The prevalence of urinary incontinence within the community: 
A systematic review

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Introduction

Urinary incontinence is often a progressive condition associated with significant morbidity and embarrassment and it imposes a significant burden on affected individuals, those who care for affected individuals and health services [1]. In order to develop effective strategies for the prevention and management of urinary incontinence, it is important to be able to estimate its prevalence with some degree of accuracy.

While extensive reviews of the epidemiological literature have been undertaken, [1-3] they have been comprehensive narrative reviews, and have not attempted to make any quantitative assessment of the cumulative data. An accurate overall estimate of the prevalence of urinary incontinence within communities from the literature has proven difficult for various reasons. These include: differences in the definitions of urinary incontinence used, the populations studied and the variations in study design.

Systematic reviews provide the methodology whereby a rigorous summary of the literature can be undertaken. Although meta-analysis is usually performed to summarise randomised controlled trials, meta-analysis of observational studies is being increasingly undertaken and guidelines for such analyses have been developed. [4]

This systematic review was undertaken to derive age and gender-specific rates of urinary incontinence from the literature and apply them to the populations of Australia and the United Kingdom (U.K.).
Methods

Search strategy

Both Medline and Embase databases were searched using key words common to those cited in previous reviews of the literature as search terms:
- urinary incontinence (MeSH heading) OR
- bladder control (text word) OR
- lower urinary tract symptoms (text word) AND any of the following
- prevalence, incidence, epidemiology, OR natural history (MeSH heading).

Reference lists from retrieved studies and conference proceedings were examined for any studies that might not have been retrieved by the database searches. The search was limited to studies of adults (>18 yrs old) published in English. Only studies published after 1995 were included in the search, since awareness, reporting, and patterns of disease may have differed significantly before then.

The search provided a total of 225 abstracts: 112 abstracts from the Medline database, 110 from the Embase database and 3 from references lists. One hundred and seventy two abstracts were culled for the following reasons: 90 were repeats, 20 were not community based, 22 made general comment about urinary incontinence, 12 were reviews of prevalence studies, 8 studied the prevalence of specific symptoms of urinary incontinence, 6 were studies of faecal incontinence or related combined symptoms of urinary and faecal incontinence, 4 reported the prevalence of urinary incontinence in specific medical conditions, 3 were studies of measurement, two studied urinary incontinence in specific samples and 5 were culled for other reasons. Copies of the remaining fifty-three studies were obtained and underwent initial scrutiny.

Study Selection

We applied the following a priori inclusion criteria:

a) community based sampling frame  
b) response rate >65%  
c) >125 participants per gender group  
d) age and gender separation of results (stratification)  
e) used a validated instrument to measure incontinence

Two reviewers with content expertise (PC and WB) reviewed the 53 papers in duplicate and independently; disagreements were resolved by an adjudicator (JA).
The validity of using the literal International Continence Society definition of incontinence to measure self-reported urinary incontinence is questionable [5], and two studies were excluded from further review for this reason [6, 7]. A further 39 studies were excluded for the following reasons: sixteen did not have study populations that were considered to be entirely cross sectional and or community based [8-23], six reported response rates in each gender below 65% [24-29], five were studies of lower urinary tract symptoms other than urinary incontinence or studies of genitourinary symptoms [30-34], ten reported data in a manner which did not allow extraction by age and gender [35-43], one was a measures study [44], and one used an unclear measure of urinary incontinence and was not age stratified [45].

Only 4 studies were left for analysis [46-49]. We therefore relaxed the inclusion criteria and allowed studies using non-validated measures of incontinence raising the number of studies to 12 [50-57].

Data extraction

Two reviewers (PC and WB) extracted data independently and in duplicate; disagreements were resolved by an adjudicator (JA). Data was extracted on the following: population, study characteristics, definition of incontinence, time frame for incontinence. Age- and gender-stratified prevalences were extracted for each study by 10-year age groups.

Data analysis

Prevalences were pooled across each of the age and gender strata. The Q-test was adapted for proportions and used to test for heterogeneity before pooling across strata, as follows:

\[ Q = \sum W_i (\hat{p}_i - \bar{p})^2 \]

where
- \( W_i \) is the weight of each study, given by the inverse of the variance
- \( \hat{p}_i \) is the prevalence in study i
- \( \bar{p} \) is the mean prevalence across all studies

The Q-statistic follows a chi-square distribution with \( (k-1) \) degrees of freedom. Threshold of significance was taken as \( p<.10 \).

A random effects model was then used to pool the age and gender stratified estimates using the following formula:
\[
\bar{p}^* = \frac{\sum W_i p_i}{\sum W_i^*}
\]

where
\( \bar{p} \) is the pooled prevalence
\( p_i \) is the prevalence in study \( i \), and
\( W_i^* \) is the weight of each study, given by:

\[
W_i^* = \frac{1}{\text{var}(p_i) + D}
\]

where
\[
D = \frac{Q - (k - 1)}{U} \quad \text{if } Q > k - 1 \quad \text{or} \quad D = 0 \quad \text{otherwise}
\]

\( k \) is the number of studies
and
\[
U = \sum W_i - \left( \frac{\sum W_i^2}{\sum W_i} \right)
\]

The 95% C.I. for population effect size is:

\[
\left( \bar{p}^* - \frac{1.96}{\sqrt{\sum W_i^*}}, \bar{p}^* + \frac{1.96}{\sqrt{\sum W_i^*}} \right)
\]

The results of this analysis were then applied to the age stratified Australian National Population Statistics to provide an estimate of the prevalence of urinary incontinence in the Australian populations. [58]

**Results**

**Female urinary incontinence**

Table 1 lists the characteristics of all included studies with data on urinary incontinence in females. Of the 12 studies, 10 were in Caucasians and 2 in Orientals. The overall prevalence of incontinence ranged from \( \approx 10\% \) to \( \approx 70\% \), although this partly reflects the varying age ranges in the studies. Figure 1 presents the age-specific prevalences in graphic form. The Q-test indicated strong heterogeneity across strata (\( p < .01 \)). The source of this heterogeneity was not apparent; exploration of ethnicity, definition of incontinence, time frame of incontinence (e.g. ever or current), use of objective tests to measure incontinence (e.g.
counting pads), and degree of incontinence, all failed to account for heterogeneity. From Figure 1, it is apparent that 4 studies by Dolan [47], Holtedahl [53], Nygaard [55] and Swithinbank [48] documented very high prevalences, ranging between 50 and 80%. This may be linked to parity. One study from Ireland [47], indicated high parity, with 28% of women in the study having 4 or more children. Although parity was not mentioned in other studies it was judged that these 4 studies could probably not be generalised to the Australian or community, and they were dropped. The remaining studies were still heterogeneous, and we pooled them using the random effects model; the pooled, age-specific prevalences for females and males are listed in Table 2. The prevalences range from 16.5% in 20-40 year olds to 31% in over 80 year olds. All studies show a consistent decrease in prevalence between the 50-59 age group and the 60-69 age group; the pooled prevalence decreases from 26% to 20%, although the confidence intervals overlap to a large degree, indicating that there is no statistically significant difference.

Applying these age-stratified estimates to the Australian population leads to an estimate of the prevalence of urinary incontinence of 19.3% among Australian women. This equates to an anticipated 1.8 million Australian women with some degree of incontinence (Table 3). The validity of this estimate however is tempered by the fact that there was significant heterogeneity at the study level that could not be explained; hence we cannot be absolutely confident about this estimate.

**Male urinary incontinence**

Table 1 lists the characteristics of all included studies with data on urinary incontinence in males. Of the 5 studies, 3 were in Caucasians and 2 in Orientals. The overall prevalence of incontinence in males ranged from ~5% to ~15%. Figure 2 presents the age-specific prevalences in graphic form. Despite the much narrower range of values compared to females, the Q-test still indicated strong heterogeneity across strata (p< .01). As before, the source of this heterogeneity was not apparent; exploration of ethnicity, definition of incontinence, time frame of incontinence (e.g. ever or current), use of objective tests to measure incontinence (e.g. counting pads), and degree of incontinence, all failed to account for heterogeneity. Pooling despite heterogeneity using the random effects model yielded the age-specific prevalences listed in Table 2; the prevalence ranged from 3% in 40-49 year olds to 16% in over 80 year olds.

Applying these age-stratified estimates to the Australian population leads to an estimate of the prevalence of urinary incontinence of 2.2% among Australian men. This gives anticipated Australian 216,000 men with some degree of incontinence (Table 3). As before, the validity of this estimate is tempered by the fact that there was significant heterogeneity at the study level that could not be explained; hence we cannot be absolutely confident about this estimate.
Discussion

We have systematically reviewed the literature with a view to answering the question: What is the prevalence of urinary incontinence within the Australian community? We limited ourselves to high quality, reasonably large, community-based studies with high response rates, in order to avoid potential biases. Nevertheless, our study has some limitations:

a) It was not within the scope of this study to comprehensively contact all authors to request extra information; as a result we had to limit ourselves to studies that described their results in sufficient detail to be included.

b) We did not include results from abstracts or search for unpublished studies (so-called “grey literature”).

c) There was no method available to assess publication bias. However, since these studies focused on prevalence estimates and not effect sizes, there is no reason to believe that they would be subject to the same publication bias, i.e. studies with positive results are more likely to be published than those with negative results.

Despite these limitations, this represents the first meta-analysis of the prevalence of urinary incontinence in the literature. We estimate that there are over 2 million Australian people with some degree of incontinence. We estimate that the prevalence of incontinence in women varies from 16.5% in 20-40 year olds to 31% in over 80 year olds. The studies show a consistent dip in the prevalence between the 50-59 age group and the 60-69 age group. This dip has been documented before [3, 59]. It may be due to post-menopausal use of hormone replacement therapy alleviating mild incontinence, a change in or restriction of activities that promote urine leakage, or it may be due to selective mortality of those 50-59 year olds with poorer health (if this is associated with incontinence). The prevalence of incontinence among younger women is approximately 7 fold higher compared to younger men, although this falls to approximately 2 fold higher among older women compared to older men. In both genders, the prevalence increases with age; among women, it is 2 fold higher in the over 80 age group compared to 20-40 age group, and among men, it is 5 fold higher in the over 80 age group compared to 20-40 age group. These relative numbers probably reflect the earlier onset of incontinence in women, perhaps due to pregnancy and delivery related factors, and the increased prevalence of prostate problems in older men.

Although we were able to generate these age-stratified prevalences and estimate the magnitude of incontinence in the Australian community, these summary numbers must be taken cautiously for a number of reasons:
a) We pooled the results despite significant heterogeneity. Pooling can be done using fixed or random effects models. The fixed effects model answers the question of whether the treatment or risk factor had an effect in all the studies that were done, and hence includes only within-study variance terms. The random effects model assumes that the studies done are a random sample of all possible studies, and answers the question of whether the treatment or risk factor will have an effect on average; this model therefore incorporates between-study variance terms. Common practice is to pool using a fixed effects model when studies are homogeneous, and to use a random effects model when there is heterogeneity. The latter however has been discouraged by methodologists [60-63]; the main focus should be on trying to understand the sources of heterogeneity rather than providing a possibly meaningless summary measure [64].

b) The pooled studies reflect differing definitions and severities of incontinence. Hence we cannot say whether the pooled estimate reflects the prevalence of mild, moderate or severe incontinence, nor whether it reflects current incontinence, or incontinence at any time.

c) The studies provide insufficient description of potential confounders. For example, parity and body-mass index are potential confounders of urinary incontinence and it was impossible to adjust prevalences because this information was often not stated.

Health policy decision makers require a clear description of the magnitude and distribution of a health or disease state and we are forced to conclude that there is insufficient information to provide this. Our pooled estimate is a useful start but is not particularly helpful for decision making; the woman with transient incontinence in the last few weeks of her pregnancy requires different resources than a nursing home patient with dementia and incontinence.

Recommendations from the International Continence Society in regard to future epidemiological studies of the prevalence of urinary incontinence include the following [3]:

a) The use of a validated definition of incontinence that would allow comparisons across studies in different settings and cultures. The ICS recommends that further prevalence studies should only be performed with recommended and validated questionnaires, but gives no examples. The ICS further recommend that there should be standardisation of measurement instruments for measuring urinary incontinence in the community.

b) In resect to epidemiological research, that the following elements be included in the definition: The individual's statement of any urine loss, the frequency of loss, the quantity of urine lost and the duration of the condition.
c) Not to include quality of life or “bother” in the definition of urinary incontinence for epidemiological studies in order that patients perceptions not be allowed to distort prevalence estimates or limit the detection of risk factors.

d) Collecting comprehensive information about confounders, such as BMI and parity.

In conclusion, it is disappointing that with so many studies published in this area, there is still a lack of high quality, basic descriptive epidemiology of this important health problem; what studies are available do not express results in a manner that allows informed policy making or health resource allocation. This systematic review has gone some way towards providing such data.

Word count 2450

This study was funded by The Australian Commonwealth Department of Health and Aged Care.
<table>
<thead>
<tr>
<th>First Author</th>
<th>Country</th>
<th>Age range and gender</th>
<th>n=</th>
<th>Definition of incontinence used in the study</th>
<th>Validation status</th>
<th>Timeframe</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bogren [46]</td>
<td>Sweden</td>
<td>♀ at 65 yrs female</td>
<td>216</td>
<td>Involuntary voiding of urine.</td>
<td>Validated</td>
<td>Timeframe unclear</td>
</tr>
<tr>
<td>Bortolotti [50]</td>
<td>Italy</td>
<td>♀ &gt;40 female</td>
<td>2721</td>
<td>At least one episode</td>
<td>Validation unclear</td>
<td>In previous year</td>
</tr>
<tr>
<td>Dolan [47]</td>
<td>Ireland</td>
<td>♀ 35 – 74 female</td>
<td>689</td>
<td>Leaking of urine during: a list of eight activities</td>
<td>Validated</td>
<td>Current experience</td>
</tr>
<tr>
<td>Hagglund [51]</td>
<td>Sweden</td>
<td>♀ 18 – 70 female</td>
<td>3076</td>
<td>Do you have a problem with involuntary loss of urine (eg when you laugh, jump, cough, sneeze)?</td>
<td>Validation not mentioned</td>
<td>Current experience</td>
</tr>
<tr>
<td>Hannestad [52]</td>
<td>Norway</td>
<td>♀ 20 - ≥90 female</td>
<td>27936</td>
<td>Do you have with involuntary loss of urine</td>
<td>Validation not mentioned</td>
<td>Current experience</td>
</tr>
<tr>
<td>Holtedahl [53]</td>
<td>Norway</td>
<td>♀ 50 – 74 female</td>
<td>507</td>
<td>Not stated</td>
<td>Validation not mentioned</td>
<td>Current experience</td>
</tr>
<tr>
<td>Koyama [54]</td>
<td>Japan</td>
<td>♀ ≥ 65 female</td>
<td>1448</td>
<td>Even a small amount of involuntary leakage at a time when there was no</td>
<td>Validation not mentioned</td>
<td>Current experience</td>
</tr>
<tr>
<td>First Author</td>
<td>Country</td>
<td>Age range in years and gender</td>
<td>n=</td>
<td>Definition of incontinence used in the study</td>
<td>Validation status</td>
<td>Timeframe</td>
</tr>
<tr>
<td>--------------</td>
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<td>---------------------------------------------------------------------------------------------------------------</td>
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<td>-------------------------</td>
</tr>
<tr>
<td>Nygaard [55]</td>
<td>United States</td>
<td>♂ 65-90 female</td>
<td>2025</td>
<td>How often do you have difficulty holding your urine until you can get to a toilet? Do you ever leak when you cough, sneeze or laugh?</td>
<td>Current experience</td>
<td>Validation not mentioned</td>
</tr>
<tr>
<td>Perry [56]</td>
<td>Britain</td>
<td>♂ 40-80 female</td>
<td>7659</td>
<td>Do you ever leak urine when you don’t mean to?</td>
<td>Current experience</td>
<td>Validation not mentioned</td>
</tr>
<tr>
<td>Swithinbank [48]</td>
<td>Britain</td>
<td>♂ 19-80 female</td>
<td>2075</td>
<td>Does urine leak when you are physically active, exert yourself, cough or sneeze? [65]</td>
<td>During the previous month</td>
<td>Validated</td>
</tr>
<tr>
<td>Tseng [57]</td>
<td>Taiwan</td>
<td>♂ 65-80 female</td>
<td>256</td>
<td>Inappropriate leakage of urine</td>
<td>Current experience</td>
<td>Validation not mentioned</td>
</tr>
<tr>
<td>Van Geelen [49]</td>
<td>Holland</td>
<td>♂ 50-75 female</td>
<td>1761</td>
<td>Urine loss with coughing, sneezing and other activities</td>
<td>Current experience or in the last year</td>
<td>Validated</td>
</tr>
<tr>
<td>Bogren [46]</td>
<td>Sweden</td>
<td>♂ 65 male</td>
<td>219</td>
<td>Involuntary voiding of urine.</td>
<td>Validated</td>
<td>Timeframe unclear</td>
</tr>
<tr>
<td>First Author</td>
<td>Country</td>
<td>Age range in years and gender</td>
<td>n=</td>
<td>Definition of incontinence used in the study</td>
<td>Validation status</td>
<td>Timeframe</td>
</tr>
<tr>
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</tr>
<tr>
<td>Bortolotti</td>
<td>Italy</td>
<td>♂ ≥ 50 male</td>
<td>2629</td>
<td>At least one episode</td>
<td>Validation unclear</td>
<td>In previous year</td>
</tr>
<tr>
<td>Koyama</td>
<td>Japan</td>
<td>♂ ≥ 65 male</td>
<td>856</td>
<td>Even a small amount of involuntary leakage at a time when there was no intention of urinating</td>
<td>Validation not mentioned</td>
<td>Current experience</td>
</tr>
<tr>
<td>Perry</td>
<td>Britain</td>
<td>♂ 40-≥80 male</td>
<td>4682</td>
<td>Do you ever leak urine when you don’t mean to?</td>
<td>Validation not mentioned</td>
<td>Current experience</td>
</tr>
<tr>
<td>Tseng</td>
<td>Taiwan</td>
<td>♂ 65 -≥80 male</td>
<td>248</td>
<td>Inappropriate leakage of urine</td>
<td>Validation not mentioned</td>
<td>Current experience</td>
</tr>
</tbody>
</table>
Table 2. Pooled age-stratified prevalences urinary incontinence  
(Random effects model)

<table>
<thead>
<tr>
<th>Age group</th>
<th>Proportion</th>
<th>95% C.I.</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Women</td>
<td></td>
</tr>
<tr>
<td>&lt;40</td>
<td>0.165</td>
<td>(0.158, 0.172)</td>
</tr>
<tr>
<td>40-49</td>
<td>0.209</td>
<td>(0.111, 0.306)</td>
</tr>
<tr>
<td>50-59</td>
<td>0.257</td>
<td>(0.180, 0.335)</td>
</tr>
<tr>
<td>60-69</td>
<td>0.203</td>
<td>(0.143, 0.263)</td>
</tr>
<tr>
<td>70-79</td>
<td>0.235</td>
<td>(0.152, 0.317)</td>
</tr>
<tr>
<td>80+</td>
<td>0.284</td>
<td>(0.203, 0.365)</td>
</tr>
<tr>
<td></td>
<td>Men</td>
<td></td>
</tr>
<tr>
<td>&lt;40</td>
<td>-</td>
<td></td>
</tr>
<tr>
<td>40-49</td>
<td>0.030</td>
<td>(0.030, 0.030)</td>
</tr>
<tr>
<td>50-59</td>
<td>0.040</td>
<td>(0.001, 0.079)</td>
</tr>
<tr>
<td>60-69</td>
<td>0.068</td>
<td>(0.025, 0.111)</td>
</tr>
<tr>
<td>70-79</td>
<td>0.113</td>
<td>(0.057, 0.168)</td>
</tr>
<tr>
<td>80+</td>
<td>0.151</td>
<td>(0.034, 0.267)</td>
</tr>
</tbody>
</table>
Table 3. Estimated prevalence of urinary incontinence in Australia
(Random Effects)

<table>
<thead>
<tr>
<th>Age group</th>
<th>Australian Population*</th>
<th>Proportion of Incontinence^</th>
<th>Prevalence of Incontinence</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Males</td>
<td>Females</td>
<td>Males</td>
</tr>
<tr>
<td>&lt;40</td>
<td>5,577,093</td>
<td>5,414,884</td>
<td>-</td>
</tr>
<tr>
<td>40-49</td>
<td>1,372,212</td>
<td>1,373,537</td>
<td>0.030</td>
</tr>
<tr>
<td>50-59</td>
<td>1,078,134</td>
<td>1,042,819</td>
<td>0.040</td>
</tr>
<tr>
<td>60-69</td>
<td>711,364</td>
<td>725,572</td>
<td>0.068</td>
</tr>
<tr>
<td>70-79</td>
<td>502,525</td>
<td>611,470</td>
<td>0.113</td>
</tr>
<tr>
<td>80+</td>
<td>183,982</td>
<td>343,574</td>
<td>0.151</td>
</tr>
<tr>
<td>Total</td>
<td>9,425,310</td>
<td>9,511,856</td>
<td></td>
</tr>
</tbody>
</table>

*estimated 1999 population (see website, reference 58)
^pooled estimates
# excluding some studies (Dolan, Holtedahl, Nygaard, Swithinbak).
Figure 1. Graph of information: female urinary incontinence
Figure 2. Graph of information: male urinary incontinence
REFERENCES


Structured abstract (Word Count: 231) ≈

**Objectives:** To quantify the prevalence of urinary incontinence in the Australian and population by deriving age and gender-specific rates of urinary incontinence from the literature and applying them to the Australian and population.

**Design:** Systematic review of the literature pertaining to the prevalence of urinary incontinence from 1995 onward.

**Setting:** Only studies of the prevalence of community based urinary incontinence were included.

**Included studies:** The following a priori inclusion criteria were applied: community based sampling frame, response rate >65%, >125 participants per gender group, age and gender separation of results (stratification), used a validated instrument to measure incontinence.

**Main outcome measures:** The age and gender stratified prevalence of urinary incontinence in community dwelling adults was calculated using a random effects model. Overall prevalence of female urinary incontinence was estimated to be 19.3% in Australian women respectively, and 2.2% in Australian men. When applied to population estimates it is estimated that there are 216,612 males and 1,836,906 females incontinent of urine in Australia.

**Conclusions:** It is disappointing that with so many studies published in this area, there is still a lack of high quality, basic descriptive epidemiology of this important health problem. The results of this systematic review allow for some quantification of the prevalence of urinary incontinence.