health-related quality of life of stress, urge and mixed urinary incontinence. *BJU Int* 2003;92:731–5.
- Stewart WF, Van Rooyen JB, Cundiff GW, et al. Prevalence and burden of overactive bladder in the United States. *World J Urol* 2003;20:327–36.
- Nuotio M, Tammela TL, Luukkaala T, Jylha M. Urgency and urge incontinence in an older population: ten-year changes and their association with mortality. *Aging Clin Exp Res* 2002;14:412–9.
- Moher D, Liberati A, Tetzlaff J, Altman DG. Preferred Reporting Items for Systematic Reviews and Meta-analyses: the PRISMA statement. *Ann Intern Med* 2009;151:264–9, W264.
- Wang Y, Xu K, Hu H, et al. Prevalence, risk factors, and impact on health related quality of life of overactive bladder in China. *Neurourol Urodyn* 2011;30:1448–55.
- Irwin DE, Milsom I, Hunskaar S, et al. Population-based survey of urinary incontinence, overactive bladder, and other lower urinary tract symptoms in five countries: results of the EPIC study. *Eur Urol* 2006;50:1306–15, discussion 1314–5.
- Milsom I, Abrams P, Cardozo L, Roberts RG, Thuroff J, Wein AJ. How widespread are the symptoms of an overactive bladder and how are they managed? A population-based prevalence study. *BJU Int* 2001;87:760–6.
- Irwin DE, Kopp ZS, Agatep B, Milsom I, Abrams P. Worldwide prevalence estimates of lower urinary tract symptoms, overactive bladder, urinary incontinence and bladder outlet obstruction. *BJU Int* 2011;108:1132–8.
- Hu TW, Wagner TH. Economic considerations in overactive bladder. *Am J Manag Care* 2000;6(Suppl):S591–8.
- Irwin DE, Mungapen L, Milsom I, Kopp Z, Reeves P, Kelleher C. The economic impact of overactive bladder syndrome in six Western countries. *BJU Int* 2009;103:202–9.
- Reeves P, Irwin D, Kelleher C, et al. The current and future burden and cost of overactive bladder in five European countries. *Eur Urol* 2006;50:1050–7.
- Papanicolaou S, Pons ME, Hampel C, et al. Medical resource utilisation and cost of care for women seeking treatment for urinary incontinence in an outpatient setting: examples from three countries participating in the PURE study. *Maturitas* 2005;52(Suppl 2):S35–47.
- Johannesson M, O’Conor RM, Kobelt-Nguyen G, Mattiasson A. Willingness to pay for reduced incontinence symptoms. *Br J Urol* 1997;80:557–62.
- Ganz ML, Smalarz AM, Krupski TL, et al. Economic costs of overactive bladder in the United States. *Urology* 2010;75:526–32, 532 e1–18.
- Population estimates. US Census Bureau Web site. <http://www.census.gov/popest/data/state/totals/2012>. Accessed March 13, 2013.
- Hu TW, Wagner TH, Bentkover JD, et al. Estimated economic costs of overactive bladder in the United States. *Urology* 2003;61:1123–8.
- Wilson L, Brown JS, Shin GP, Luc KO, Subak LL. Annual direct cost of urinary incontinence. *Obstet Gynecol* 2001;98:398–406.
- Subak L, Van Den Eeden S, Thom D, Creasman JM, Brown JS, Reproductive Risks for Incontinence Study at Kaiser Research Group. Urinary incontinence in women: direct costs of routine care. *Am J Obstet Gynecol* 2007;197:596, e591–9.
- Subak LL, Brown JS, Kraus SR, et al. The “costs” of urinary incontinence for women. *Obstet Gynecol* 2006;107:908–16.
- O’Conor RM, Johannesson M, Hass SL, Kobelt-Nguyen G. Urge incontinence: quality of life and patients’ valuation of symptom reduction. *Pharmacoeconomics* 1998;14:531–9.
- Dowell CJ, Bryant CM, Moore KH, Simons AM. Calculating the direct costs of urinary incontinence: a new test instrument. *BJU Int* 1999;83:596–606.
- Palmer MH, Athanasopoulos A, Lee KS, Takeda M, Wyndaele JJ. Sociocultural and environmental influences on bladder health. *Int J Clin Pract* 2012;66:1132–8.
- de Ridder D, Roumeguere T, Kaufman L. Overactive bladder symptoms, stress urinary incontinence and associated bother in women aged 40 and above: a Belgian epidemiological survey. *Int J Clin Pract* 2013;67:198–204.
- Foley AL, Loharuka S, Barrett JA, et al. Association between the geriatric giants of urinary incontinence and falls in older people using data from the Leicestershire MRC Incontinence Study. *Age Ageing* 2012;41:35–40.
- Felde G, Bjelland I, Hunskaar S. Anxiety and depression associated with incontinence in middle-aged women: a large Norwegian cross-sectional study. *Int Urogynecol J* 2012;23:299–306.
- Ojengbede OA, Morhason-Bello IO, Adedokun BO, Okonkwo NS, Kolade CO. Prevalence and the associated trigger factors of urinary incontinence among 5000 black women in sub-Saharan Africa: findings from a community survey. *BJU Int* 2011;107:1793–800.
- Zhu L, Lang J, Liu C, et al. Epidemiological study of urge urinary incontinence and risk factors in China. *Int Urogynecol J* 2010;21:589–93.
- Lee KS, Sung HH, Na S, Choo MS. Prevalence of urinary incontinence in Korean women: results of a National Health Interview Survey. *World J Urol* 2008;26:179–85.
- Tennstedt SL, Link CL, Steers WD, McKinlay JB. Prevalence of and risk factors for urine leakage in a racially and ethnically diverse population of adults: the Boston Area Community Health (BACH) Survey. *Am J Epidemiol* 2008;167:390–9.
- Zhu L, Lang J, Wang H, Han S, Huang J. The prevalence of and potential risk factors for female urinary incontinence in Beijing. *China Menopause* 2008;15:566–9.
- Diokno AC, Estanol MV, Ibrahim IA, Balasubramaniam M. Prevalence of urinary incontinence in community dwelling men: a cross

- sectional nationwide epidemiological survey. *Int Urol Nephrol* 2007;39:129–36.
- [35] Benner JS, Becker R, Fanning K, et al. Bother related to bladder control and health care seeking behavior in adults in the United States. *J Urol* 2009;181:2591–8.
- [36] Perry S, McGrother CW, Turner K. An investigation of the relationship between anxiety and depression and urge incontinence in women: development of a psychological model. *Br J Health Psychol* 2006;11:463–82.
- [37] Rohr G, Stovring H, Christensen K, Gaist D, Nybo H, Kragstrup J. Characteristics of middle-aged and elderly women with urinary incontinence. *Scand J Prim Health Care* 2005;23:203–8.
- [38] Tegerstedt G, Maehle-Schmidt M, Nyren O, Hammarstrom M. Prevalence of symptomatic pelvic organ prolapse in a Swedish population. *Int Urogynecol J Pelvic Floor Dysfunct* 2005;16:497–503.
- [39] Goepel M, Hoffmann JA, Piro M, Rübber H, Michel MC. Prevalence and physician awareness of symptoms of urinary bladder dysfunction. *Eur Urol* 2002;41:234–9.
- [40] Lapitan MC, Chye PL, Asia-Pacific Continence Advisory Board. The epidemiology of overactive bladder among females in Asia: a questionnaire survey. *Int Urogynecol J Pelvic Floor Dysfunct* 2001;12:226–31.
- [41] Hannestad YS, Rortveit G, Sandvik H, Hunskar S. A community-based epidemiological survey of female urinary incontinence: the Norwegian EPINCONT study: Epidemiology of Incontinence in the County of Nord-Trøndelag. *J Clin Epidemiol* 2000;53:1150–7.
- [42] Brown JS, Vittinghoff E, Wyman JF, et al. Urinary incontinence: does it increase risk for falls and fractures? Study of Osteoporotic Fractures Research Group. *J Am Geriatr Soc* 2000;48:721–5.
- [43] Schulman C, Claes H, Matthijs J. Urinary incontinence in Belgium: a population-based epidemiological survey. *Eur Urol* 1997;32:315–20.
- [44] Pöyhönen A, Hakkinen JT, Koskimaki J, Hakama M, Tammela TL, Auvinen A. Empirical evaluation of grouping of lower urinary tract symptoms: principal component analysis of Tampere Ageing Male Urological Study data. *BJU Int* 2013;111:467–73.
- [45] Vaughan CP, Johnson II TM, Ala-Lipasti MA, et al. The prevalence of clinically meaningful overactive bladder: bother and quality of life results from the population-based FINNO study. *Eur Urol* 2011;59:629–36.
- [46] Ge J, Yang P, Zhang Y, Li X, Wang Q, Lu Y. Prevalence and risk factors of urinary incontinence in Chinese women: a population-based study. *Asia Pac J Public Health*. In press.
- [47] Qiu J, Lv L, Lin X, et al. Body mass index, recreational physical activity and female urinary incontinence in Gansu, China. *Eur J Obstet Gynecol Reprod Biol* 2011;159:224–9.
- [48] Dooley Y, Kenton K, Cao G, et al. Urinary incontinence prevalence: results from the National Health and Nutrition Examination Survey. *J Urol* 2008;179:656–61.
- [49] Fenner DE, Trowbridge ER, Patel DA, et al. Establishing the prevalence of incontinence study: racial differences in women's patterns of urinary incontinence. *J Urol* 2008;179:1455–60.
- [50] Tikkinen KA, Tammela TL, Rissanen AM, Valpas A, Huhtala H, Auvinen A. Is the prevalence of overactive bladder overestimated? A population-based study in Finland. *PLoS One* 2007;2:e195.
- [51] Waetjen LE, Liao S, Johnson WO, et al. Factors associated with prevalent and incident urinary incontinence in a cohort of midlife women: a longitudinal analysis of data: study of women's health across the nation. *Am J Epidemiol* 2007;165:309–18.
- [52] Zhang W, Song Y, He X, et al. Prevalence and risk factors of lower urinary tract symptoms in Fuzhou Chinese women. *Eur Urol* 2005;48:309–13.
- [53] Homma Y, Yamaguchi O, Hayashi K, Neurogenic Bladder Society Committee. Epidemiologic survey of lower urinary tract symptoms in Japan. *Urology* 2006;68:560–4.
- [54] Song HJ, Kim MJ, Huh JS, et al. A study of lower urinary tract symptoms for the Korean women aged 30 and over. *Int Urogynecol J Pelvic Floor Dysfunct* 2006;17:356–9.
- [55] Thom DH, van den Eeden SK, Ragins AI, et al. Differences in prevalence of urinary incontinence by race/ethnicity. *J Urol* 2006;175:259–64.
- [56] Araki I, Beppu M, Kajiwara M, et al. Prevalence and impact on generic quality of life of urinary incontinence in Japanese working women: assessment by ICI questionnaire and SF-36 health survey. *Urology* 2005;66:88–93.
- [57] Melville JL, Katon W, Delaney K, Newton K. Urinary incontinence in US women: a population-based study. *Arch Intern Med* 2005;165:537–42.
- [58] Corcos J, Schick E. Prevalence of overactive bladder and incontinence in Canada. *Can J Urol* 2004;11:2278–84.
- [59] Hakkinen J, Koskimaki J, Huhtala H, Tammela TL, Hakama M, Auvinen A. Changes in prevalence of urinary symptoms in Finnish men—a population-based 5-year follow-up study. *Scand J Urol Nephrol* 2004;38:378–84.
- [60] Siracusano S, Pregazzi R, d'Aloia G, et al. Prevalence of urinary incontinence in young and middle-aged women in an Italian urban area. *Eur J Obstet Gynecol Reprod Biol* 2003;107:201–4.
- [61] Moller LA, Lose G, Jorgensen T. The prevalence and bothersomeness of lower urinary tract symptoms in women 40–60 years of age. *Acta Obstet Gynecol Scand* 2000;79:298–305.
- [62] Brown JS, Grady D, Ouslander JG, Herzog AR, Varner RE, Posner SF. Prevalence of urinary incontinence and associated risk factors in postmenopausal women. Heart & Estrogen/Progestin Replacement Study (HERS) Research Group. *Obstet Gynecol* 1999;94:66–70.
- [63] Foldspang A, Mommsen S. Adult female urinary incontinence and childhood bedwetting. *J Urol* 1994;152:85–8.
- [64] International programs. US Census Bureau Web site. <http://www.census.gov/population/international/data/idb/informationGateway.php>. Accessed March 21, 2013.