Prevalence, Incidence and Obstetric Factors’ Impact on Female Urinary Incontinence in Europe: A Systematic Review

**Introduction**

According to the most recent definition of the International Continence Society (ICS), urinary incontinence (UI), a symptom of impaired storage, ‘is the complaint of any involuntary leakage of urine’ [1]. In each specific circumstance, UI should be further described by specifying its relevant factors, e.g. type, frequency, severity, precipitating factors, social impact, effect on hygiene and quality of life, the management of the leakage and whether or not the individual seeks or desires help because of UI.

UI is a prevalent, bothersome and costly condition, affecting primarily women. UI is not a lethal condition, but it deeply affects a woman’s quality of life. The issue of UI has been well documented and there are national and international networks focusing on the condition. However, systematic, reliable and consistent data are lacking, particularly with regard to certain groups of the female population. Tackling inequalities in health and improving quality of life are listed as two of the overall aims of the Public Health Action Program.

Undoubtedly, the symptom of UI is a common problem, thus factors affecting its prevalence are often sought by clinicians, health researchers and service planners to improve the management and treatment of those affected. Accurate prevalence data are difficult to retrieve from the epidemiologic UI literature, since there are striking differences among the studies in terms of methodologies,
Materials and Methods

A systematic review of the literature was performed in September 2010 using MEDLINE via PubMed, and manual searches of reference lists from systematic reviews and consensus conferences. Therefore, we employed the PRISMA (Preferred Reporting Items for Systematic Reviews and Meta-Analyses) checklist [4] and Comprehensive Meta-Analysis® (v.2) software (Biostat, Englewood, N.J., USA) was used for statistical analyses. MEDLINE was searched for the following terms (either alone or in combination) including both ‘MeSH’ (medical subject heading) and ‘free text’ protocols: ‘urinary incontinence’, ‘urinary incontinence, urge’, ‘urinary incontinence, stress’, ‘urinary bladder, overactive’, ‘prevalence’, ‘incidence’, ‘pregnancy’, ‘childbirth’, ‘vaginal delivery’ and ‘caesarean delivery’ (table 1).

All work was conducted by four investigators (M.A.C., C.D.E., A.A. and M.F.) under the guidance of the project manager (W.A.).

All investigators individually reviewed all the abstracts of the retrieved studies in order to select the papers that were relevant to the review topic and independently decided on the eligibility of the studies according to the recommendations from the Cochrane manual for systematic reviews [5]. The investigators reviewed abstracts to exclude all studies in which female UI prevalence and incidence were not explicitly stated, animal or in vitro experiments, and analyses of results taken directly from abstracts, letters, comments and case reports. We confined the eligible target population to European female adults. The epidemiologic studies published in English, Spanish, French, German and Italian between 2000 and September 2010 were examined to identify studies with eligible outcomes.

Data were extracted separately and independently by two of the authors and were cross-checked.

The prevalence and incidence rates of UI in women in Europe were determined. We included population-based studies that examined the prevalence and incidence of UI in women in Europe. We included cohort, cross-sectional and case-control studies that examined risk factors for female UI. Finally, we confirmed eligible levels of evidence for each research issue.

The following articles were included for full review: for issues regarding the prevalence and incidence of female UI, large, population-based, cross-sectional or cohort studies and analyses of population-based registries or nationally representative administrative databases; regarding risk factors of UI, baseline data from clinical trials and case-control studies, and regarding the possible effects of obstetric interventions, randomized, controlled, clinical trials; multicenter, nonrandomized, clinical trials, and observational studies without excluding any study that reported the targeted outcome rates among UI patients.

The following studies were excluded: studies including target populations such as children, adolescents, males, institutionalized females or patients with specific comorbidities (e.g. diabetes, obesity and/or neurological diseases), and studies on non-European females.

Study quality was analyzed using the framework recommended in the manual of comparative effectiveness reviews [6].

Study evaluation and data extraction were performed manually and independently by four researchers. Any discrepancies were discussed. Quality control was conducted by the researchers. We abstracted the prevalence and incidence of UI as reported by

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Table 1. Exact search strings

<table>
<thead>
<tr>
<th>Queries</th>
<th>Hits, n</th>
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<tbody>
<tr>
<td>(2) {('Urinary Incontinence' [MeSH] OR 'Urinary Incontinence, Urge' [MeSH] OR 'Urinary Incontinence, Stress' [MeSH]) OR 'Urinary Bladder, Overactive' [MeSH]} AND 'Incidence' [MeSH]</td>
<td>217</td>
</tr>
<tr>
<td>(3) {('Urinary Incontinence' [MeSH] OR 'Urinary Incontinence, Urge' [MeSH] OR 'Urinary Incontinence, Stress' [MeSH]) OR 'Urinary Bladder, Overactive' [MeSH]} AND 'Quality of Life' [MeSH]</td>
<td>490</td>
</tr>
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<td>(4) {('Urinary Incontinence' [MeSH] OR 'Urinary Incontinence, Urge' [MeSH] OR 'Urinary Incontinence, Stress' [MeSH]) OR 'Urinary Bladder, Overactive' [MeSH]} AND 'Quality of Life' [MeSH]</td>
<td>970</td>
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<td>(5) 'Urinary Incontinence' AND 'Prevalence'</td>
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<tr>
<td>(6) 'Urinary Incontinence' AND 'Incidence'</td>
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<td>(7) 'Urinary Incontinence' AND 'Pregnancy'</td>
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</tr>
<tr>
<td>(8) 'Urinary Incontinence' AND 'Childbirth'</td>
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</tr>
<tr>
<td>(9) 'Urinary Incontinence' AND 'Vaginal Delivery'</td>
<td>279</td>
</tr>
<tr>
<td>(10) 'Pelvic Floor Muscle Training' AND 'Pregnancy'</td>
<td>56</td>
</tr>
<tr>
<td>(11) 'Pelvic Floor Muscle Training' AND 'Childbirth'</td>
<td>20</td>
</tr>
<tr>
<td>(12) 'Urinary Incontinence' AND 'Quality of Life'</td>
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<td>(13) 'Urinary Incontinence' AND 'Cost'</td>
<td>351</td>
</tr>
<tr>
<td>(14) 'Urinary Incontinence' AND 'Cost-Effectiveness'</td>
<td>93</td>
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<tr>
<td>(15) 'Urinary Incontinence AND Obstetrics'</td>
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<td>(16) 'Urinary Incontinence AND Economic Burden'</td>
<td>37</td>
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<tr>
<td>(17) 'Urinary Incontinence AND Social Burden'</td>
<td>18</td>
</tr>
</tbody>
</table>

1 Entry date from 2000/01/01 to 2010/09/30 for studies on humans/females published in English, Spanish, German, French and Italian.
the authors, including number of prevalent and incident cases; cumulative incidence during the study period to estimate annual incidence rates; adjusted relative measures of the association as reported relative risk, odds ratio (OR), or hazard ratio (HR), and the time when the outcomes were assessed and follow-up time after intervention. We extracted author-reported adjustments for patient age, race, gender, confounding factors and ‘treatment’ status (Appendix).

**Results**

From screening of 4,391 records, 260 full-text articles were retrieved with 133 articles included in the systematic review and 5 randomized controlled trials (RCTs) included in the meta-analysis (fig. 1).

![PRISMA flow diagram](image)

**Prevalence and Incidence Rates of UI in Women in Europe and Specific UI Subtypes**

**Studies Reporting UI Prevalence**

We identified 17 studies that investigated the prevalence of any UI type exclusively in European female study cohorts. They reported prevalence rates of 16.1–68.8% [7, 8]. The remaining studies investigated UI in both sexes in community-living populations, and thus it was possible to extract female prevalence rates, too. They reported female prevalence rates of 13.1–70.9% [9, 10]. The most prevalent type of UI was stress UI (SUI), ranging from 13 to 50% [7, 11] in the former group of analyzed studies [8] and from 6.4 to 42.2% [9, 12] in the latter. The number of women included in the former group ranged from 405 [13] to 27,936 [11] and in the latter from 227 to 142,651 [14,
Study populations came from population-based, cross-sectional surveys carried out in the following European countries: Austria, Denmark, Finland, France, Germany, Greece, Italy, Norway, Portugal, Spain, Sweden, The Netherlands, UK and Turkey. UI was reported across different age groups, varying from specific age groups to a broad age range. Several studies reported the prevalence of different UI types, including SUI, urge (UUI) and mixed UI (MUI). The methods used to collect data varied widely (postal, telephone and face-to-face personal interviews, and postal and self-completion questionnaires) as well as UI definition, and only a few studies employed validated questionnaires.

**Differences between Studies**

There were many aspects of the identified studies that were dissimilar. These included the age groups; the response rate to the different surveys; the European area investigated; whether the type of UI was specified (SUI, UUI or MUI); the different questionnaires administered; whether data collection was by postal or self-completion questionnaires, face-to-face interview, computer-assisted telephone interview, and the time frame for which UI was reported.

**Differences in the Questionnaires Employed**

Most studies used institutionalized questionnaires which applied different UI definitions (for more information, see online suppl. table 1; for all online suppl. material, see www.karger.com/doi/10.1159/000339929). The validated questionnaires used were: Urogenital Distress Inventory (UDI), International Consultation on Incontinence Questionnaire Short Form (ICIQ-SF) and Bristol Female Lower Urinary Tract Symptoms (BLUTS).

**Age-Specific Prevalence of UI**

In the studies that compared the prevalence of UI across different age groups, the prevalence was reported to be lowest in the younger groups, but the differences between estimates for the age groups were only in a few studies statistically assessed [8, 12, 16–19].

**Results of Studies Reporting UI Incidence**

Seven studies examined the incidence of UI in Europe [20–26]. One study used a validated questionnaire (BLUTS) to investigate UI [22]. Wennberg et al. [20] carried out a longitudinal population-based study in one primary health care district in Sweden and analyzed data from women aged ≥20 years in 1991 and 6 years later. They reported an overall incidence of 21% and remission in 34%. At a 6-year follow-up, Nuotio et al. [21] reassessed 240 ladies ≥70 years from the 3rd wave of the Tampere longitudinal study of aging initiated in 1979 and found an overall incidence of UUI and/or MUI of 17%. Wehrberger et al. [22] evaluated data from 441 women subjected to a free health investigation in 1999 in Austria and reassessed in 2005. They found an overall incidence of 25.6% (mean annual incidence of 3.9%) and remission of 19% (mean annual remission of 2.9%). In a prospective population cohort study conducted in the UK in 12,570 middle-aged and older women at baseline and the 1-year follow-up, the incidence rates of SUI and MUI were 3.6 and 4.5%, respectively [23]. A 1-year SUI incidence rate of 8.3% was derived from the Leicestershire MRC Incontinence study [24]. Results from one ongoing longitudinal cohort study in 2,277 women aged 40–60 years showed an annual incidence of one of more types of UI of 5.8%, with a remission rate of 37.7% [25]. Swedish women <65 years scheduled for a gynecologic health examination in 1993 were reassessed 5 years later by Samuelsson et al. [26]. They showed a mean annual incidence of 2.9% (overall incidence of 13.7%) with a mean annual remission of 5.9% (overall remission of 27.8%).

**Discussion and Conclusion**

We found a wide variation in the estimates of the prevalence and incidence of female UI in Europe. Age represents a significant risk factor. Despite the underrepresentation of elderly women, the highest prevalence rates were reported for this age group, but these findings came from a few studies that formally tested whether the estimates of prevalence in women of different age groups were statistically different from other groups. The methods used to collect data, as well as the way in which UI was diagnosed, contributed further to the wide variability in findings. Studies on UI incidence highlighted that UI often may be transient. Our findings support the need for further research to better establish the age-specific prevalence and incidence of UI in women in different European countries using homogeneous and validated questionnaires in population-based samples in which the issues of selection bias and response rate are carefully considered in order to obtain comparable results.

**Effect of Pregnancy and Childbirth on UI Incidence and Prevalence**

We identified 7 studies that investigated the prevalence of UI during pregnancy in Europe [27–33]. Four
studies were conducted in continent primiparous women [27–30] before pregnancy; 2 studies evaluated all preg-
nant women [31, 32], and in 1 study, carried out in pri-
migravidae, the continent status before pregnancy was not
mentioned [33]. Solans-Domènech et al. [27] carried out
1 cohort study in 1,128 continent nulliparous pregnant
women attending the public health service with the aim
to estimate the frequency and severity of UI during preg-
nancy and after delivery. They used the Incontinence Se-
verity Index and the ICIQ-SF questionnaires to measure
UI and its severity. They considered the 2002 ICS defini-
tion. They found a prevalence rate of UI at the 1st trimest-
er of 8.3% (95% CI 6.6–10), at the 2nd of 31.8% (28.9–
34.7) and at the 3rd of 34.8% (31.7–37.9). The most preva-
 lent type of UI was the SUI (up to 79.2% at the 3rd trimester). At an average follow-up of 7 weeks after deliv-
ery, UI prevalence amounted to 16.3%. In multivariate
analysis, they found the following risk factors of UI in
pregnancy: maternal age >35 years [adjusted HR 2.1, 95%
confidence interval (CI) 1.0–2.8], initial maternal BMI
(adjusted HR 1.3, 95% CI 1.3–2.2), a family history of UI
(adjusted HR 1.7, 95% CI 1.3–2.2).

Arrue et al. [28] evaluated 396 nulliparous pregnant
women ‘at term’ and 6 months after delivery in order to
assess the prevalence of SUI during pregnancy and in the
post-partum period. Using the Incontinence Severity In-
dex and the ICIQ-SF questionnaires, they found an SUI
prevalence rate at term of 31.2%. The prevalence rates of
SUI and MUI 6 months after childbirth were 12.1 and 3%,
respectively. In 2001, Kristiansson et al. [31] published the
results from a prospective, longitudinal, observational
cohort study on all consecutive women attending a Swed-
ish gynecological department in early pregnancy, with
the aim to evaluate the possible relationship of reproduc-
tive hormones and SUI on UI onset during pregnancy.
They used a self-completion institutionalized question-
naire in which SUI was defined as ‘urinary leakage when
coughing or lifting’. They evaluated 195 consecutive
women and found an increasing SUI rate according to the
stage of pregnancy (10% at week 12, 23% at week 24 and
26% at week 36). Thirteen weeks after delivery, the preva-
lence of SUI was 7.2%. They found that the women re-
porting SUI during pregnancy showed the lowest relaxin
levels, suggesting a role of this hormone in maintaining
urinary continence during pregnancy.

Van Brummen et al. [33] reported the results of a pro-
spective cohort study in 344 nulliparous women at 12–18
weeks of gestation and 1 year after childbirth in order to
assess the severity of both SUI and overactive bladder
(OAB) symptoms. They defined SUI according to the
2002 ICS definitions and used the UDI questionnaire to
assess the severity of UI. They found the following UI preva-
lence rates: at 12 weeks of gestation 7.6% of SUI and
6.7% of OAB with UI, and at 36 weeks of gestation 15.4%
of SUI and 16.9% of OAB with UI. One year after deliv-
ery, the prevalence rates of SUI and OAB with UI were
10.5 and 14.8%, respectively. Wesnes et al. [32] evaluated
43,279 Norwegian women in pregnancy and found a
prevalence of any UI before pregnancy of 26.2% and at
30 weeks of gestation of 58.1%. Taking into account only
primiparous women (n = 12,679), they found a preva-
lence of any UI at 30 weeks of gestation of 40.2% [34]. Six
months after delivery, the prevalence of any UI was 31% [29]. They found the following significant risk factors for
UI during pregnancy: age >35 years (adjusted OR 1.4,
95% CI 1.3–1.5), ≥1 deliveries (adjusted OR 2.0, 95% CI
1.9–2.1), initial maternal body mass index (adjusted OR
1.7, 95% CI 1.5–1.9). Diez-Itaza et al. [30] carried out a lon-
gitudinal study in Spanish primiparous women in order
to investigate the risk factors involved in SUI occurrence
1 year after the 1st delivery. One hundred three of 352
(29.3%) primiparous women presented with SUI during
pregnancy ‘at term’. One year after delivery, the preva-
lence of SUI was 11.4%, with an incidence of 4.3%.

Conclusion

The main risk factors for UI during pregnancy in pri-
migravidae are maternal age, increased initial body mass
index and preexistent UI. Considering all pregnant wom-
en, parity represents a further risk factor. The main risk
factors for postpartum UI are maternal age, parity, ma-
ternal overweight and UI during pregnancy.

Possible Effects of Obstetric Factors on Prevalence and
Incidence of UI in Women after Delivery in Europe

Overall, we identified 25 studies investigating the im-
 pact of obstetric factors on UI after childbirth: 10 cross-
sectional studies [35–44]; 11 cohort studies [45–55]; 3 case-
control studies [56–58], and 1 quasi-RCT [34]. Perineal
tears [41] and episiotomy [34] do not seem to negatively
affect urinary continence status at 1 and 4 years [34, 41]
post partum, respectively. A case-control study between
women with and without obstetric anal sphincter injuries
[57] showed a significantly higher risk of SUI 10 weeks af-
fer delivery in women with these injuries (OR 2.65, 95% CI
1.22–5.74), as well as in women with a second-stage labor
>50 min (median time; OR 2.32, 95% CI 1.07–5.06). Con-
cerning instrumental vaginal delivery, data are conflict-
ing. Persson et al. [35], who evaluated 251,027 primiparous women, found a significant advantage of spontaneous vaginal delivery versus an instrumental one on later incontinence surgery (OR 0.82, 95% CI 0.70–0.95). The remaining studies did not observe any significant difference. Both instrumental and spontaneous vaginal delivery resulted significantly less protective than cesarean section. In a retrospective cohort study, Demirci et al. [42] found an advantage in performing a cesarean section only for women with a history of cesarean section (OR 0.25, 95% CI 0.07–0.87). We identified 8 RCTs [59–66] and 1 cohort study and nested RCT [67] that investigated the impact of pelvic floor muscle training (PFMT) on UI after delivery. None of these studies showed a significant effect of postnatal PFMT on both mid- (6 months) and long-term UI after pregnancy (up to 6 years). Data on antenatal PFMT were conflicting. Two studies showed a preventive role 3 months after delivery [60, 61], which was not confirmed by the others at a longer follow-up (fig. 2, 3).

**Conclusion**

Among the many methods proposed to prevent postpartum UI, episiotomy and PFMT were investigated. The results are disappointing or limited. Nine RCTs focused on the impact of PFMT on the improvement in the continence status in women after childbirth. Antenatal PFMT could be helpful in the prevention of postpartum UI in primiparous women without UI during pregnancy. The cesarean section seemed to be followed by less postnatal UI than vaginal delivery, but this advantage disappeared with time and after the second cesarean section (OR 0.47, 95% CI 0.04–5.69).
Appendix: Analytical Framework

Identifying Studies Eligible for Research Questions

(1) Incidence and prevalence of UI in women in Europe and specific UI subtypes

Verification/Selection of Study Eligibility
Criterion 1 – Confirm eligibility of the target population
Eligible descriptors:
- Adult females in the European Community
  - Yes
  - No
  - If No – exclude

Criterion 2 – Confirm eligibility of the outcomes
Eligible descriptors:
- Prevalence of UI
  - Yes
  - No
- Incidence of UI
  - Yes
  - No
  - If No for all descriptors – exclude

Criterion 3 – Confirm eligible level of evidence
Eligible descriptors:
- Large population-based cross-sectional analyses
  - Yes
  - No
- Large population-based cohort studies
  - Yes
  - No
  - If No for all descriptors – exclude

This evaluation can be possible after reviewing the full text of the articles

(1a) Possible effects of pregnancy and childbirth on UI incidence and prevalence
Criterion 1 – Confirm eligibility of the target population
Eligible descriptors:
- Adult females in the European Community
  - Yes
  - No
  - If No – exclude

Criterion 2 – Confirm eligibility of the outcomes
Eligible descriptors:
- Prevalence of UI
  - Yes
  - No
- Incidence of UI
  - Yes
  - No
  - If No – exclude

Criterion 3 – Confirm eligible level of evidence
Eligible descriptors:
- Large population-based cross-sectional analyses
  - Yes
  - No
- Large population-based cohort studies
  - Yes
  - No
- Clinical trials
  - Yes
  - No
- Analysis of Medicare database
  - Yes
  - No
- Analysis of registries
  - Yes
  - No
- Case-control study
  - Yes
  - No
  - If No for all descriptors – exclude

This evaluation can be possible after reviewing the full text of the articles

(2) Possible effects of obstetric factors on UI prevalence and incidence in women after delivery in Europe
Criterion 1 – Confirm eligibility of the target population
Eligible descriptors:
- Adult European females in pregnancy
  - Yes
  - No
- Adult European females after childbirth
  - Yes
  - No
  - If No for all descriptors – exclude

Criterion 2 – Confirm eligibility of the outcomes
Eligible descriptors:
- Prevalence of UI
  - Yes
  - No
- Incidence of UI
  - Yes
  - No
  - If No – exclude

Criterion 3 – Confirm eligible level of evidence – the studies that examined the association between incident or prevalent UI in pregnancy and after delivery with obstetric factors AND obtained at least one strategy to reduce bias including multivariate analysis, matching or stratification
Eligible descriptors:
- Large population-based cross-sectional analysis
  - Yes
  - No
- Large population-based cohort studies
  - Yes
  - No
- Clinical trials
  - Yes
  - No
- Analysis of Medicare database
  - Yes
  - No
- Analysis of registries
  - Yes
  - No
- Case-control study
  - Yes
  - No
  - If No for all descriptors – exclude

(3) Possible effect of female UI on economic and human burden in Europe
Criterion 1 – Confirm eligibility of the target population
Eligible descriptors:
- Adult incontinent females in the European Community
  - Yes
  - No
  - If No – exclude

Criterion 2 – Confirm eligibility of the outcomes
Eligible descriptors:
- Cost of UI
  - Yes
  - No
- Cost-effectiveness of UI treatments
  - Yes
  - No
- Quality-of-life domains
  - Yes
  - No
- Help seeking
  - Yes
  - No
  - If NO for all descriptors – exclude

Criterion 3 – Confirm eligible level of evidence – the studies that examined the effect of female UI on the European economic and human burden AND obtained at least one strategy to reduce bias including multivariate analysis, matching or stratification
Eligible descriptors:
- Large population-based cross-sectional analysis
  - Yes
  - No
- Large population-based cohort studies
  - Yes
  - No
- Clinical trials
  - Yes
  - No
- Analysis of Medicare database
  - Yes
  - No
- Analysis of registries
  - Yes
  - No
- Case-control study
  - Yes
  - No
  - If No for all descriptors – exclude

This evaluation can be possible after reviewing the full text of the articles
References


Female Urinary Incontinence in Europe

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