available at www.sciencedirect.com
journal homepage: www.europeanurology.com

European Association of Urology

Platinum Priority – Incontinence
Editorial by XXX on pp. x-y of this issue

Prevalence of Female Urinary Incontinence in the General Population According to Different Definitions and Study Designs

Dina Bedretdinova [a,b,c,d,e,*], *Xavier Fritel* [a,b,e,f], *Henri Panjo* [a,b,e], *Virginie Ringa* [a,b,e]

[a] *INSERM, Centre for Research in Epidemiology and Population Health (CESP), U1018, Gender, Sexuality and Health Team, F-94276, Le Kremlin-Bicêtre, France;* [b] *Université Paris-Sud, UMRS 1018, F-94276, le Kremlin Bicêtre, France;* [c] *Doctoral School of Public Health, UMRS 1018, F-94276, Le Kremlin-Bicêtre, France;* [d] *French School of Public Health, Rennes, France;* [e] *Institut National d'Études Démographiques (INED), F-75012, Paris, France;* [f] *Service de Gynécologie-Obstétrique et Médecine de la Reproduction, Université de Poitiers, CHU de Poitiers, Poitiers, France*

Article info

Article history:
Accepted July 16, 2015

Associate Editor:
J.-N. Cornu

Keywords:
Cross-sectional study
Epidemiology
Prevalence
Questionnaire
Symptoms
Telephone-based study
Urinary incontinence
Web-based study
Women

Abstract

Background: Estimates of the prevalence of female urinary incontinence (UI) vary widely.
Objective: To estimate UI prevalence among women in France using data from five national surveys and analyse prevalence differences among the surveys according to their design (representative sample or not, survey focused on UI or not) and UI definition (based on symptoms or disease perception).
Design, setting, and participants: Data came from two representative telephone surveys, Fecond (5017 women aged 15–49 yr) and Barometer (3089 women aged 40–85 yr), general and urinary postal surveys of the GAZEL cohort (3098 women aged 54–69 yr), and the web-based NutriNet survey (85 037 women aged 18–87 yr).
Outcome measurements and statistical analysis: Definitions of UI based on the International Conference on Incontinence Questionnaire UI short form (ICIQ-UI-SF) and on a list of health problems were considered. We compared age-adjusted prevalence rates among studies via logistic regression and generalised linear models.
Results and limitations: Overall, 13% of the women in Fecond, 24% in Barometer, 15% in the GAZEL general survey, 39% in the GAZEL urinary survey, and 1.5% in the NutriNet survey reported any UI. Prevalence rates in representative samples with the same UI definition (ICIQ-UI-SF) were concordant. UI prevalence in the representative samples was 17%. The estimated number of women in France with UI was 5.35 million (95% confidence interval [CI] 5.34–5.36 million) for any UI and 1.54 million (95% CI 1.53–1.55 million) for daily UI. For the GAZEL sample, UI prevalence was lower but UI severity was greater for responses to a questionnaire with the list-based UI definition rather than to a questionnaire with the ICIQ-UI-SF-based definition. In all surveys, information about UI was self-reported and was not validated by objective measurements.
Conclusions: UI definitions and sampling strategies influence estimates of UI prevalence among women. Precise estimates of UI prevalence should be based on non–UI-focused surveys among representative samples and using a validated standardised symptom-based questionnaire.
Patient summary: We looked at estimates of urinary incontinence (UI) prevalence in studies with different designs and different UI definitions in a large population of French women. We found that estimates varied with the definition and the design. We conclude that the most precise estimates of UI prevalence are obtained in studies of representative populations that are not focused on UI and use a validated international standard questionnaire with sufficient details to allow grading of UI severity. Most women reported rare urine leakages involving small amounts of urine with little impact on their quality of life.

* Corresponding author. Centre for Research in Epidemiology and Population Health, 82 rue du General Leclerc, 94276 Le Kremlin-Bicetre Cedex, France. Tel. +33 1 45212437; Fax: +33 1 45212075.
E-mail address: dina.dinova@gmail.com (D. Bedretdinova).

http://dx.doi.org/10.1016/j.eururo.2015.07.043
0302-2838/

1. Introduction

Estimation of the prevalence of urinary incontinence (UI) in the general population remains a challenge, as shown by available studies, which report UI prevalence rates between 5% and 69% in women [1–3]. There are probably multiple reasons for this variability across studies.

Much of the research on UI prevalence has been performed among nonrepresentative samples comprising older women and/or clinical samples [4–6]. Another reason for the variability of UI prevalence in epidemiological studies may be the variety of definitions [7]. One way that UI is identified is through questionnaires that ask for details about the frequency of urine leakages, that is, a symptom-based definition. The International Conference on Incontinence Questionnaire UI short form (ICIQ-UI-SF) was developed with a symptom-based approach [8]. Another way to identify diseases in epidemiological studies is through a yes/no question with a list of common diseases proposed to participants: those who perceive themselves to have a disease tick the relevant item. This can be considered a perception-based definition.

UI prevalence among women in France has been measured mainly for clinical or other nonrepresentative samples or in studies with low response rates or non-standardised definitions (Supplementary Table 1) [4,9–16].

The main aims of our work were (1) to estimate and compare the prevalence of UI in France according to a validated international standard questionnaire, the ICIQ-UI-SF, for two population-based representative samples, and (2) to analyse differences in UI prevalence among studies according to their design, including the sample characteristics (representative or not), the survey aim (general health or UI-focused), and UI definition. We compared studies that used (1) the same design and same UI definition, (2) different designs and the same definition, and (3) different UI definitions for the same sample. We hypothesised that estimated prevalence would be higher in UI-focused surveys and when using a symptom-based rather than a perception-based definition.

2. Patients and methods

2.1. Sampling design

We obtained data from five surveys in four French national samples: two representative population-based telephone surveys, Fecond and the National Health Barometer 2010 (hereafter called Barometer); two postal surveys for the GAZEL cohort, one general and one focused on urinary problems (hereafter called GAZEL-G and GAZEL-U); and a web-based survey of adult volunteers NutriNet-Santé (hereafter called NutriNet). These studies were chosen because of data availability, the study period, and the inclusion of questions about UI.

The survey protocol for Fecond and Barometer were very similar; both were nationwide health surveys with two-stage (household and individual) random sampling, and interviews were conducted via a computer-assisted telephone interview system. The objective of Fecond was to analyse practices related to sexual and reproductive health in a representative sample of men and women aged 15–49 yr in 2010 [17]. Barometer is a survey by the National Institute of Prevention and Health Education to analyse health behaviours in a random representative sample of the population aged 15–85 yr [18]. For Fecond the rate of participation refusal was 31% in the landline sample and 37% in the mobile sample [17], while the refusal rate for Barometer was 39% for both [18]. We used data from all women who were asked about urine leakage, comprising all women in Fecond (15–49 yr; $n = 5030$; weighted $n = 5017$) and women aged 40–85 yr in Barometer ($n = 3432$; weighted $n = 3089$). The samples were weighted to be representative of the general French population, taking into account sex, age groups, municipality of residence and its size, education level, and the number of persons per household.

GAZEL (www.gazel.inserm.fr) is an ongoing project established in 1989 [9,19]. We used data from the annual postal general questionnaire sent in 2008 to all participants (GAZEL-G, response rate 70.4%) and from a specific questionnaire focused on urinary problems sent in 2008 (GAZEL-U, response rate 82%): 3098 women aged 54–69 yr responded to both questionnaires and were included in our analysis.

NutriNet (www.etude-nutrinet-sante.fr) is a nationwide web-based survey focused on nutrition and health [20,21]; it began in 2009 and was open to all volunteers aged 18 yr and older. The study design made it impractical to estimate the response rate. Data from 85 037 women aged 18–87 yr were available for 2011.

2.2. Ethics

All surveys were approved by the French Data Protection Authority (Commission Nationale Informatique et Liberté) [16–21]. All subjects provided informed consent or its equivalent.

2.3. Outcomes

The symptom-based definition was from the ICIQ-UI-SF questionnaire, included in the Fecond, Barometer, and GAZEL-U surveys. Women who reported any leakage of urine were coded as incontinent (any UI). If women did not answer this question, their data were considered to be missing (242 in Fecond, 29 in Barometer, 122 in GAZEL) and were excluded. We distinguished participants who reported daily leakage from those reporting weekly leakage.

The perception-based definition, whereby a list of health problems in the last 12 mo included one item, either "involuntary loss of urine" or "urinary incontinence, urinary leakages", was used for all participants in the annual GAZEL-G questionnaire and in the NutriNet health questionnaire. This definition resulted in no missing data.

2.4. Statistical methods

The UI prevalence rate was described for 5-yr age groups, taking into account only binary information on incontinence. For women in the same age group of the representative samples (ie, 40–49 yr) we compared the prevalence of any UI, daily UI, and weekly UI between Fecond and Barometer using the Rao-Scott χ^2 test [22] to determine whether these representative samples produced significantly different UI prevalence estimates. We also compared UI prevalence between landline and mobile samples using a χ^2 test for the women in the representative samples.

To estimate the female French population with any UI, daily UI, and weekly UI, we applied the age-standardised UI prevalence rate from the pooled Fecond and Barometer data to the French female population observed in 2010 according to Institut National de la Statistique et des Études Économiques [23].

To analyse differences in UI prevalence among studies according to their design, we first assessed the association (odds ratio, OR) between any UI and age (in years) for each study using a logistic regression model. We performed a test for homogeneity of the age effect across the

Please cite this article in press as: Bedretdinova D, et al. Prevalence of Female Urinary Incontinence in the General Population According to Different Definitions and Study Designs. Eur Urol (2015), http://dx.doi.org/10.1016/j.eururo.2015.07.043

NutriNet, Fecond, Barometer, and GAZEL-U studies. Second, we fitted logistic regression models to assess the associations between weekly UI and age and between daily UI and age in all the ICIQ-UI-SF–based studies, with tests for homogeneity of the age effect across the studies (Fecond, Barometer, and GAZEL-U). For the incontinent participants in Fecond, Barometer, and GAZEL-U, we fitted three cumulative logit models to compare leakage frequency, leakage amount, impact of UI on quality of life (QoL), and the ICIQ-UI-SF score among the three surveys, controlling for age. The ICIQ-UI-SF score was calculated in Fecond and GAZEL-U according to Klovning et al [24]; the higher the score, the more severe is the UI.

To compare differences in UI prevalence due to different definitions of UI, we analysed the agreement between the perception-based and symptom-based definitions in the GAZEL sample by computing the κ statistic for the measure of agreement. Because data for the severity of urinary leakage (use of pads/protection, number of days with urinary leakage during the past week) were available only for women in the GAZEL-U symptom-based survey, we analysed the differences between those women and women who declared they were incontinent in both GAZEL questionnaires to obtain information about UI severity for women with incontinence according to the perception-based GAZEL-G definition. We applied the Mantel-Haenszel χ^2 test, Fisher's exact, and the Wilcoxon test, as appropriate, for this comparison.

We performed a complete-case analysis because missing data for the main outcomes were negligible. We considered $p < 0.05$ statistically significant. Analyses were performed using SAS 9.3 (SAS Institute, Cary, NC, USA) and Stata 13 (StataCorp, College Station, TX, USA) software.

3. Results

Table 1 summarises the main characteristics of each survey and the UI definition applied. The prevalence of any UI varied from 1.5% to 39% (Table 2). The prevalence of any UI, defined by the ICIQ-UI-SF, in the pooled data from the two representative samples (Fecond and Barometer) was 17% (Fig. 1). We did not observe any significant difference between these surveys in the prevalence of any UI, daily UI, or weekly UI among women aged 40–49 yr ($p > 0.05$), or any significant difference between landline and mobile samples. We estimated that approximately 5.35 million (95% CI 5.34–5.36 million) women (age-standardised prevalence 20.01%, 95% CI 19.98–20.03%) in France, or one in every five adult women between the ages of 15 and 85 yr, reported at least one UI symptom in 2010. Likewise, we estimated that 3.81 million (95% CI 3.80–3.82 million; age-standardised prevalence 14.25%, 95% CI 14.22–14.28%) experience UI at least weekly, and 1.54 million (95% CI 1.53–1.55 million; age-standardised prevalence 5.76%, 95% CI 5.72–5.79%) suffer from daily UI.

As expected, there was an age effect for any UI; tested in logistic models, this effect was similar in all the studies that used a symptom-based definition for any UI and was stronger in studies using the perception-based definition (Table 3). In the representative samples, more women reported weekly than daily UI (Fig. 2). The pooled data from the two representative samples, considering all women (all ages), showed that the age effect was significantly stronger for daily UI (OR 1.25, 95% CI 1.21–1.29) than for weekly UI (OR 1.09, 95% CI 1.07–1.11; $p < 0.001$). Among women aged 54–69 yr, the prevalence of daily UI was roughly similar in GAZEL-U and Barometer, while weekly UI prevalence was significantly higher in GAZEL-U.

After controlling for age, the distribution of answers to ICIQ-UI-SF questions (Fig. 3) on leakage frequency and amount did not differ among incontinent women in Fecond, Barometer, and GAZEL-U. However, we found that women from the representative studies were more likely to report that UI affected their QoL ($p < 0.001$) and the global ICIQ

Table 1 – Main characteristics of the five French surveys on urinary incontinence (UI) and their UI definitions

Parameter	Fecond	Barometer	GAZEL-U	GAZEL-G	NutriNet
Design	Telephone	Telephone	Postal	Postal	Web
Year of survey	2010	2010	2008	2008	2009–2011
UI-focused survey	No	No	Yes	No	No
Representative sample	Yes	Yes	No	No	No
Sample size	5017	3089	3098 [a]	3098 [a]	85 037
UI definition					
Type	Symptom-based	Symptom-based	Symptom-based	Perception-based	Perception-based
Time frame for questions	Last month	Last month	Last month	Last 12 mo	Last 12 mo
Question used to define UI	ICIQ-UI-SF: any leakage for the question "How often do you leak urine?" after the introductory phrase "Many people leak urine occasionally. We are trying to find out how many people have urine leakage and how it bothers them"	ICIQ-UI-SF: any leakage for the question "How often do you leak urine?" after the introductory phrase "We are now going to ask some questions about possible urine leakage that you may have"	ICIQ-UI-SF: any leakage for the question "How often do you leak urine?"	Item 39 (Involuntary loss of urine) in a list of 66 health problems: "State here the ones you suffer or have suffered from during the past 12 months"	Item 74 (Urinary incontinence, urinary leakages) in a list of 111 health problems: "During the past 12 months, have you had and/or were you treated for one or several of the following health problems"
UI frequency	+	+	+	NA	NA
Urinary leakage amount	+	NA	+	NA	NA
Impact of UI on QoL	+	+	+	NA	NA

NA = not available; ICIQ-UI-SF = International Conference on Incontinence Questionnaire UI short form; QoL = quality of life.
[a] Women responded to both questionnaires.

Please cite this article in press as: Bedretdinova D, et al. Prevalence of Female Urinary Incontinence in the General Population According to Different Definitions and Study Designs. Eur Urol (2015), http://dx.doi.org/10.1016/j.eururo.2015.07.043

Table 2 – Main social, demographic, and urinary incontinence (UI) characteristics of women who participated in five French surveys

Parameter	Fecond	Barometer	GAZEL-U	GAZEL-G	NutriNet
Respondents (*n*)	5017	3089	3098 [a]	3098 [a]	85 037
Age range (yr)	15–49	40–85	54–69 [a]		18–87
Age, % (*n*)					
<20 yr	15 (762)	–	–		2.5 (2093)
20–29 yr	24 (1215)	–	–		24 (20 458)
30–39 yr	29 (1477)	–	–		22 (19 032)
40–49 yr	31 (1564)	28 (866)	–		20 (16 744)
50–59 yr	–	28 (858)	40 (1235) [a]		19 (16 283)
60–69 yr	–	21 (633)	60 (1863) [a]		11 (9263)
70–79 yr	–	17 (535)	–		1.3 (1110)
>80 yr	–	6 (197)	–		0.1 (54)
Body mass index, % (*n*)					
<25 kg/m^2	76 (3769)	58 (1755)	59 (1818) [a]		71 (58 696)
25–30 kg/m^2	17 (846)	28 (848)	30 (924) [a]		19 (15 428)
≥30 kg/m^2	7.4 (369)	14 (427)	11 (354) [a]		9.9 (8188)
Education level, % (*n*)					
≤Baccalauréat	67 (3355)	84 (2582)	87 (1859) [a,b]		38 (32 413)
>Baccalauréat	33 (1662)	16 (508)	13 (273) [a,b]		62 (52 624)
Children, % (*n*)					
0	44 (2198)	77 (2377) [c]	12 (369) [a,c]		38 (31 988) [d]
1	16 (783)	12 (380) [c]	27 (835) [a,c]		17 (14 068)
2	26 (1314)	7.7 (237) [c]	47 (1441) [a,c]		29 (24 293)
>2	14 (720)	3.1 (96) [c]	15 (452) [a,c]		17 (14 688)
Pregnant, % (*n*)	2.9 (154)	0.1 (4)	0 [a]		2.4 (2025)
UI, % (*n*)	13 (673)	24 (731)	39 (1201)	15 (478)	1.5 (1299)
UI in landline sample, % (*n*)	14 (573) [*]	24 (686) [†]	NA	NA	NA
UI in mobile sample, % (*n*)	13 (100) [*]	22 (45) [†]	NA	NA	NA
Weekly UI, % (*n*)	11 (561)	17 (510)	31 (944)	NA	NA
Daily UI, % (*n*)	2.2 (112)	7.2 (221)	8.3 (257)	NA	NA

NA = not available.
[a] Women responded to both GAZEL-G and GAZEL-U.
[b] Data missing for 996 respondents.
[c] Information based on the question "How many children <18 yr old live with you?".
[d] Nulliparous women were defined as those who did not report having any children.
[*] Within-survey χ^2 test, $p = 0.6$.
[†] Within-survey χ^2 test, $p = 0.6$.

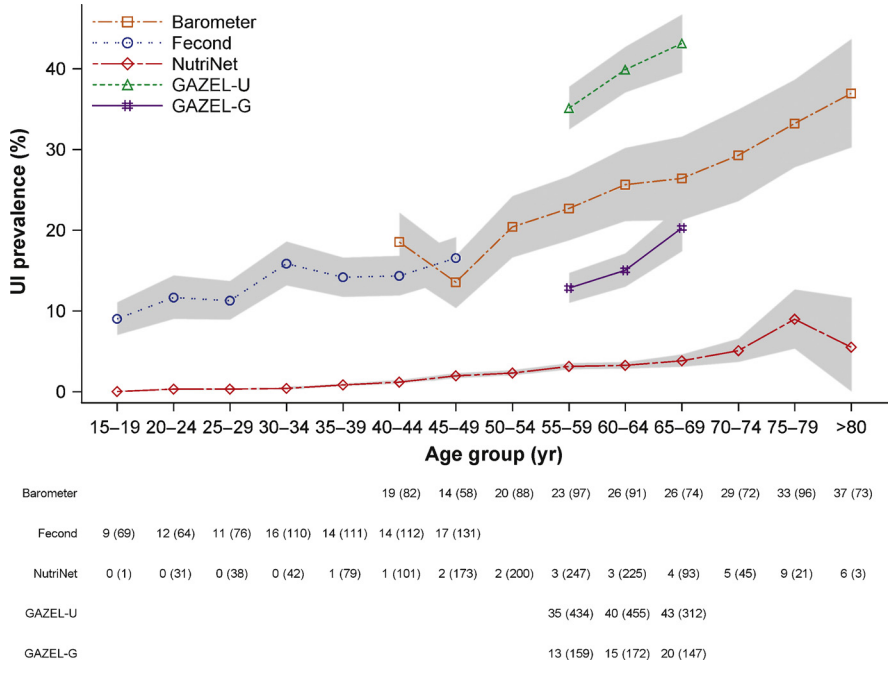

Fig. 1 – Prevalence of urinary incontinence (UI; percentage with 95% confidence interval) by 5-yr age groups in the Fecond, Barometer, GAZEL-G, GAZEL-U, and NutriNet surveys. Data below the graphic report the percentage (number) of women with UI by survey and age group.

Please cite this article in press as: Bedretdinova D, et al. Prevalence of Female Urinary Incontinence in the General Population According to Different Definitions and Study Designs. Eur Urol (2015), http://dx.doi.org/10.1016/j.eururo.2015.07.043

Table 3 – Logistic models of main urinary incontinence (UI) risk factors among women who participated in five French surveys

Effect on UI	Odds ratio (95% confidence interval)				
	Fecond	Barometer	GAZEL-U	GAZEL-G	NutriNet
Age [a]					
Any UI	1.10 (1.05–1.15)	1.15 (1.1–1.19)	1.19 (1.1–1.3)	1.31 (1.16–1.49)	1.35 (1.3–1.4)
Weekly UI	1.12 (1.07–1.18)	1.05 (1.01–1.1)	1.11 (1.02–1.22)	NA	NA
Daily UI	0.98 (0.87–1.1)	1.3 (1.2–1.4)	1.25 (1.07–1.46)	NA	NA
Body mass index					
<25 kg/m^2	Reference	Reference	Reference	Reference	Reference
25–30 kg/m^2	1.5 (1.2–1.9)	1.8 (1.5–2.2)	1.35 (1.2–1.6)	1.77 (1.4–2.2)	2.3 (2–2.6)
≥30 kg/m^2	2.2 (1.6–3)	2.6 (2–3.4)	2.1 (1.7–2.6)	2.1 (1.6–2.8)	3.5 (3.1–4.1)
Children					
0	Reference	Reference	Reference	Reference	Reference [b]
1	1.52 (1.16–2)	0.56 (0.4–0.8) [c]	0.17 (0.9–1.5) [c]	1.27 (0.88–1.8) [c]	2.5 (2.06–3.1)
2	1.72 (1.35–2.2)	0.6 (0.4–0.9) [c]	1.4 (1.12–1.8) [c]	1.42 (1.0–1.99) [c]	3.6 (3.04–4.3)
>2	2.2 (1.67–2.9)	1.04 (0.5–2) [c]	1.3 (0.98–1.74) [c]	1.34 (0.9–2) [c]	5.05 (4.2–6.0)

NA = not available;
[a] Test for homogeneity of age effect for a 5-yr increment across Fecond, Barometer, GAZEL-U, and NutriNet studies using logistic models: any UI, $p < 0.001$; weekly UI, $p = 0.15$; daily UI, $p = 0.0006$.
[b] Nulliparous women were defined as those who did not report having any children.
[c] Information based on the question "How many children <18 yr old live with you?".

score was higher for women in Fecond (mean ± SD, 7.9 ± 3.6) than women in GAZEL-U (6.9 ± 3.7; $p = 0.0002$). Most women (90%) had ICIQ scores of <13 out of 21 (mild or moderate UI).

Among the GAZEL women who completed both questionnaires, we found poor concordance between reports of UI in the general survey (perception-based definition) and in the UI-focused survey (symptom-based definition) (κ = 0.36, 95%CI 0.33–0.39). Women identified as incontinent according to both definitions were likely to declare more severe UI than women who reported they were incontinent only for the ICIQ-UI-SF questions (Table 4).

4. Discussion

Our work shows that the sampling strategy (representative or not), study aim (focused on general health or on UI), and UI definition (based on a validated specific questionnaire or on a list of diseases) influenced estimates of UI prevalence. Estimates from a survey focused on UI and using a UI-specific symptom-based questionnaire yielded reports of higher UI prevalence, mostly mild UI. Estimates from general health surveys including but not focused on UI and with a perception-based definition of UI produced reports of lower UI prevalence, but of more severe UI. Because

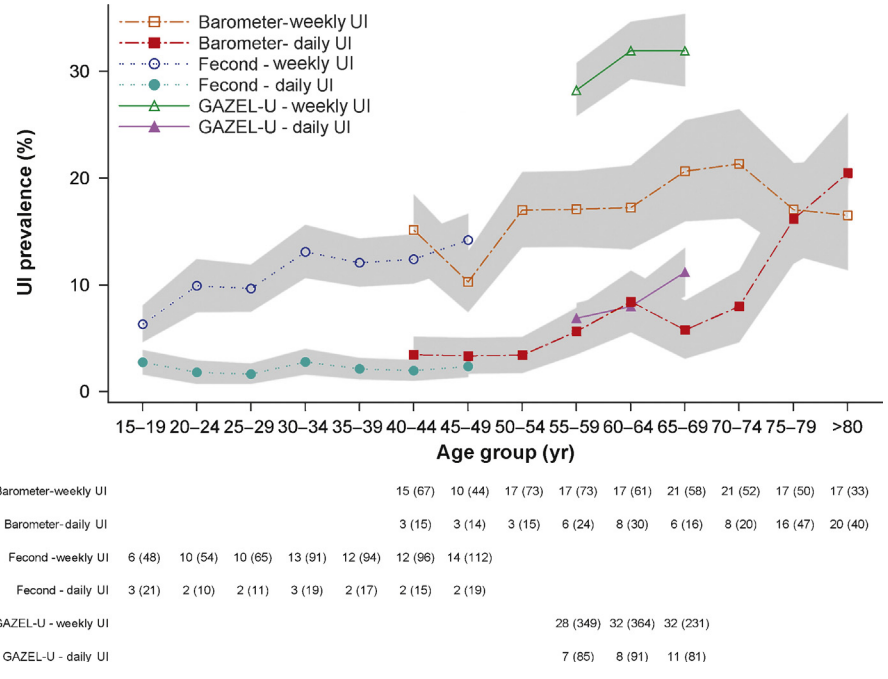

Fig. 2 – Prevalence of weekly and daily urinary incontinence (UI; percentage with 95% confidence interval) in representative samples (Fecond and Barometer) and a nonrepresentative sample (GAZEL-U). Data below the graphic report the percentage (number) of women with UI by survey, weekly or daily frequency, and age group.

Please cite this article in press as: Bedretdinova D, et al. Prevalence of Female Urinary Incontinence in the General Population According to Different Definitions and Study Designs. Eur Urol (2015), http://dx.doi.org/10.1016/j.eururo.2015.07.043

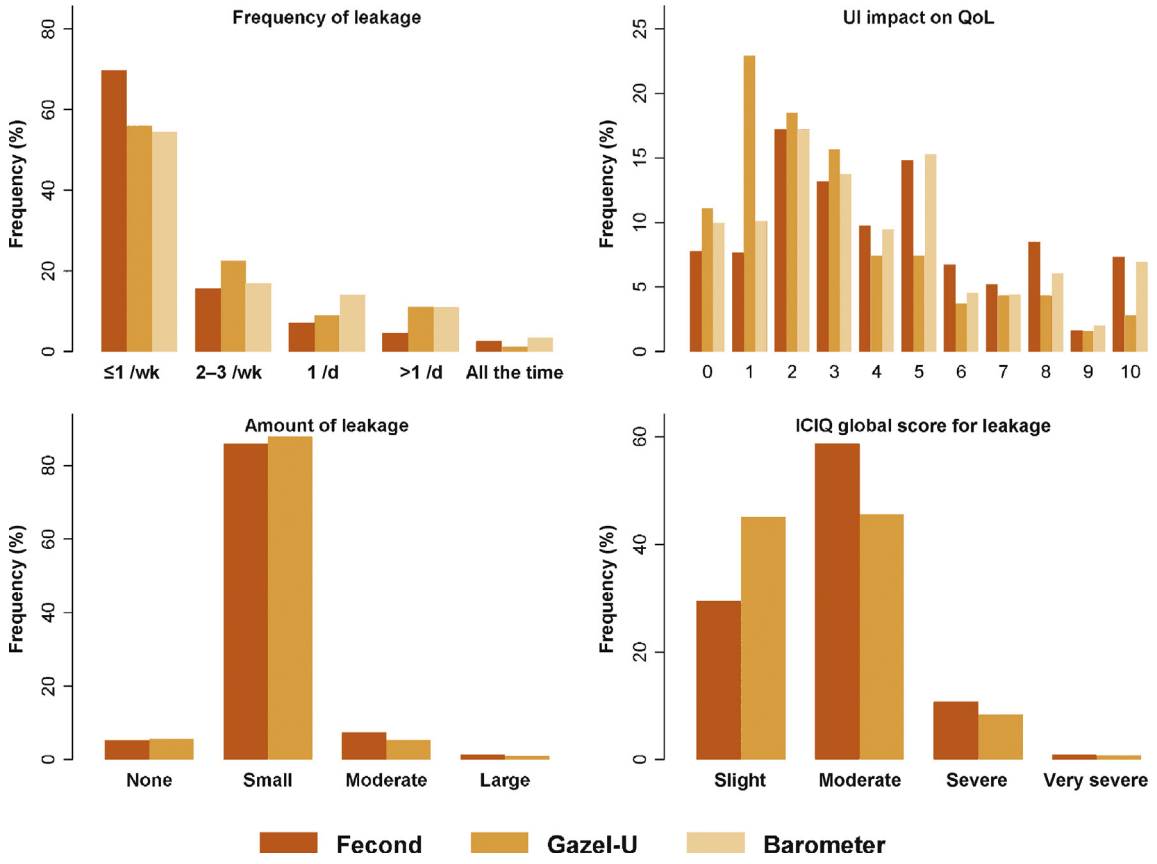

Fig. 3 – Distributions for answers to the International Conference on Incontinence Questionnaire urinary incontinence (UI) short form (ICIQ-UI-SF) by women with UI in the Fecond, Barometer, and GAZEL-U surveys. Frequency of leakage: ≤1/wk = about once a week or less often; 2–3/wk = two or three times a week; 1/d = about once a day; >1/d = several times a day. UI impact on quality of life (QoL): 0 = not at all; 10 = a great deal. UI severity (ICIQ-UI-SF score) [24]: slight (1–5), moderate (6–12), severe (13–18) and very severe (19–21).

estimates based on representative samples and defining UI via a validated specific questionnaire can be generalised more appropriately, these results show that approximately five million women aged 15–85 yr in France had some UI symptoms in 2010, and more than one million had daily UI symptoms.

The high concordance for UI prevalence rates and characteristics observed in the age groups covered by the two representative samples that used the ICIQ-UI-SF (Fecond and Barometer) supports the use of estimates based on representative samples and validated specific questionnaires to obtain precise results. Volunteer bias and healthy participant bias both result in lower prevalence estimates. For example, in NutriNet, the sample with the lowest UI prevalence (1.5%), participants were volunteers and were on the whole younger and healthier than participants in the other surveys we considered. Similarly, participants in the GAZEL cohort had volunteered to participate in medical research and worked at Électricité de France-Gaz de France.

The survey aim (focus on health in general or UI in particular) is another source of variation in UI prevalence, as shown by our results and those of others [1,2,25]. In UI-focused surveys [4,6,13,26,27], most questions cover UI symptoms. Our findings comparing the prevalence of any UI among women aged 54–69 yr in Barometer (general health survey) and GAZEL-U (UI-focused survey) are consistent with this hypothesis, suggesting that the higher prevalence in GAZEL-U is probably due to weekly UI. UI-focused surveys are thus likely to overestimate UI prevalence, but most incontinent women may have mild UI.

UI definitions also play a major role in estimating UI prevalence. Our comparison between surveys for answers to the detailed ICIQ-UI-SF questions found higher concordance for objective questions or items (leakage frequency and amount). For the more subjective questions (impact of UI on QoL) we observed that UI had less of an effect on QoL in GAZEL-U than it did in Fecond and Barometer. ICIQ-UI-SF appears to be a sensitive instrument for capturing data on any urinary leakage and allows grading of UI severity.

The other definition of UI used in the surveys was based on disease perception (GAZEL-G and NutriNet). Our findings are consistent with the report by Herzog et al [28] that surveys that include incontinence in a list of diseases tend to produce lower prevalence estimates. Our hypothesis is that women with mild UI might not tick the specific item for UI among a list of conditions, whereas they do report mild UI when responding to a questionnaire that asks about specific symptoms. This hypothesis is supported by our comparison between women with UI according to both GAZEL questionnaires and women with UI only according to ICIQ-UI-SF: the latter had milder UI than women who were

Please cite this article in press as: Bedretdinova D, et al. Prevalence of Female Urinary Incontinence in the General Population According to Different Definitions and Study Designs. Eur Urol (2015), http://dx.doi.org/10.1016/j.eururo.2015.07.043

Table 4 – Comparison of responses by women in the GAZEL cohort between those who reported urinary incontinence (UI) in both questionnaires and those who responded using only the specific UI questionnaire

Parameter	UI reported, % (*n*)		*p* value
	Both questionnaires	ICIQ-UI-SF alone	
Respondents	418	783	
ICIQ-UI-SF 1: leakage frequency			
≤1 event/wk	38 (160)	65 (512)	<0.0001 *
2–3 events/wk	28 (116)	20 (156)	
1 event/d	12 (50)	7.5 (59)	
>1 event/d	20 (84)	6.3 (49)	
All the time	1.9 (8)	0.9 (7)	
ICIQ-UI-SF 2: leakage amount			
None	3.4 (14)	7.0 (54)	<0.00013 †
Small	86 (360)	89 (688)	
Moderate	8.6 (36)	3.6 (28)	
Large	1.7 (7)	0.8 (6)	
ICIQ-UI-SF 3: QoL score (0–10)			
Mean score ± standard deviation	4.1 ± 2.8	2.5 ± 2.3	<0.0001 ‡
5th percentile	1	0	
Median	3	2	
95th percentile	10	8	
Mode	2	1	
ICIQ global score			
Slight	27 (111)	55 (426)	<0.0001 †
Moderate	57 (236)	40 (307)	
Severe	15 (63)	4.8 (37)	
Very severe	1.7 (7)	0.4 (3)	
Pad use			
None	45 (175)	67 (412)	<0.0001 †
1–3 pads/wk	18 (70)	15 (92)	
4–6 pads/wk	13 (51)	9.8 (61)	
1–4 pads/d	22 (84)	8.4 (52)	
>4 pads/d	1.8 (7)	0.5 (3)	
Days with urinary leakage last week			
None	27 (104)	48 (290)	<0.0001 *
1–2 d	38 (147)	39 (236)	
3–4 d	12 (46)	6.2 (38)	
5–6 d	4.4 (17)	2.8 (17)	
Every day	18 (69)	4.8 (29)	
Amount of urinary leakage			
None	0.3 (1)	0.6 (4)	<0.0001 †
Few drops	57 (227)	76 (505)	
Jet/trickle	37 (146)	21 (137)	
Flow	4.8 (19)	2.0 (13)	
Flood	0.8 (3)	0.8 (5)	
Consultation for involuntary urinary leakage			
No	49 (206)	77 (605)	<0.0001 *
Yes, once	33 (136)	17 (134)	
Yes, several times	18 (76)	5.6 (44)	
Urinary leakage is a hygienic or social problem			
No	40 (150)	61 (409)	<0.0001 *
Yes	60 (220)	39 (259)	
Urinary leakage frequency			
Weekly	66 (279)	85 (668)	<0.0001 *
Daily	34 (142)	15 (115)	

ICIQ = International Conference on Incontinence Questionnaire; ICIQ-UI-SF = ICIQ UI short form. QoL = quality of life.
* Mantel-Haenszel χ^2 test; † Fisher's exact test; ‡ Wilcoxon test.

also considered incontinent according to a list-based (or perception-based) definition. It is evident that meeting two criteria for a condition may lead to selection of participants with more severe symptoms. Nonetheless, in both surveys with lists (NutriNet and GAZEL-G) the item about UI was in the second part of the list, close to items about life-threatening diseases (cancer, stroke, etc.). This might result in the item being ticked only by women with severe or treated UI; women with mild UI could consider their symptoms unimportant compared with cancer and cardiovascular diseases. The wording is also important, as a question about recent urinary leakages, which might be considered to be occasional, may be answered differently to a question about a disease, which might be considered to refer to a permanent and severe condition [29]. Thus, perception-based definitions might detect only severe forms of disease.

Our findings have useful implications for clinical practice when screening for UI, for example among women after delivery or surgery, that is, among women not seeking care

Please cite this article in press as: Bedretdinova D, et al. Prevalence of Female Urinary Incontinence in the General Population According to Different Definitions and Study Designs. Eur Urol (2015), http://dx.doi.org/10.1016/j.eururo.2015.07.043

for UI [30]. In such settings, UI should be assessed using a standardised instrument that makes it possible to determine UI severity and thus facilitates comparison of results among clinical studies.

In all surveys considered in our analyses, information about UI was self-reported and was not validated using objective measurements. However, self-reported symptoms of UI from the ICIQ-UI-SF, a tool with grade A recommendation [1], correlate well with objective measures [31,32]. A limitation of our work is the use of this single questionnaire, the only one available for our data. Other questionnaires may be more specific, but there is no consensus about which is most effective for detecting UI in the general population [1,6,25].

To the best of our knowledge, this is the first study to estimate population-based rates of UI prevalence using the ICIQ-UI-SF in representative samples. In addition, it is the first study to compare UI prevalence rates estimated with ICIQ-UI-SF and another UI definition in the same sample. Therefore, it is the first study to analyse in detail the influence of sample characteristics, definitions, survey aim, and mode of questionnaire administration on estimates of UI prevalence.

5. Conclusion

UI definitions and sampling strategies both influence estimates of UI prevalence among women. The ICIQ-UI-SF questionnaire appears to be appropriate for estimating national prevalence in representative samples, although clinicians should be aware that it is a measure of a symptom of urinary leakage and not of a disease. According to the ICIQ, a substantial proportion of French adult women experience symptoms of urinary leakage. On the basis of our results, we recommend that future observational studies of UI prevalence should be performed in representative samples and should seek to study general health rather than simply UI; they should also use a validated international standard questionnaire to facilitate international comparisons. Moreover, it is important to use a definition of UI with sufficient detail to allow UI severity to be graded, because measures of UI prevalence without details regarding severity are difficult to interpret.

Author contributions: Dina Bedretdinova 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: Ringa, Fritel.
Acquisition of data: Ringa, Fritel.
Analysis and interpretation of data: Bedretdinova, Ringa, Fritel.
Drafting of the manuscript: Bedretdinova.
Critical revision of the manuscript for important intellectual content: Ringa, Fritel, Panjo.
Statistical analysis: Bedretdinova, Panjo.
Obtaining funding: Ringa, Fritel.
Administrative, technical, or material support: Ringa.
Supervision: Ringa, Fritel.
Other: None.

Financial disclosures: Dina Bedretdinova 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: None.

Funding/Support and role of the sponsor: Funding was obtained from the Fecond working group, the French Ministry of Health, the French National Agency of Research, National Institute of Health, Medical Research, the National Institute for Demographic Research, French National Institute of Prevention and Health Education, Électricité de France-Gaz de France, the Population-based Cohort Platform, Epidemiology and Public Health Research Centre, UMRS INSERM Versailles St-Quentin University 1018, the Cohortes Santé TGIR Program, Agence Nationale de la Recherche, Agence Française de Sécurité Sanitaire de l'Environnement et du Travail, the NutriNet-Santé study working group, Institut de Veille Sanitaire, Institut National de la Recherche Agronomique, Conservatoire National des Arts et Métiers, Fondation pour la Recherche Médicale (FRM), and Université Paris 13. The sponsors played a role in data collection

Acknowledgments: The authors thank all the French women who participated in the Fecond, Barometer, GAZEL, and NutriNet surveys, all the scientists who helped to conduct these studies, and the teams that assisted in fieldwork. We thank the Fecond working group. The FECOND study was supported by a grant from the French Ministry of Health, a grant from the French National Agency of Research (ANR-08-BLAN-0286-01), and funding from the National Institute of Health and Medical Research and the National Institute for Demographic Research. We thank the groups of scientists who conducted National Health Barometer 2010 in France, which was supported by Institut National de Prévention et d'Éducation pour la Santé. We also wish to acknowledge Électricité de France-Gaz de France, especially Service Général de Médecine de Contrôle and Caisse Centrale d'Action Sociale du Personnel des Industries Électrique et Gazière, the Population-based Cohort Platform, Epidemiology and Public Health Research Centre, and UMRS INSERM Versailles St-Quentin University 1018, which is responsible for GAZEL database management, in particular Marie Zins. The GAZEL Cohort Study was funded by Électricité de France-Gaz de France and Caisse Centrale d'Activités Sociales, and has received grants from the Cohortes Santé TGIR Program, Agence Nationale de la Recherche, and Agence Française de Sécurité Sanitaire de l'Environnement et du Travail. We thank the scientists, dieticians, technicians, and assistants who helped carry out the NutriNet-Santé study, and all the dedicated and conscientious volunteers. We especially thank Serge Hercberg, Pilar Galan, and Soizic Gueho. The NutriNet-Santé Study was supported by the French Ministry of Health, Institut de Veille Sanitaire, Institut National de la Santé et de la Recherche Médicale, Institut National de la Recherche Agronomique, Conservatoire National des Arts et Métiers, Institut National de Prévention et d'Education pour la Santé, Fondation pour la Recherche Médicale, and Université Paris 13. We thank the French School of Public Health and Doctoral School of Public Health 420 for the doctoral contract. We thank Jo Ann Cahn for editorial assistance. We are also very grateful to the referees and editors for their valuable comments and suggestions.

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.2015.07.043.

References

[1] Abrams P, Cardozo L, Khoury S, Wein A, editors. Incontinence. Ed. 5. Bristol, UK: ICUD; 2013.

[2] Cerruto MA, D'Elia C, Aloisi A, Fabrello M, Artibani W. Prevalence, incidence and obstetric factors' impact on female urinary incontinence in Europe: a systematic review. Urol Int 2013;90:1–9.
[3] Thom D. Variation in estimates of urinary incontinence prevalence in the community: effects of differences in definition, population characteristics, and study type. J Am Geriatr Soc 1998;46:473–80.
[4] Lasserre A, Pelat C, Guéroult V, et al. Urinary incontinence in French women: prevalence, risk factors, and impact on quality of life. Eur Urol 2009;56:177–83.
[5] Dursun P, Dogan NU, Kolusari A, et al. Differences in geographical distribution and risk factors for urinary incontinence in Turkey: analysis of 6,473 women. Urol Int 2014;92:209–14.
[6] Sensoy N, Dogan N, Ozek B, Karaaslan L. Urinary incontinence in women: prevalence rates, risk factors and impact on quality of life. Pak J Med Sci 2013;29:818–22.
[7] Fultz NH, Herzog AR. Prevalence of urinary incontinence in middle-aged and older women: a survey-based methodological experiment. J Aging Health 2000;12:459–69.
[8] Avery K, Donovan J, Peters TJ, Shaw C, Gotoh M, Abrams P. ICIQ: a brief and robust measure for evaluating the symptoms and impact of urinary incontinence. Neurourol Urodyn 2004;23:322–30.
[9] Fritel X, Ringa V, Varnoux N, Fauconnier A, Piault S, Bréart G. Mode of delivery and severe stress incontinence. a cross-sectional study among 2,625 perimenopausal women. Br J Obstet Gynaecol 2005; 112:1646–51.
[10] Amarenco G, Haab F, Touboul C, et al. Etat des lieux de l'incontinence urinaire en France chez les femmes de 35 ans et plus. Pelvi-Périnéologie 2010;5:230–42.
[11] Fourcade RO, Gaudin AF, Mazzetta C, Robsertson C, Boyle P. [Prevalence of lower urinary tract disorders and incontinence in Auxerre. French segment of the UrEpik study]. Presse Med 2002; 31(5):202–10.
[12] Gasquet I, Tcherny-Lessenot S, Gaudebout P, Bosio Le Goux B, Klein P, Haab F. Influence of the severity of stress urinary incontinence on quality of life, health care seeking, and treatment: a national cross-sectional survey. Eur Urol 2006;50:818–25.
[13] Hunskaar S, Lose G, Sykes D, Voss S. The prevalence of urinary incontinence in women in four European countries. BJU Int 2004; 93:324–30.
[14] Minaire P, Jacquetin B. [The prevalence of female urinary incontinence in general practice]. J Gynecol Obstet Biol Reprod 1992;21: 731–8.
[15] Boyle P, Robertson C, Mazzetta C, et al. The prevalence of lower urinary tract symptoms in men and women in four centres. The UrEpik study. BJU Int 2003;92:409–14.
[16] Fritel X, Panjo H, Varnoux N, Ringa V. The individual determinants of care-seeking among middle-aged women reporting urinary incontinence: analysis of a 2273-woman cohort. Neurourol Urodyn 2014;33:1116–22.
[17] Legleye S, Charrance G, Razafindratsima N, Bohet A, Bajos N, Moreau C. Improving survey participation: cost effectiveness of callbacks to refusals and increased call attempts in a national telephone survey in France. Public Opin Q 2013;77:666–95.
[18] Beck F, Gautier A, Guignard R, Richard J-B. Health Barometer 2010 methods. French Institute for Health Prevention and Health Education; 2013. www.inpes.sante.fr/Barometres/barometre-sante-2010/pdf/Health-Barometer-2010-Methods.pdf
[19] Goldberg M, Leclerc A, Bonenfant S, et al. Cohort profile: the GAZEL Cohort Study. Int J Epidemiol 2007;36:32–9.
[20] Hercberg S, Castetbon K, Czernicjow S, et al. The Nutrinet-Sante Study: a web-based prospective study on the relationship between nutrition and health and determinants of dietary patterns and nutritional status. BMC Public Health 10:242.
[21] Kesse-Guyot E, Andreeva V, Castetbon K, et al. Participant profiles according to recruitment source in a large Web-based prospective study: experience from the Nutrinet-Sante study. J Med Internet Res 2013;15:e205.
[22] Scott A. Rao-Scott corrections and their impact. In: Proceedings of the Survey Research Methods Section. American Statistical Association; 2007;3514–8.
[23] INSEE. Demography in France 2010: evolution and structure of population. http://insee.fr/fr/themes/tableau_local.asp?ref_id=POP1B&millesime=2010&niveau=1&typgeo=FE&codgeo=1
[24] Klovning A, Avery K, Sandvik H, Hunskaar S. Comparison of two questionnaires for assessing the severity of urinary incontinence: the ICIQ-UI SF versus the incontinence severity index. Neurourol Urodyn 2009;28:411–5.
[25] Minassian VA, Stewart WF, Wood GC. Urinary incontinence in women: variation in prevalence estimates and risk factors. Obstet Gynecol 2008;111:324–31.
[26] Coyne KS, Sexton CC, Thompson CL, et al. The prevalence of lower urinary tract symptoms (LUTS) in the USA, the UK and Sweden: results from the Epidemiology of LUTS (EpiLUTS) study. BJU Int 2009;104:352–60.
[27] Kocak I, Okyay P, Dundar M, Erol H, Beser E. Female urinary incontinence in the west of Turkey: prevalence, risk factors and impact on quality of life. Eur Urol 2005;48:634–41.
[28] Herzog AR, Fultz NH. Prevalence and incidence of urinary incontinence in community-dwelling populations. J Am Geriatr Soc 1990; 38:273–81.
[29] Vandoninck V, Bemelmans BL, Mazzetta C, et al. The prevalence of urinary incontinence in community-dwelling married women: a matter of definition. BJU Int 2004;94:1291–5.
[30] Fritel X. Should we systematically ask about postnatal incontinence? Br J Obstet Gynaecol 2015;122:963.
[31] Rotar M, Trsinar B, Kisner K, et al. Correlations between the ICIQ-UI short form and urodynamic diagnosis. Neurourol Urodyn 2009;28: 501–5.
[32] Karantanis E, Fynes M, Moore KH, Stanton SL. Comparison of the ICIQ-SF and 24-hour pad test with other measures for evaluating the severity of urodynamic stress incontinence. Int Urogynecol J Pelvic Floor Dysfunct 2004;15:111–6.

Please cite this article in press as: Bedretdinova D, et al. Prevalence of Female Urinary Incontinence in the General Population According to Different Definitions and Study Designs. Eur Urol (2015), http://dx.doi.org/10.1016/j.eururo.2015.07.043