The epidemiology of urinary incontinence within the community
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Introduction

The International Continence Society defines urinary incontinence as a condition where there is an objectively demonstrated involuntary loss of urine that results in a social or hygiene problem (ICS 1976). 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.

In order to develop effective strategies for the prevention and management of urinary incontinence and for the provision of health care facilities and resources for subjects and those who care for subjects with this condition, it is important to consider the following:

- prevalence
- risk factors
- natural history of the condition
- rate of spontaneous remission.

This report presents a compilation and review of published international and available Australian data on the prevalence of urinary incontinence.

The following personnel participated in the compilation of this report:

- A/Professor Richard Millard M.B, B.S, F.R.C.S. (Eng) F.R.A.C.S, Associate Professor of Urology, Prince of Wales Hospital, University of New South Wales, Sydney NSW.
- Pauline Chiarelli Dip Physio (Syd Uni), M Med Sc (H Prom), Research Associate, Faculty of Medicine, University of Newcastle Newcastle NSW.
- Dr Wendy Bower PhD, Department Urology and Nephrology, The Children's Hospital, Westmead, NSW.
- Dr George Szonyi M.B, B.S, F.R.A.C.P, F.A.F.R.M, Head - Department of Geriatric Medicine, Royal Prince Alfred and Balmain Hospital, Sydney NSW.
- Professor Nicholas J Talley M.D, PhD, Professor of Medicine, Nepean Hospital, University of Sydney, Penrith, NSW.
Published reviews of the prevalence of incontinence

In 1996, Chiarelli reviewed 26 studies on prevalence of urinary incontinence covering the period from 1954 to 1995 (Chiarelli 1996). This publication reviewed:

- subject characteristics (number, age and gender)
- survey methods and response rates
- definitions used to determine prevalence of urinary incontinence in the general population and various sub-populations - women, pregnant women and postpartum women

Hampel and co-workers conducted an epidemiological review and meta-analysis featuring 48 studies of female urinary incontinence conducted between 1954 and 1995 (Hampel et al. 1997). The authors commented on the paucity of data on the incidence of urinary incontinence and their meta-analysis included the following estimates:

- incidence of stress urinary incontinence in women aged 45-49 years decreased from 0.55% to 0.43% while the incidence of urge incontinence increased from 0.08% to 0.2%.
- prevalence of urinary incontinence in women was as follows:
  - 10.5% (95% CI 5%-16%) in those aged less than 30 years,
  - 24.5% (95% CI 14%-41%) in those aged 30-60 years
  - 23.5 (95% CI 4.5% -44%) in those over 60 years
  - 55.7% in institutionalised subjects
  - 25.13% in physically or mentally impaired subjects

Thom reviewed 21 population-based studies published between 1971 and 1997 in order to analyse the contribution of methodological differences in study
design to differences in the reported rates of urinary incontinence (Thom 1998).

The review by Thom was in agreement with the comments made by Chiarelli and Hampel and concluded that:

- studies into the prevalence of urinary incontinence are difficult to compare because of differences in the definitions of urinary incontinence used, the populations studied and the variations in study design
- studies using broader definitions of urinary incontinence such as 'ever leaked' tend to be associated with higher prevalence
- broader definitions of incontinence were often used in studies that were of relatively simple design but often featured much larger populations than studies using more complex measures
- studies using non-validated measures of incontinence were associated with significantly higher estimates of prevalence than studies using validated measures.

The three reviews by Chiarelli, Hampel and Thom reached the following conclusions indicating the prevalence of urinary incontinence:

- increases with age
- is greater among women than among men
- increases with parity
- increases during pregnancy and following childbirth and rates in both of these settings is greater in multiparous women than in primiparous women
- of the stress incontinence type is more prevalent in younger women while urge urinary incontinence and mixed urinary incontinence appeared to be more prevalent in older women
- that was classified as occasional is higher than regular urinary incontinence.
Source of data

This publication is a follow-up review of 36 international and 14 Australian studies and published or completed since the reviews of Chiarelli, Hampel and Thom described above. The studies are summarised in Appendices 1-6. The studies included in this review were limited to population-based studies available in English that were either indexed by Medline or cited by reviews that were indexed by Medline. Not all the Australian studies fulfil these indexing and citation criteria. These studies were included at the suggestion of members of the Continence Foundation of Australia. The reason for their inclusion is that they contain local data on the prevalence of urinary incontinence that would not otherwise be available for the purposes of this review.

Appendices 1 to 3 summarise the population based studies done in women, mixed populations and men respectively. Appendices 4 to 6 include detailed results such as the distribution of subjects by gender and age, and the prevalence individual subtypes of urinary incontinence as well as the overall rate.
Summary of the studies reviewed

The number of population prevalence studies published from 1983 to 2000 and featured in this review are as follows:

<table>
<thead>
<tr>
<th>Populations</th>
<th>International studies</th>
<th>Australian studies</th>
</tr>
</thead>
<tbody>
<tr>
<td>Men only</td>
<td>3</td>
<td></td>
</tr>
<tr>
<td>Women only</td>
<td>19</td>
<td>4</td>
</tr>
<tr>
<td>Men and women</td>
<td>10</td>
<td>5</td>
</tr>
<tr>
<td>Children</td>
<td>4</td>
<td>1</td>
</tr>
</tbody>
</table>

Details of the study populations are given in Appendix 1.

The International studies of women only included in this review may be classified as follows:

- 10 studies - random population samples or whole population groups
- 2 studies - population-based registers
- 4 studies - medical care delivery registers
- 1 study - staff list

Four of the study populations listed above were under evaluation as part of larger studies already underway, and one study featuring women only drew part of its sample from consecutive attendances at a hospital outpatient clinic.
The populations featured in the Australian studies included in this review may be classified as follows:

- 1 study - subjects randomly selected from a telephone directory (Muscatello, unpublished observations)
- 1 study - subjects selected randomly from the Medicare database (Chiarelli, Brown et al. 1999)
- 3 studies - subjects already taking part in health surveys based on stratified, multi-cluster sampling methods (Pinnock and Marshall 1997; Muscatello unpublished observations; MacLennan 2000),
- 1 study - subjects attending national election polling booths in different socio-demographic suburbs of a large city; in children (Bower 1996)
- 3 studies - consecutive patients attending various health facilities (Benness et al. 1989; Chiarelli and Campbell 1997; Gunthorpe 1998).

Of the studies featured in this review, 15 included both women and men, 3 included only men, while the majority of the studies were conducted using female subjects only.

The Australian study by Miller was not a study of the population prevalence of urinary incontinence, but was a detailed characterisation of the experience of urinary incontinence amongst women already known to be incontinent from the Women’s Health Australia (WHA) (Brown et al. 1998).
Survey instruments and survey delivery

The survey instruments and methods of survey delivery featured in the International studies included the following:

- 11 studies - postal surveys
- 8 studies - structured interview
- 3 studies - self-administered questionnaires
- 3 studies - telephone surveys
- 7 unspecified

The survey instruments and methods of survey delivery featured in 9 Australian studies included the following:

- 3 studies, postal surveys (Millard et al. 1998; Chiarelli et al. 1999; Lam et al. 1999)
- 2 studies self administered questionnaires (Gunthorpe 1993; Bower 1996)
- 3 studies telephone-based surveys (Pinnock and Marshall 1997; Muscatello unpublished observations; MacLennan 2000)
- 1 study - doctor administered questionnaire (Benness and Manning 1999)

Three of the studies by Chiarelli et al. reported on different aspects of urinary incontinence in the same study population (Chiarelli and Brown 1997; Chiarelli and Brown 1999; Chiarelli 1999).
The influence of instrument validation and self-report on estimates of prevalence

Among the studies included in this review, those using non-validated measures of incontinence tended to be associated with higher estimates of prevalence than studies using validated measures.

The estimates of the prevalence of urinary incontinence in women provided by studies that either did not use validated instruments or made no mention of the use validated instruments, ranged from 15.6% to 56% (median between 27.7% and 34.0%). Studies making use of validated measures reported a wide range of values for the prevalence of urinary incontinence in women 13% - 57% (median 23%).


The one study using validated measures to assess the prevalence of urinary incontinence in men only reported an overall rate of 9.2% compared to 29-32.3% reported by the other studies.

The use of self-report of regular incontinence results in higher estimates of the prevalence of urinary incontinence than when objective measures are applied. The study by Holtedahl used objective measures (pad test) to confirm the incontinence reported by the study subjects (Holtedahl and Hunskaar 1998). The results of the pad test demonstrated that 19% of the women studied had experienced urinary incontinence. By contrast, the use of self-report of urinary incontinence by the study population indicated an overall prevalence of 30.6%.
Four of the Australian studies featured the use of validated instruments for the assessment of urinary incontinence (Gunthorpe 1993; Pinnock and Marshall 1997; Muscatello unpublished observations; MacLennan 2000). However, the use of validated instruments in the surveys did not increase the homogeneity of the outcomes.

It would appear from the literature used within this review, that the use of validated instruments to measure the prevalence of urinary incontinence had little effect on the study outcomes in female populations but did appear to produce lower prevalence rates in studies within male populations.

While urodynamic assessment of bladder function is sometimes held to be the ‘Gold Standard’ of the objective measurement of urinary incontinence, these measures are often considered to be non-physiological. For this reason, there is contention surrounding the use of urodynamic assessment as the ‘Gold Standard’ with some experts claiming the 48-hour home pad test to be a better measure of the ‘real life’ experience of urinary incontinence since urinary incontinence that only occurs with such activities as laughing, sneezing, jumping etc, cannot be reproduced in a laboratory setting. Versi, 1990

Holtedahl et al objectively measured urinary incontinence using urodynamic assessment in a sub-study of women 87 women out of 698 who self-reported urinary incontinence using ICS definition. They estimated the prevalence of objectively demonstrated urinary incontinence to be 18.9%. (Holtedahl, 1998)

With this in mind, the lower rates of urinary incontinence reported in studies using objective measures of urinary incontinence other than the 48-hour home pad test might be called into question.
Survey response rates

The range of survey response rates reported in the studies featured in this review ranged from 41% to 90%. A range of factors known to influence the survey response rates observed in population-based studies will influence how representative a sample is of the general population. These include:

- method used to select sample
- method of distributing and collecting surveys eg postal, telephone and face to face
- type of survey method used
- survey complexity

Two Australian studies each reported two response rates, the first rate reported reflected the response rate to an initial general health survey (68% and 68%) while the second rate reported was the response rate to a specific incontinence screening survey among those who responded to first survey (99% and 97%) (MacLennan 2000; Muscatello unpublished observations).

Millard used a multi-staged, clustered sample drawn from 100 postal districts of Sydney with a response rate of 42%. In view of the low response rate, the population sample was examined to ensure that it was a representative sample of the socio-demographics of the population surveyed (Millard et al. 1998).

The Women’s Health Australia (WHA) study reported response rates of 48% in the younger cohort (< 30 years of age), 54% in the mid-age cohort (30 to 60 years of age) and 41% in the older cohort (above 60 years of age) (Brown et al. 1998). An evaluation of the socio-demographic characteristics of the study sample revealed that while the study participants were broadly representative of the general female population of Australia and included Aboriginal women
and women from ethnic minorities, two specific groups were over represented:

- women with tertiary education
- women in rural and remote regions

Survey response rates reported by the remaining Australian studies ranged from approximately 74% (Bower 1996; Pinnock and Marshall 1997; Gunthorpe 1998) to 90% (Chiarelli and Campbell 1997).

It is widely held that survey response rates below 65% are likely have their results confounded by response bias. Therefore studies with response rates lower than 65% might be seen to provide less reliable prevalence estimates than those with response rates higher than 65%. (Dolan 1999, Chiarelli 1999, Millard 1998, Roberts 1999, Palmer 1999, Smoger 2000, Ueda 2000, Umlauf 1996).
Definitions of incontinence used in the studies

The International studies included in this review varied in the definitions of urinary incontinence they employed. These included whether subjects:

- were currently experiencing urinary incontinence (17 studies)
- had experienced urinary incontinence within the last year (5 studies)
- had ever experienced urinary incontinence (3 studies).

Of interest is the observation that there was no discernible difference between estimates of the prevalence of urinary incontinence based on definitions of 'ever', or 'in the last year' or 'current experience'. There is limited but conflicting evidence that suggests:

- spontaneous remission of urinary incontinence is reported in older women and men over a minimum of three years (self-report of urinary incontinence; Campbell et al. 1985; Herzog et al. 1990)
- a lack of spontaneous remission was found in women measured two occasions, one year apart. (objective measure) (Holteå and Hunskaar 1998).

Alternatively, these reports may simply reflect both the type of survey tool used (self-report versus objective measure) and the altered expectations of continence among subjects experiencing ongoing urinary incontinence.

The study by Foldspang and Mommsen was carried out with the specific aim of validating the International Continence Society (ICS) definition of urinary incontinence as a measure of the experience of urinary incontinence (Foldspang and Mommsen 1997). In order for a subject's experience of incontinence to fulfil the ICS definition, the urinary incontinence must pose a social or hygiene problem for the individual (or their carer). Foldspang et al. compared the following parameters:
• self-reports of frequent urinary incontinence
• social abstention
• seeking of medical help
• whether women considered their incontinence to be a social or hygienic problem.

The investigators reported that women tended to report frequent urinary incontinence, social abstention and the need to seek medical help irrespective of whether they considered their urinary incontinence to be a problem in terms of social interaction or personal hygiene. As a consequence, the investigators concluded that the ICS definition of urinary incontinence was inadequate for the purposes of biomedical research.

The study by Moller also used the ICS definition of urinary incontinence being a social or hygiene problem (Moller et al. 2000). The investigators reported a relatively low estimate of urinary incontinence in women (16.1%) compared with many of the other studies (median value 28%). The value of prevalence estimated by Moller et al. may need to be reconsidered in the context of the comments made by Foldspang and Mommsen on the adequacy of the ICS definition (Foldspang and Mommsen 1997).
Prevalence of urinary incontinence

**Influence of age and gender**

In the six studies that featured populations including men and women and reported a combined prevalence, estimates of urinary incontinence that varied from 9.8% - 48.7% (Nakanishi & Tatara 1997; Schulman, et al. 1997; Damian et al. 1998; Millard 1998; Roberts et al. 1998; Iglesia et al. 2000).

In summarising the results of the studies providing the ratio of female to male urinary incontinence, the prevalence of urinary incontinence is seen to be significantly greater in women than in men in all but those studies within much older age groups. Therefore estimations of overall prevalence of urinary incontinence provided by mixed gender studies in the absence of gender specific estimations should be considered to be less accurate.

In the studies that included men, the range of overall urinary incontinence in men was 3.6% - 47% (Median 4.4% - 12%) (See Appendices 2, 3, 5 and 6). The studies by Roberts et al, Umlauf and Sherman, and Damien et al. estimated the overall prevalence of urinary incontinence in men to be to be 24.3%, 29% and 35.8% respectively, whereas the estimates provided by the remaining studies ranged between 2% - 13%.

A total of 32 studies reported on the prevalence of urinary incontinence in women. The estimates of the prevalence of urinary incontinence provided by these studies ranged from 9.8% to 69% (Median 17.7%).

**Australian studies in both male and female populations**

The study by Millard included estimates of the overall prevalence of urinary incontinence in males (13%) and females (34%) and also attempted to characterise the different symptoms of incontinence experienced by males and females with incontinence and reported the following:

<table>
<thead>
<tr>
<th>Type of incontinence</th>
<th>Females (%)</th>
<th>Males (%)</th>
</tr>
</thead>
</table>

...
With respect to previous incontinence, Millard also reported that among the 76% of subjects who were currently dry, 23% (16% of men and 30% of women), had experienced some urinary leakage in their past adult life (Millard 1998). Moreover, when previous experience of urinary incontinence was added to all present incontinence a total of 41% of adults (28% of men and 53% of women) have experienced involuntary loss of urine at some time in their adult life. Amongst those who reported current experience of being wet, 73% were female, and females accounted for 88% of those with severe incontinence.

Pinnock et al. used an instrument derived from the International Prostate Symptom Score (IPSS) which features questions on both lower urinary tract symptoms (LUTS) and quality of life, but is not specifically aimed at detecting urinary incontinence (Pinnock and Marshall 1997). Overall, 39% of women and 26% of men reported troublesome LUTS. The most common symptoms in both women and men were found to be frequency of urination (frequency) and nocturia (getting out of bed more than twice each night), while 6% of women and 0.7% of men reported wet underclothes, which is the only measure they used for incontinence. The prevalence of LUTS was high within this sample, but the estimate of incontinence was far lower than in other studies.

Muscatello determined the prevalence of LUTS in an English speaking, inner-urban population of males and females, using the IPSS, the Bristol Lower Urinary Tract Questionnaire, and five questions relating specifically to urinary incontinence (Muscatello unpublished observations). No overall estimation of the prevalence of urinary incontinence was made. The prevalence of symptoms
of incontinence (stress or urge) were estimated to be 45% of the female population surveyed and 15% of the male population.

The primary objective of the study by Lam et al. was to determine the prevalence of faecal incontinence using a study population drawn randomly from a South Sydney electoral roll (see Part B - Anal Incontinence). The study also included questions relating to urinary incontinence based on a simple unvalidated measure of urinary incontinence that differentiated between stress incontinence and urge incontinence. The prevalence of stress and urge incontinence in women was reported as identical (31.0%) but this cannot be assumed to indicate the same 31% of women experienced both stress and urge incontinence. No details were given for the overall prevalence of urinary incontinence. Similarly the prevalence of stress and urge incontinence in men was estimated to be 12% and 4% respectively, with but no details given of the overall prevalence of urinary incontinence (Lam et al. 1999).

MacLennan et al. studied the prevalence of pelvic floor disorders, symptoms of urinary and anal incontinence and collected relevant details of obstetric and gynaecological history (MacLennan et al. 2000). The authors provided the following estimates of prevalence:

<table>
<thead>
<tr>
<th>Disorder</th>
<th>Females %</th>
<th>Males %</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pelvic floor</td>
<td>46.2</td>
<td>11.1</td>
</tr>
<tr>
<td>Urinary incontinence (all types)</td>
<td>35.3</td>
<td>4.4</td>
</tr>
<tr>
<td>Stress incontinence</td>
<td>20.8</td>
<td>1.5 (34)</td>
</tr>
<tr>
<td>Urge incontinence</td>
<td>2.9</td>
<td>1.9 (43)</td>
</tr>
<tr>
<td>Mixed stress/urge incontinence</td>
<td>11.6</td>
<td>1.0 (23)</td>
</tr>
</tbody>
</table>
**International estimates of the female to male urinary incontinence prevalence ratio**

Eight International studies used both male and female subjects within the study population (Schulman et al. 1997; Nakanishi et al. 1997, Damian et al. 1998; Koyama et al. 1998; Roberts et al. 1998; Bortolotti et al. 2000; Temml et al. 2000, Ueda 2000). These provided the following estimates of the ratio of the overall prevalence of urinary incontinence in women to prevalence in men:

<table>
<thead>
<tr>
<th>Author, year</th>
<th>Prevalence ratio F:M</th>
</tr>
</thead>
<tbody>
<tr>
<td>Schulman et al. 1997</td>
<td>3</td>
</tr>
<tr>
<td>Nakanishi 1997</td>
<td>1</td>
</tr>
<tr>
<td>Koyama et al. 1998</td>
<td>2.4</td>
</tr>
<tr>
<td>Roberts et al. 1998</td>
<td>2</td>
</tr>
<tr>
<td>Damian et al. 1998</td>
<td>1.8</td>
</tr>
<tr>
<td>Bortolotti et al. 2000</td>
<td>5.5 ‘young’ group</td>
</tr>
<tr>
<td></td>
<td>2.2 ‘older’ group</td>
</tr>
<tr>
<td>Temml et al. 2000</td>
<td>5.3</td>
</tr>
<tr>
<td>Ueda et al. 2000</td>
<td>5.1</td>
</tr>
</tbody>
</table>
Australian estimates of the female to male urinary incontinence prevalence ratio

Estimates of the female to male ratio of the overall prevalence of urinary incontinence derived from Australian Studies are consistent with those derived from International studies and are summarised below:

<table>
<thead>
<tr>
<th>Author, year</th>
<th>Prevalence ratio F:M</th>
</tr>
</thead>
<tbody>
<tr>
<td>Millard 1998</td>
<td>2.7</td>
</tr>
<tr>
<td>1 (after 60 years of age)</td>
<td></td>
</tr>
<tr>
<td>Maclennan et al. 2000</td>
<td>11.7</td>
</tr>
<tr>
<td>Muscatello unpublished observation</td>
<td>4.6</td>
</tr>
</tbody>
</table>

The effect of age, gender and, the passage of time


The only study not to report a consistent association between age and the prevalence of urinary incontinence in both men and women was by Roberts in which this association was only present in the male sub-group (Roberts et al. 1998).

It therefore seems reasonable to assume that studies providing the analysis of prevalence estimates using stratification by age groups are likely to be more accurate. Age stratified estimates of the prevalence of urinary incontinence were presented by two of the international studies and one Australian study Hagglund et al, and Simeonova (Simeonova, 1990, Hagglund, 1999, Chiarelli, 1999.)
The prospective study by Nygaard demonstrated that the prevalence of urinary incontinence increased significantly at both three and six years follow-up (Nygaard and Lemke 1996). The incidence of urge incontinence was estimated to be 26.5% over the three years between the third and sixth year follow-up. Over the same period the remission rate was estimated to be 22.1%. Estimates of the incidence and remission rates for stress incontinence were 28.6% and 25.1% respectively.

Moller et al. using discrete groupings of women aged 40, 45, 50, 55 and 60 years, found that the prevalence of symptoms of stress incontinence rose from age 40 to 55 years then fell in the group of 60 year-old women, while the prevalence of the symptoms of urge incontinence continued to increased with age (Moller et al. 2000 ).

The studies otherwise show a consistent association between increasing age and increasing prevalence of urinary incontinence. In addition, they show that the prevalence of the symptoms of urinary incontinence (stress, urge and mixed) differs between younger women - who have a higher prevalence of stress incontinence and older women who have a higher prevalence of urge incontinence. The studies also indicate that urge incontinence comprises a greater proportion of the urinary incontinence experienced by men than in women. Men have a higher proportion of urge incontinence overall. Older women have more urge incontinence than younger women who more commonly experience symptoms of stress incontinence.

The prevalence of urinary incontinence in Australian populations was also seen to increase with age. Chiarelli conducted a retrospective analysis of the data from the Australian Longitudinal Women's Health Study, (subsequently re-titled the Women's Health Australia or WHA) using a postal survey containing an unvalidated measure for urinary incontinence (Chiarelli and Brown 1997). No attempt at differentiation between symptoms of urinary incontinence was undertaken within this study. This analysis stratified the prevalence of urinary incontinence by age using three discrete age ranges. A subsequent analysis
resurveyed 500 women who had reported urinary incontinence from each age group used a validated instrument in order to characterise the type and severity of urinary incontinence (Miller et al. 2000). These two surveys are summarised in the following table:

<table>
<thead>
<tr>
<th>Cohort</th>
<th>Overall prevalence* % (total n = 41,724)</th>
<th>Prevalence of symptoms of incontinence** % (total n = 1,500)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Young (19-22 y)</td>
<td>12.8</td>
<td>Stress: 10.7, Urge: 2.7, Mixed: 86, Other: 0</td>
</tr>
<tr>
<td>Mid-aged (45-49 y)</td>
<td>36.1</td>
<td>Stress: 6.4, Urge: 1.3, Mixed: 92.3, Other: 0</td>
</tr>
<tr>
<td>Older (70-74 y)</td>
<td>35</td>
<td>Stress: 1.7, Urge: 6.2, Mixed: 91.3, Other: 0.8</td>
</tr>
</tbody>
</table>

* using an unvalidated measure of urinary incontinence
** using a validated questionnaire administered to 1,500 subjects who were considered to have urinary incontinence on the basis of the baseline postal questionnaire.

While no appreciable difference was found in the overall prevalence of urinary incontinence between the mid-aged and the older women in the women in the baseline survey, the prevalence of leaking urine ‘often’ increased from 7% to 16% to 20% in the three age cohorts respectively (Chiarelli et al. 1999).

The baseline survey revealed no differences in the prevalence of urinary incontinence between women in rural and remote areas and women from urban areas. No significant difference was detected in the prevalence of urinary incontinence in women with English as a second language. However, a significant difference between the prevalence of urinary incontinence in Aboriginal and Torres Strait Islander women and other Australian women was detected in women making up the young cohort (19-22 years). This difference was attributed to the fact that there was a significantly higher parity amongst
younger Aboriginal and Torres Strait Island women than in other Australian women in the younger cohort (Chiarelli and Brown 1997).
Miller et al. also asked incontinent Australian women to compare their present bladder control with their bladder control three years ago (Miller et al. 2000).

<table>
<thead>
<tr>
<th>Cohort</th>
<th>How are symptoms now compared to three years ago? (%) *</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Much better</td>
</tr>
<tr>
<td>Young (19-22 y)</td>
<td>10.0</td>
</tr>
<tr>
<td>Mid-aged (45-49 y)</td>
<td>9.6</td>
</tr>
<tr>
<td>Older (70-74 y)</td>
<td>7.6</td>
</tr>
</tbody>
</table>

* remainder of respondents gave no response

In the male and female population studies, the prevalence of urinary incontinence was seen to rise significantly with age (Millard 1998). Millard estimated the prevalence of urinary incontinence to be as follows:

<table>
<thead>
<tr>
<th>Rate Females (%)</th>
<th>Rate Males (%)</th>
<th>Age group</th>
</tr>
</thead>
<tbody>
<tr>
<td>19</td>
<td>10</td>
<td>10 - 29 years</td>
</tr>
<tr>
<td>50</td>
<td>16</td>
<td>45-59 years</td>
</tr>
<tr>
<td>42</td>
<td>44</td>
<td>60-74 and 75+ years</td>
</tr>
</tbody>
</table>

Pinnock et al. found LUTS to be significantly age-related in men, but less so in women (Pinnock and Marshall 1997). Muscatello et al. found a significant association between age and prevalence of urinary incontinence in both men...
and women (Muscatello unpublished observations). MacLennan et al. showed a significant association between urinary incontinence and age in females (MacLennan 2000):  

<table>
<thead>
<tr>
<th>Age</th>
<th>Relative risk of overall urinary incontinence</th>
</tr>
</thead>
<tbody>
<tr>
<td>15-34 years</td>
<td>1</td>
</tr>
<tr>
<td>35-54 years</td>
<td>2.1</td>
</tr>
<tr>
<td>55 years</td>
<td>3.1</td>
</tr>
</tbody>
</table>

Thus the symptomatology of urinary incontinence appears to be progressive in a significant proportion of incontinent women but to a lesser degree in younger women. This observation supports the hypothesis that the cumulative effects of ageing and the activities of daily living influence the continence status of women over a long period of time (DeLancey 1993).

The association between age and urinary incontinence is supported by studies that show the physiological effect of age muscle tissue (Allen et al. 1990; Perucchini et al. 1997), nerve tissue (Allen et al. 1990) and collagen (Landon et al. 1990; Ulmsten and Falcone 1999). These play an integral role within the urinary tract and the supportive structures around the genitourinary tract and other pelvic organs.

**Prevalence of urinary incontinence in child populations**

Primary enuresis is defined as bedwetting occurring without a continence break of more than six month (Hunskaar 2000). Secondary enuresis is defined as bedwetting that has recurred after a period of dryness exceeding six months and may indicate behavioural neurological or infective causes or may be the result of chronic retention with overflow. Nocturnal enuresis may occur in the absence of other symptoms of urinary incontinence (monosymptomatic primary nocturnal enuresis or MPNE) or less commonly in association with diurnal
urgency and urge incontinence (polysymptomatic enuresis PPE) (Hunskaar 2000). International surveys report the following prevalence of nocturnal enuresis:

<table>
<thead>
<tr>
<th>Country of origin (author)</th>
<th>N (age)</th>
<th>Sub group</th>
<th>Prevalence of enuresis</th>
<th>Prevalence of MPNE (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sweden (Hellström et al. 1990)</td>
<td>3556 (7 years)</td>
<td>Female</td>
<td>7</td>
<td>3</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Male</td>
<td>12</td>
<td>7</td>
</tr>
<tr>
<td>UK (Swithinbank et al. 1994)*</td>
<td>1176 (11-12 years)</td>
<td>Female</td>
<td>4 (n=665)</td>
<td>NS</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Male</td>
<td>6 (n=511)</td>
<td>NS</td>
</tr>
<tr>
<td>Japan (Watanabe et al. 1994)</td>
<td>not given (7 years)</td>
<td>Female</td>
<td>NS</td>
<td>5</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Male</td>
<td>NS</td>
<td>15</td>
</tr>
<tr>
<td>France (Collet et al. 1993)</td>
<td>1677</td>
<td>4-5 years</td>
<td>Report by child</td>
<td>17</td>
</tr>
<tr>
<td></td>
<td></td>
<td>6-7 years</td>
<td>Report by child</td>
<td>5</td>
</tr>
<tr>
<td></td>
<td>386</td>
<td>4-5 years</td>
<td>Report by parents</td>
<td>29</td>
</tr>
<tr>
<td></td>
<td></td>
<td>6-7 years</td>
<td>Report by parents</td>
<td>7</td>
</tr>
</tbody>
</table>

NS = not specified

* enuresis defined as “more than one bedwetting episode in the preceding three months”

Bower et al. measured the prevalence of urinary incontinence amongst 2282 urban-dwelling Australian children aged 5 to 12 (Bower 1996). The study instrument was self-administered by the parents of children in the sample. The subjects were identified using a sample of parents voting in a compulsory election. A total of 74% of parents approached agreed to participate. Overall, 18.4% of the population studied were found to be experiencing nocturnal enuresis at least once a month and daytime wetting was experienced by 5.5% of subjects. The study also surveyed the prevalence of marked (at least one episode per week) nocturnal enuresis (5.1%) and daytime wetting (1.4%) of the population. A total of 60% of children with nocturnal enuresis in this study were male regardless of whether the enuresis was primary or secondary.
The study by Bower also indicated that the presence of childhood nocturnal enuresis is a risk factor for the subsequent development of urinary incontinence in adult life (see page 41).

**Specific sub-populations of women**

Gunthorpe studied the prevalence of urinary incontinence amongst 348 women in GP surgery waiting rooms, using a validated instrument. This survey indicated that 76.7% of women had experienced at least one episode of urinary incontinence in the previous year (Gunthorpe 1998; Gunthorpe 2000). However, this population sub-group might not be representative of the overall female population since the reason for presentation of a significant proportion of the study subjects to a GP would have included conditions known to be associated with urinary incontinence. Similarly high estimates of the overall prevalence of urinary incontinence were reported by studies using specific populations including pregnant women (64%) (Chiarelli and Campbell 1997) and amongst rural Aboriginal women (54%) (Benness and Manning 1999).

**Prevalence by most severe measure of incontinence**

A variety of definitions were used to assess the more severe levels of incontinence. These included the following:

a) wearing incontinence pad protection or the 'use of aids'

b) frequency of incontinence:
   - leaking once per week
   - leaking once per day
   - 'leaking most or all of the time'
   - 'leaking often'

c) reduced quality of life

d) experiencing 'severe' symptoms

e) 'substantial dissatisfaction with urinary symptoms'
a) Wearing pad protection: In studies using the need to wear pads as the measure of severity (Brieger et al. 1997; Roberts et al. 1998; Dolan et al. 1999; Palmer et al. 1999; Rizk et al. 1999), the estimates of prevalence were as follows:

<table>
<thead>
<tr>
<th>Estimate %</th>
<th>M/ F</th>
<th>Country/ geographic region/ population characteristic; Author</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.5</td>
<td>F</td>
<td>China</td>
</tr>
<tr>
<td>5.5</td>
<td>F</td>
<td>Middle East</td>
</tr>
<tr>
<td>12.3</td>
<td>F</td>
<td>Ireland</td>
</tr>
<tr>
<td>20.3</td>
<td>F</td>
<td>USA; working women</td>
</tr>
<tr>
<td>30.3</td>
<td>F</td>
<td>USA; rural</td>
</tr>
<tr>
<td>20.3</td>
<td>M</td>
<td>USA; rural</td>
</tr>
</tbody>
</table>

Since the use of pads might be associated with other factors such as availability and socio-economic status, other measures of the severity of urinary incontinence might be considered to be more robust.

The study by Millard demonstrated that pad utilisation does not correlate with the degree of incontinence and only 35% of regularly incontinence women use pads. Maximum pad utilisation was 56% amongst women with incontinence ‘without warning or provocation’ (Millard 1998).
b) Frequency of incontinence episodes: Studies which reported the severity of incontinence according to frequency provided the following estimates:

<table>
<thead>
<tr>
<th>Measure of severity</th>
<th>Prevalence %</th>
<th>Authors</th>
</tr>
</thead>
<tbody>
<tr>
<td>Leaking ‘more than drops only’ more than twice a month</td>
<td>8</td>
<td>Kuh, Cardozo et al. 1999</td>
</tr>
<tr>
<td>Leaking more than once a week</td>
<td>23</td>
<td>Foldspan and Mommsen 1997</td>
</tr>
<tr>
<td>Daily leaking</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Daily leaking</td>
<td>29.4</td>
<td>Schulman, Claes et al. 1997</td>
</tr>
<tr>
<td>Daily leaking</td>
<td>30.3 (F)</td>
<td>Roberts, Jacobsen et al. 1998</td>
</tr>
<tr>
<td>Daily leaking</td>
<td>22.2 (M)</td>
<td></td>
</tr>
<tr>
<td>Leaking most or all the time</td>
<td>5-8%</td>
<td>Malmsten et al. 1997</td>
</tr>
<tr>
<td>44-66 (depending on age cohort)</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

c) Effects on quality of life: Two studies reported severity of incontinence as "affecting the quality of life" (Koyama et al. 1998; Temml et al. 2000). When reviewed in relation to the urban populations within these two studies - 20% of the combined male and female population men in Koyama et al. and 18% of women and 17% of men in Temml et al. stated that urinary incontinence impaired their quality of life. The study by Temml et al. demonstrated that quality of life was more often impaired in subjects experiencing urge incontinence (62.5% women and 57.5% men) than in those experiencing stress incontinence (39.9% women, 17.4% men).
d) Symptom severity: The Australian studies of symptom severity are summarised as follows:

<table>
<thead>
<tr>
<th>Measure of incontinence</th>
<th>Gender; other characteristics</th>
<th>Prevalence (%)</th>
<th>Author</th>
</tr>
</thead>
<tbody>
<tr>
<td>Often</td>
<td>F; Young (19-22 y)</td>
<td>7</td>
<td>Chiarelli</td>
</tr>
<tr>
<td></td>
<td>F; Mid-aged (45-49 y)</td>
<td>16</td>
<td></td>
</tr>
<tr>
<td></td>
<td>F; Older (70-74 y)</td>
<td>20</td>
<td></td>
</tr>
<tr>
<td>Use of protection against leakage</td>
<td>F; Aboriginal</td>
<td>20</td>
<td>Benness</td>
</tr>
<tr>
<td>‘Substantially dissatisfied with their urinary condition’*</td>
<td>F</td>
<td>16</td>
<td>Pinnock</td>
</tr>
<tr>
<td></td>
<td>M</td>
<td>9</td>
<td></td>
</tr>
<tr>
<td>Moderate to more severe or frequent</td>
<td>F</td>
<td>33.9</td>
<td>Millard</td>
</tr>
<tr>
<td></td>
<td>M</td>
<td>14.2</td>
<td></td>
</tr>
<tr>
<td>Significant incontinence now</td>
<td>F</td>
<td>11</td>
<td></td>
</tr>
<tr>
<td></td>
<td>M</td>
<td>2</td>
<td></td>
</tr>
<tr>
<td>Use of ‘some kind of extra protection’ against leakage</td>
<td>F</td>
<td>13.8</td>
<td>MacLennan</td>
</tr>
<tr>
<td></td>
<td>M</td>
<td>3.1</td>
<td></td>
</tr>
</tbody>
</table>

* NB this measure was not applied specifically in reference to incontinence but referred to ‘Lower Urinary Tract Symptoms’ (LUTS)

From these results it would appear that more women than men experience more serious levels of urinary incontinence.
The 1998 ABS survey of Disability, Ageing and Carers provides estimates of the numbers of people in Australia who use aids and appliances to manage incontinence. The following table summarises these data.

<table>
<thead>
<tr>
<th>Age range</th>
<th>Total numbers from ABS survey using continence aids</th>
<th>Proportion of aged and disabled people using continence aids</th>
</tr>
</thead>
<tbody>
<tr>
<td>0 - 4</td>
<td>778</td>
<td>100%</td>
</tr>
<tr>
<td>5 - 64</td>
<td>30904</td>
<td>6%</td>
</tr>
<tr>
<td>65+</td>
<td>130943</td>
<td>37%</td>
</tr>
</tbody>
</table>

Caution should be used when comparing these data with the estimations already provided of the numbers of people using pads to manage urinary incontinence. The apparent higher proportion of people aged 65+ who use aids and appliances to manage urinary incontinence is most likely a reflection of the underestimation of pad usage amongst women under the age of 65 years who are not disabled, and therefore not included in the ABS figures. In addition, the ABS data refer to severely disabled people and include residents from care facilities, rather than community-dwelling individuals represented in the epidemiological data presented so far. Another consideration is that these ABS data include the use of aids and appliances not just the use of pads.

Notwithstanding the difficulties mentioned above, it can be seen that the aged and the disabled within the Australian community commonly use aids and appliances to manage urinary incontinence.


Influence of ethnicity

Asian populations

In the studies included in this review, those conducted within Asian populations (Brieger et al. 1997; Ma 1997; Nakanishi et al. 1997; Koyama et al. 1998) suggest a lower estimate of the prevalence of urinary incontinence (9.8% to 34%) than estimates derived from other populations. A study by Lapitan which was recently presented to an international forum, studied the prevalence of urinary incontinence in 28 centres across 11 Asian-Pacific countries. The results of this well coordinated study supporting the concept of lower overall rates of urinary incontinence amongst some female Asian populations. Estimates of prevalence range from Pakistan (24%), Korea (22.6%), Thailand (20.9%), Philippines (13.9%), Malaysia (13.1%), Hong Kong (12.0), Singapore (11.8%), China (11.6%), Taiwan (7.4%), India (6.2%), to Indonesia (5.8%) (Lapitan 2000). It is unclear whether this represents a true difference in prevalence among subjects from different countries and ethnic groups or whether these differences reflect a reluctance to report symptoms as a result of specific values attached to incontinence by some cultures.

Caucasian- and African-American populations

The study by Fultz et al. (1999) specifically examined differences in prevalence between Caucasian-American women and African-American women and found significant differences between the two groups. A total of 23% percent of Caucasian women reported urinary incontinence compared with 16% of African American women. The finding of a lower prevalence of urinary incontinence among African American women supports the findings from the earlier study by Burgio et al. (1991). These findings are also supported by the study by Palmer which reported that the prevalence of urinary incontinence was lower among African-American women and Asian-American women than Caucasian-American women however the sample size of women in each of these groups was small compared to those included in the studies by Fultz and by Burgio (Palmer et al. 1999). Other independent studies also support the concept of racial differences in the prevalence of urinary incontinence (eg Lara and Nacey 1994), with the
authors stating that African American women are less likely to report health problems overall.

Estimates of the prevalence of incontinence in the studies conducted in general American populations range from 21% to 55% in studies featuring women only, 48.7% in studies featuring both sexes, and 29% in a study conducted in a male only population. Based on these estimates, the prevalence of urinary incontinence in American populations appears to be at the high end of the ranges reported worldwide. This observation is supported by the findings in a review of population estimates of urinary incontinence performed by Hampel et al. (1997) as well as the clinical studies conducted in women from a range of racial groups experiencing urinary incontinence and pelvic organ prolapse by Bump (Bump 1993).

**Australian studies in Aborigines and ethnic groups**

Only one of the surveys in Australian populations was specifically devoted to the study of a single racial group. Benness and Manning surveyed 281 community dwelling, non-urban Aboriginal women and estimated the prevalence of urinary incontinence in these women to be 54% (Benness and Manning 1999).

Beness et al. examined the prevalence of urinary incontinence amongst 281 Aboriginal women using an unvalidated, doctor-administered questionnaire and found the overall prevalence of urinary incontinence to be 54% (Benness and Manning 1999). Symptoms of stress incontinence were most prevalent (49%), followed by those of urge incontinence (29%) and mixed incontinence (20%). While the size of this study sample might not provide sufficient power to provide a highly accurate estimate of the prevalence of urinary incontinence within this population, the study makes an important contribution to the body of knowledge.
Compared to the overall Caucasian female population, a significantly higher estimate of the prevalence of urinary incontinence was provided by Chiarelli et al. in the WHA study, but only amongst younger Aboriginal women, while women with English as a second language were not seen to have any higher prevalence of urinary incontinence than the other women in the study (Chiarelli and Brown 1997).

Aboriginal women have greater mean BMI and a higher prevalence of diabetes than their Caucasian Australian contemporaries. There is also a significantly higher parity among younger Aboriginal and Torres Strait Island women than in other Australian women in the younger cohort (19-22 years) (Day et al. 1999). These factors may contribute to the higher prevalence of urinary incontinence reported among Aboriginal Women compared to Caucasian Australian subjects.

No studies reported the evaluation of urinary incontinence or LUTS in Aboriginal or Torres Strait Islander men, and in view of the seemingly higher prevalence of urinary incontinence in Aboriginal women, further studies in these specific populations might be warranted.
The incidence of urinary incontinence

Study of incidence of urinary incontinence requires comparison of the prevalence of urinary incontinence in the same sample population at different time points, preferably conducted in a prospective manner. This was the case in two of the studies presented here. The study by Nygaard in women aged over 65 years, measured urinary incontinence by self-report in women at baseline, 3 and 6 years (Nygaard and Lemke 1996). For urinary stress incontinence the three-year incidence and remission rates between years 3 and 6 were estimated to be 28.6 and 25.1% respectively. For urge incontinence the three-year incidence and remission rates between years 3 and 6 were 28.5% and 22.1% respectively.

The study by Holtedahl and Hunskaar (1998) included two clinical evaluations, one year apart. This study revealed a 0.9% incidence of urinary incontinence over one year and no reports of spontaneous remission. The age range of women in this study was a little lower (50-74 years) than in the previously mentioned studies.

Samuelsson surveyed women at baseline and then at follow-up three years later (Samuelsson et al 1997 & 2000). The authors of this study estimated the mean annual incidence of urinary incontinence among women was 2.9% overall (ever leak) and 0.5% for subjects who experienced incontinence at least once each week. The mean annual rate of remission was estimated to be 5.9%, reflecting the dynamic nature of the experience of urinary incontinence.

The results from these studies are supported by the results of an earlier study of the incidence of urinary incontinence in healthy middle-aged women evaluated on two occasions, three years apart. Burgio estimated a cumulative incidence of urinary incontinence over three years to be 8.0% (Burgio et al. 1991).
The remission of urinary stress incontinence might be explained in those women who are: relieved of upper respiratory tract symptomatology, reduce BMI, or those who undergo successful surgery aimed at reducing urinary incontinence. The remission of urge incontinence might be explained by resolution of urinary tract infection or as a result of medication.

Clearer understanding of the incidence of female urinary incontinence in younger women would provide information helpful to the development of prevention strategies.
Other variables significantly associated with urinary incontinence

In epidemiological studies of urinary incontinence, associations between variables often appear to be significant. While the strength of associations between variables can be estimated, these associations cannot be assumed to reflect causation.

**Body mass index**

There is a significant relationship between urinary incontinence and body mass index (BMI) (Ma 1997; Holtedahl and Hunskaar 1998; Brown et al. 1999; Fultz et al. 1999; Kuh et al. 1999; Palmer et al. 1999; Simeonova et al. 1999; Bortolotti et al. 2000; Chiarelli et al. 1999; MacLennan 2000). Others have found this relationship to be true for stress urinary incontinence (Simeonova et al. 1999; Brown et al. 1999).

There is additional evidence to support the epidemiological association between the prevalence of urinary incontinence and increased BMI. Noblett et al. in a retrospective analysis of charts of patients undergoing urodynamic evaluation showed a significant correlation between BMI and intra-abdominal pressures, and suggested that the presence of obesity may result in increased stress on the structures of the pelvic floor secondary to the effects caused by chronic increases intra-abdominal pressure (Noblett et al. 1997).

The association between the prevalence of urinary incontinence and increased BMI has also been shown using factorial analysis, in Yugoslavian women (Sustersic and Kralj 1998). Other comparative studies between women with increased BMI and those without have shown significant differences in the experience of urinary incontinence and the need to wear protective pads (Rasmussen et al. 1997). Other studies report significant decrease in the...

Increased body mass index or weight greater than 120% of normal has been associated with increased risk of stress incontinence, genuine stress incontinence (GSI) on testing, and urge incontinence in a number of separate studies (Koelbl and Riss 1987; Dwyer et al. 1988; Wingate et al. 1994). These factors have also been reported to be significant and independent risk factors for urinary incontinence (Mommsen and Foldspang 1994; Brown et al. 1996).

A study reported a significant decrease in stress urinary incontinence from 61.2% to 11.6% in 138 morbidly obese women following bariatric surgery (procedures to reduce stomach volume eg stapling, banding etc) (Dietel et al. 1988). Bump showed similar benefit following weight loss in the resolution of urge incontinence and detrusor over-activity (Bump et al. 1992).

In the study by Chiarelli the there was a very positive correlation between increasing BMI, urinary incontinence and the relative risk of urinary incontinence in the older age group. Similar positive associations were noted in the young and mid age groups (Chiarelli, Brown et al. 1999).

<table>
<thead>
<tr>
<th>Body weight class BMI</th>
<th>Odds ratios (95% CI)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Young (19-22 y)</td>
</tr>
<tr>
<td>Underweight: &lt; 19.9</td>
<td>1.00</td>
</tr>
<tr>
<td>Ideal: 20-24.9</td>
<td>1.08 (0.94-1.23)</td>
</tr>
<tr>
<td>Overweight: 25-29.9</td>
<td>1.34 (1.13-1.60)</td>
</tr>
<tr>
<td>Obese: 30-40</td>
<td>2.09 (1.67-2.61)</td>
</tr>
<tr>
<td>Very obese: &gt;40</td>
<td>1.82 (1.07-3.09)</td>
</tr>
</tbody>
</table>
Urinary tract infection

A number of epidemiological studies have shown significant associations in women between having a history of lower urinary tract infection (UTI) and being incontinent of urine. Estimates of the relative risk of urinary incontinence (both stress and urge incontinence) and a history of UTI have been reported to be between 0.4 and 2.0 (Mommsen et al. 1994), while the adverse physiological effects of UTI on bladder function and continence were also reported by Bergman and Bhatia (1985).

Three studies found a significant association between urinary tract infection (UTI) and urinary incontinence (Brown et al. 1999; Hagglund et al. 1999; Kuh et al. 1999). Measures of self-report of UTI differed between studies and included any history of kidney or bladder infections:

- ever (Kuh et al. 1999)
- in the preceding year (Brown et al. 1999)
- in last six months (Hagglund et al. 1999)

Respondents in the studies by Chiarelli et al. had a significantly higher risk of urinary incontinence if they also reported experiencing "urine that burns or stings" within the previous year. The estimated relative risk according to experiencing "urine that burns or stings" within the previous year was as follows:

<table>
<thead>
<tr>
<th>Burning and stinging</th>
<th>Odds ratios (95% CI)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Young (19-22 y)</td>
</tr>
<tr>
<td>Never</td>
<td>1.0</td>
</tr>
<tr>
<td>Sometimes</td>
<td>2.94 (2.59-3.33)</td>
</tr>
<tr>
<td>Often</td>
<td>4.19 (3.56-4.93)</td>
</tr>
<tr>
<td>Rare</td>
<td>4.93 (3.6-6.74)</td>
</tr>
</tbody>
</table>
However, symptoms of burning or stinging might indicate urogenital atrophy in addition to or instead of being a symptom of urinary tract infection (Chiarelli et al. 1999).

A total of 15% of female respondents and 5% of male respondents in the study by Millard reported urinary tract infection as a precipitating factor for urinary incontinence (Millard 1998).

**Smoking/ upper respiratory symptoms**

Two case control studies showed a strong statistical relationship between cigarette smoking and urinary incontinence (Bump and McLish 1992; Tampakoudis et al. 1995). When compared to non-smokers, the odds ratio for former smokers and current smokers has been estimated to be 2.2 and 2.48 respectively for stress incontinence and 2.92 and 1.89 respectively, urge incontinence (Bump and McLish 1992).

A significant association between the prevalence of urinary incontinence and smoking was found in two of the international studies (Brieger et al. 1997; Samuelsson et al. 1997).

Two Australian studies found the prevalence of urinary incontinence to be significantly higher in women with the following conditions:

- chronic cough
- allergies
- hayfever
- asthma
- bronchitis
- emphysema
- breathing difficulties

* indicates a significant correlation
† indicates a very significant correlation
‡ indicates a very very significant correlation
† in all age cohorts: young (19-22 y); mid-aged (45-49 y); older (70-74 y)
‡ (in the mid age and older cohorts)
**(Chiarelli and Brown et al. 1999).

The association between long term smoking and chronic lung disease is undeniable. Two large epidemiological studies have shown a significant increase in urinary incontinence in older women (>65yr) with chronic obstructive airways disease (Brown et al. 1996) and chronic coughing (Diokno et al. 1990). Smoking without lung disease does not appear to be a direct risk factor for older (Brown et al. 1996) or middle aged women (Burgio et al. 1991). Clearly, smoking is the obvious identifiable predisposing and reversible factor leading to the chronic respiratory diseases which promote urinary incontinence.

### Diabetes

Several studies described the following were significant associated with urinary incontinence:

- diabetes - urge incontinence only; RR 1.5 (Brown et al. 1999)
- diabetes - RR 1.37 (although the contribution of UTIs and other co-morbid conditions more common in subjects with diabetes than in the general population was questioned) (Millard 1998)
- family history of diabetes (Samsioe et al. 1999).

Diabetic neuropathy is a central factor in the pathogenesis of voiding dysfunction in subjects with diabetes mellitus and this process is thought to parallel the effects of diabetic neuropathy in other systems (DuBeau 1996). Diabetic neuropathy leads to impairment in the contractility of the bladder itself.
which leads to large post-void residual volumes of urine, retention of urine and finally bladder infection (Frimodt-Moller 1980).

**Enuresis**

Available information strongly supports a genetic link between childhood enuresis and a history of enuresis in one or both parents. The children of parents with a history of enuresis are likely 5-7 times more likely to be enuretic than those children without an affected parent (Rittig 1995).

Epidemiological studies of the natural history of incontinence have shown a significant association between childhood enuresis and the subsequent development of urge incontinence in adulthood and adult enuresis (Yarnell et al. 1981; Foldspang and Mommsen 1994).

In an Australian study, Millard found a relative risk of 5.0 of adult nocturnal incontinence and relative risk of 1.7 of adult daytime incontinence in subjects reporting childhood nocturnal enuresis. Subjects reporting daytime wetting as children had both a threefold increase in the risk of night-time incontinence and double the risk of daytime incontinence in adulthood (Millard 1998). These findings have significant implications given the prevalence of diurnal and nocturnal urinary incontinence among Australian children found by Bower et al. (1996) (see section on Australian studies in children; p 27).

The study by Kuh et al. specifically studied the strength of the association between adult urinary incontinence and childhood enuresis. Women with severe urinary incontinence and urge incontinence were significantly more likely to have suffered regular enuresis as a child compared to those who reported being dry both day and night. Women who were regular bedwetters at age 6 were twice as likely, while those who had been daytime wetters only were likely to be 1.5 times more likely to suffer urge incontinence at age 48 years.
Parity & mode of delivery

The incidence of urinary incontinence increases throughout pregnancy, commencing in the first trimester (Chiarelli 1999):

<table>
<thead>
<tr>
<th>Trimester</th>
<th>Prevalence of incontinence %</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>8</td>
</tr>
<tr>
<td>2</td>
<td>18</td>
</tr>
<tr>
<td>3</td>
<td>47</td>
</tr>
</tbody>
</table>

Chiarelli estimated the following levels of relative risk according to parity:

<table>
<thead>
<tr>
<th>Parity</th>
<th>Odds ratios (95% CI)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Young (19-22 y)</td>
</tr>
<tr>
<td>0</td>
<td>1.0</td>
</tr>
<tr>
<td>1</td>
<td>2.82 (2.37-3.35)</td>
</tr>
<tr>
<td>2</td>
<td>2.59 (1.86-3.61)</td>
</tr>
<tr>
<td>3 or more</td>
<td>4.84 (2.54-9.20)</td>
</tr>
</tbody>
</table>

Nine international and three Australian population studies found parity to be associated with urinary incontinence (Brieger et al. 1997; Ma 1997; Samuelsson et al. 1997; Schulman et al. 1997; Dolan et al. 1999; Hagglund et al. 1999; Kuh et al. 1999; Samsioe et al. 1999; Bortolotti et al. 2000 Chiarelli and Brown 1999; Lam, Kennedy et al. 1999; MacLennan 2000), while Simeonova found parity to be associated with the symptoms of stress incontinence only (Simeonova et al. 1999).

In an Australian survey, 31% of incontinent female respondents identified childbirth as a precipitating factor for urinary incontinence (Millard 1998). Dwyer (Dwyer et al. 1988) pointed out that coexistent obesity may also contribute significantly to the risk of urinary incontinence following childbirth.
Studies of the pathogenesis of incontinence following childbirth indicate that vaginal delivery is associated with:

- nerve damage (Snooks et al. 1984; Snooks et al. 1990; Sultan et al. 1993; Mallet et al. 1994)
- muscle damage (Mallet et al. 1994; Dimpfl et al. 1998)
- damage to the supporting structures within the genitourinary tract (Allen et al. 1990).

Studies of the prevalence of incontinence following vaginal delivery indicate:

- the increase in stress incontinence is greater than that in urge incontinence
- a 12% prevalence in the nullipara
- a 32% prevalence in parous women
- the first vaginal delivery is a significant contributor increased risk
- multiparity (> 4 children) is a significant contributor increased risk

† Sommer et al. 1990
‡ Wilson et al. 1996.

Studies of instrumental and Caesarean delivery indicate the following significant associations:

- increased risk of stress urinary incontinence and pelvic prolapse where perineal lacerations occurred (Snooks et al. 1985b; Snooks et al. 1990)
- increased risk of urinary incontinence and any first delivery or instrumental delivery (MacLennan 2000)
- increased risk of urinary incontinence and forceps use, episiotomy and perineal tears. (Lam et al. 1999)
- vacuum extraction and postpartum nerve damage (Tetzchner et al. 1997)
- vacuum extraction as well as forceps assisted delivery to be to be risk factors for pelvic floor muscle damage and faecal incontinence. (MacArthur,
et al. 1997). Vacuum extraction is associated with less pelvic floor pathology than forceps delivery (Seidman 1991)

- Caesarian section appears to be protective against the subsequent development of urinary incontinence (Wilson et al. 1996; MacArthur et al. 1997) but this is refuted by other Australian studies (MacLennan 2000).

- A significant association between instrumental delivery and urinary incontinence (Rizk et al. 1999).

Pudendal neuropathy has been associated with stress urinary incontinence and faecal incontinence (Lubowski et al. 1988). A 1986 study demonstrated that 28% of women had denervation/reinnervation potentials on EMG studies after delivery with elongation of pudendal nerve terminal motor latency (Snooks et al. 1985). There is a suggestion that chronic straining at stool may produce similar problems (Jones et al. 1987; Lubowski et al. 1988)

Chiarelli and Campbell retrospectively studied the prevalence of urinary incontinence in 304 pregnant women using an instrument validated by Gunthorpe (Chiarelli and Campbell 1997; Gunthorpe 2000). The authors of this study made the following estimates of the prevalence of urinary incontinence in pregnancy:

- 64% overall
- 37% symptoms of mixed incontinence
- 20% stress symptoms
- 7% urge symptoms.

Gynaecological conditions

Three of the international studies in women found significant associations between urinary incontinence and various gynaecological conditions (Holtedahl and Hunskaar 1998; Rizk et al. 1999; Samsioe et al. 1999). Samsioe described a negative association between urinary incontinence and the use of low dose
oestrogens for urogenital symptoms. (Samsioe et al. 1999). Previous surgery for pelvic organ prolapse was found to be significantly associated with urinary incontinence in a number of studies (Holstedahl and Hunskaar 1998; Rizk et al. 1999). Clinical assessments carried out in the study by Holstedahl et al. found significant associations between urinary incontinence and poor pelvic floor muscle contraction and any abnormal gynaecological examination (Holstedahl and Hunskaar 1998).

Incontinent female respondents in the study by Millard selected hysterectomy (7%) and menopause (5%) as precipitating factors in the development of urinary incontinence. Chiarelli et al. found a significant relationship between urinary incontinence in the mid and older age groups in women who had a past history of hysterectomy, oophorectomy or repair of pelvic organ prolapse (Chiarelli et al. 1999). Lam et al. (1999) also found past history of hysterectomy to be significantly associated with urinary incontinence.

Parys (Parys et al. 1989) reported increased incidence of genuine stress incontinence, from 39% to 58%, 3 to 6 months after hysterectomy, although other studies (Vervest 1993) showed only clinically unimportant declines in urodynamic parameters and no new incontinence 12 to 26 weeks after simple hysterectomy.

The evidence indicating hysterectomy is a contributing factor to urinary incontinence is conflicting (Thom and Brown 1998). Thom postulated that the positive epidemiological evidence associating hysterectomy with urinary incontinence contrasted with a distinct lack of association found in clinical studies of hysterectomy describing up to two years of follow-up. He suggested that this observation may reflect that the tissue damage associated with surgery does not result in urinary incontinence until many years after the time of surgery in a manner analogous to the longer term changes (beyond two years) that occur as a result of the impact of childbirth on continence mechanisms (Thom and Brown 1998).
The evidence does not support avoiding legitimately indicated hysterectomy, nor the use of supracervical hysterectomy purely on the basis of a need to avoid urinary incontinence.

**Conditions of the Nervous system**

Many neurological diseases increase in prevalence with age. The study by Nygaard, confirmed the significance of the association between neurological disease and urinary incontinence was still evident after controlling for age (Nygaard and Lemke 1996).

The study by Thom (Thom et al. 1997) showed that there was an increased likelihood of urinary incontinence beginning following the diagnosis Parkinson's disease, stroke, dementia, depression and congestive cardiac failure.

**Stroke**

Urinary incontinence occurs in 44% to 60% of patients after cerebrovascular accident or stroke (Wade and Hewer 1985; Borrie et al. 1986). Another study indicated that after four weeks up to 42% of stroke patients still experience urinary incontinence (Borrie et al. 1986).

Stroke and the resulting functional limitation were found to be significantly associated with urinary incontinence in three studies (Nygaard and Lemke 1996; Nakanishi et al. 1997; Fultz et al. 1999).

Chiarelli et al. found a positive association between urinary incontinence and past history of cerebrovascular accident (stroke) (Chiarelli and Brown 1999).
**Parkinson’s disease**

A significant association was also found in one study between the experience of Parkinson’s disease and urinary incontinence (Nygaard and Lemke 1996). In Parkinson’s disease up to 60% of patients are estimated to have urinary symptoms related to the muscular dysfunction associated with the disease being manifest within the muscles of the pelvic floor (Sotolongo 1994). Other studies show the bladder itself to undergo changes in contractility (Malone-Lee and Wiseman 1991).

**Multiple Sclerosis**

Bladder dysfunction is experienced as an initial symptom in 5% of those suffering multiple sclerosis. However, up to 90% of patients show evidence of bladder dysfunction at some time during the course of their disease. Bladder dysfunction manifests itself as detrusor hyperreflexia (60%) or an under active or areflexic detrusor (30%) (Karram 1993).

**Spinal cord injury**

Any condition affecting the spinal cord and resulting in paraplegia or quadriplegia or is likely to be associated with urinary incontinence

- traumatic spinal cord injury
- myelomeningocele – spina bifida
- spinal tumours
- transverse myelitis
- syringomyelia

Neurological damage to the conus, cauda equina or sacral nerves may produce bladder dysfunction that predisposes to urinary incontinence.
Dementia

The relative risk of urinary incontinence and dementia is 3.0 in women and 3.6 in men (Thom et al. 1997). Studies show that urinary incontinence in dementia patients may not be causally related but may have multiple other aetiologies with treatable causes and inciting factors. Urinary incontinence in dementia patients is estimated to be between 50% and 75% (DuBeau, 1996).

Psychiatric disorders

In the study by Millard, a total of 15% of psychiatric inpatients were reported to be incontinent (Millard 1998). Thom estimated the relative risk of urinary incontinence and clinical depression to be 1.6 in both women and men (Thom et al. 1997). While some studies have shown an association between urinary incontinence and depression and anxiety (Macauley et al. 1991). Other studies have found no relationship (Moore & Sutherst 1990). Issues surrounding urinary incontinence and psychiatric illness might well include both the effects of treating medication and the effects of illness on motivation to remain dry.

Reduced mobility

Millard found a significant association between impaired mobility and the prevalence of urinary incontinence (Millard 1998). The study reported the following prevalences:

- 24% overall prevalence leakage
- 45% in subjects with mildly impaired mobility
- 50% in subjects with a moderately restricted mobility.

Falls

Falls are associated with functional disability and nursing home admission in the elderly. Urinary incontinence has been shown to be a significant characteristic
of elderly people who have fallen and been admitted to a nursing home (Tinetti and Williams 1997). Data from the Women's Health Australia incontinence symptomatology sub study of community dwelling women were asked if they had ever tripped, fallen or injured themselves in any way while rushing to the toilet and reported the following results:

- 5.5% mid-age group (50-55 years); n=415
- 4.6% older age group (75-80 years); n=395.

**Constipation**

There is evidence linking chronic constipation with urinary incontinence especially in older women. There are many factors that contribute to constipation in the elderly. Older women with urinary incontinence are significantly more likely to have constipation and faecal incontinence (Diokno et al. 1990).

Faecal impaction is a common precipitator of reversible urinary incontinence in nursing home residents. Studies show that urinary incontinence is completely resolved or improved after treating faecal impaction in frail older people in nursing homes (Paillard and Resnick 1984).

In female populations, constipation was found to be significantly associated with urinary incontinence as follows (Chiarelli 1999):
<table>
<thead>
<tr>
<th>Constipation</th>
<th>Odds ratios (95% CI)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Young (19-22 y)</td>
</tr>
<tr>
<td>Never</td>
<td>1.0</td>
</tr>
<tr>
<td>Rarely</td>
<td>2.13 (1.86-2.42)</td>
</tr>
<tr>
<td>Sometimes</td>
<td>2.86 (2.43-3.36)</td>
</tr>
<tr>
<td>Often</td>
<td>2.66 (2.07-3.40)</td>
</tr>
</tbody>
</table>

Repeated straining at stool is thought to weaken pelvic floor muscles and ligaments and contribute to pelvic floor muscle dysfunction. (Jones et al. 1987; Lubowski et al. 1988)

**Musculoskeletal conditions**

Multiple analyses found persistent associations between musculoskeletal conditions such as osteoporosis, arthritis, and urinary incontinence. While the associations between these conditions are unclear, it was hypothesised that the link might be either a genetic predisposition to connective tissue disorders and/or co-existing oestrogen deficiency states (MacLennan 2000). Another hypothesis places the various arthritides and restricted mobility into close association which might account for the positive association with these conditions and urinary incontinence.

**Prostate conditions**

Five percent of incontinent men in the study by Millard identified prostatectomy as the precipitating factor in the genesis of their urinary incontinence (Millard 1998). Urinary incontinence is one of the most significant outcomes following radical surgery for prostate cancer. A recent study of 167 men who had undergone surgery for prostate cancer, about 43% of men complained of any urinary incontinence while about 25% of men complain of urinary incontinence (other than minimal leakage). This study was conducted at a median time post-
surgery of 2.7 years (range 0.3 to 5.4 years) (Gray and Petroni 1999). Bates also studied the morbidity in 87 men following total prostatectomy and estimated that 69% of men experienced some degree of leakage while 24% of the men wore pad protection. None of the men in the study had urinary incontinence prior to their surgery (Bates et al. 1998).

Radical prostatectomy (RP) for early prostate cancer has been extensively studied. In a study of 620 patients 6 and 12 months after RP (Leandri et al. 1992), 90% and 95% were dry respectively. Control was achieved at 12 months by 97% of men less than 70 years of age, and by only 94% of those over 70. These age related differences in outcome were supported by other studies (Vernon et al. 1997, Stanford et al. 2000). In a further study of 593 men having RP with attempted preservation of the neurovascular bundles (where appropriate), complete control at 3, 6, 9, 12 and 24 months was achieved in 47%, 75%, 82%, 89% and 92% respectively. The stage and grade of tumour, and whether or not the neurovascular bundles were preserved at surgery, and age of patient, had no impact on continence outcome. (Steiner et al. 1991)

Two studies have used both subjective (structured interview) and objective measures (pad testing) of urinary incontinence after RP. An Australian study (Donellan et al. 1997) of 51 patients tested 12 month after RP reported subjective (and objective) continence in 80% (84%), mild incontinence in 14% (6%), moderate incontinence in 4% (6%) and severe incontinence in 2% (4%). A Scandinavian study (Jonler et al. 1996) using a 24 hour pad test demonstrated 63% wet at 6 months of whom only 29% regarded it as a problem.

In the UK, it is estimated that almost 20% of men over the age of 50 years undergo transurethral resection of the prostate (TURP) (Garraway et al. 1991). A survey of 5 276 men following TURP found almost one third to have urinary incontinence at three months following surgery (Emberton et al. 1996). By 12
months post-surgery the prevalence of urinary incontinence in this group of men had reduced to less than 5% (Foote et al. 1991).

In a recent review of the literature since 1990, summarising 12 studies involving 6797 patients, pertaining to urinary incontinence after open prostatectomy, TURP or transurethral incision of prostate (TUIP) for benign disease, it was concluded that the rates of urinary incontinence were below 2%. The quality of reporting did not allow for a distinction to be made between rate of total and lesser degrees of incontinence. (Herschorn et al. 1998)

Utilisation data from the NSW Public Hospital system indicate that in 1986/89 a total of 6 584 TURP procedures were performed while 641 open prostatectomies (mostly RP) were performed. These figures increased to 8 033 TURP and 1316 open prostatectomies in 1995/96 (Bilgin 1997). This resulted in rates of prostatectomy per 100 000 population in 95/96 of 275 for TURP and 44 for open prostatectomy.

**Occupation and recreation**

Nygaard et al. studied urinary incontinence in nulliparous, young, elite athletes and estimated the prevalence to be 28% and reported, not surprisingly, that the activities found most likely to provoke urine loss were jumping, landings and dismounts (Nygaard et al. 1990). Nygaard et al. also found a significant association between foot flexibility and urinary incontinence in nulliparous athletes reflecting the contribution of connective tissue condition to continence (Nygaard et al. 1994). However, the same investigators also found that regular strenuous exercise did not predispose subjects to clinically significant urinary incontinence in later life (Nygard 1997) Bo et al. also found that women who are more physically active have higher prevalence of urinary incontinence than those who are not (Bo et al. 1990). These studies indicate that a woman’s continence depends not only on her actual anatomical, hormonal, cellular and neurologic status but is also dependent on the stresses placed on the pelvic floor.
There few data available to determine an association between occupational stresses and urinary incontinence. There are data to suggest that occupations that involve repetitive heavy lifting are associated with higher prevalence of pelvic organ prolapse (Jorgensen et al. 1994). Sustersic and Kralj used factor analysis to show a significant association in women, between urinary incontinence and hard physical work (Sustersic and Kralj 1998).

Of 563 female US soldiers, 31% reported urinary incontinence that was considered by subjects to be ‘embarrassing, and/or interfered with job performance.’ However, this study did not attempt to assess the causal role of occupation in the development of urinary incontinence (Davis et al. 1999).

**Medications**

Nygaard et al. showed a significant association between taking medication and urinary incontinence in older women (Nygaard and Lemke 1996). A number of commonly prescribed medications are known to affect lower urinary tract function and can contribute to urinary incontinence (eg diuretics) and urinary retention or other voiding difficulties (eg alpha blocking drugs, anticholinergic drugs and drugs with anticholinergic side-effects such as antipsychotics, antidepressants and narcotic analgesics) (Cheater and Castleden 2000).

Medications are cited as being one of the most common causes of urinary incontinence in the elderly (Resnick 1996). A very large body of literature is devoted to describing the effects of medications on continence and it is beyond the scope of this report to provide further examination of this subject.

**Incontinence in long-term care**

In facilities providing long-term care, the prevalence of urinary incontinence is estimated to be 72% in Japan (Toba et al. 1996), 62% in Canada (Borrie and...
Davidson 1992), 39% in the US (on entry) (Ouslander et al. 1993), 30.9% in the UK (Peet et al. 1995) and 54.5% in Italy (59.8% in women and 39.2% in men (Aggazzotti et al 2000). Thom and co-workers showed that urinary incontinence increases the risk of hospitalisation and substantially increases the risk of admission into nursing homes, independent of age, gender or the presence of any co-morbid condition (Thom et al. 1997). These investigators demonstrated that the relative risk of admission to a nursing home was 2.0 times greater for incontinent women and 3.2 times greater for incontinent men after adjustment for age, cohort factors and comorbid conditions.
Help-seeking amongst incontinent people

Twelve studies reported on the characteristics of help-seeking behaviours in subjects with urinary incontinence (Umlauf and Sherman 1996; Foldspang and Mommsen 1997; Ma 1997; Malmsten et al. 1997; Samuelsson et al. 1997; Damian et al. 1998; Koyama et al. 1998; Roberts et al. 1998; Dolan et al. 1999; Palmer et al. 1999; Rizk et al. 1999; Simeonova et al. 1999).

The prevalence of help-seeking among incontinent women ranged from 9% in younger urban Swedish women (mean age 38.9 years) (Samuelsson et al. 1997) to 47% in urban Swedish women (Simeonova et al. 1999). The median prevalence of help-seeking behaviours among whole population samples (male and female) of subjects with urinary incontinence was between 30.9% and 33%.

In Australia, an early study conducted by Millard in 1983, stated that 31% of women and 26% of men reported having sought help from a healthcare professional in relation to their experience of urinary incontinence (Millard and Oldenburg 1983). People with severe incontinence were not more likely to seek help than those with lesser degrees of incontinence. Another Australian study found that 30% of women and 19% of men had sought help (Muscatello unpublished observations).

Although not specifically examining a population with urinary incontinence Pinnock found 63% of men and 59% of women who were dissatisfied with their LUTS had not sought medical help.

Amongst incontinent women, Gunthorpe found that 35% had sought help for their urinary incontinence (Gunthorpe 1998; 2000).
A study that stratified help-seeking behaviour among incontinent women according to age group found:

- 33% in younger women (19-22 y)
- 45% in mid age (45-49 y) and older women (70-74 y).

The same study reported lower rates of satisfaction with treatment amongst younger incontinent women seeking help and their mid age or older counterparts (Chiarelli et al. 1999).

While 64% of women experience urinary incontinence during pregnancy, and 20% found it to be quite bothersome, only 23% had spoken with a healthcare professional about urinary incontinence (Chiarelli and Campbell 1997).

A study conducted in incontinent Aboriginal women reported even lower rates of help seeking with only 16% of the sample having sought help (Benness and Manning 1999).

One study examined the reasons for the delay in seeking help among women and revealed that most women delayed because of the following reasons (Norton et al. 1988):

- they hoped their symptoms would improve spontaneously
- they thought their symptoms were normal
- embarrassment in speaking to their doctor about their urinary incontinence (a less common explanation).

The study by Holst et al. also found a reason for incontinent women not seeking help that they thought their symptoms were normal. However, these investigators also reported that women had low expectations of any treatment benefits (Holst and Wilson 1988).
Incontinent Australian women who reported leaking urine “often” or “always” and had not sought help from a healthcare professional were asked to give reasons for not seeking help (WHA; Brown et al. 1998). The following table summarises the responses from three age groups of women.

<table>
<thead>
<tr>
<th>Reason for not seeking help</th>
<th>Young women 21-26yrs n=241 (%)</th>
<th>Mid-age women 48-53yrs n=415 (%)</th>
<th>Older women 72-79yrs n=395 (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Don’t consider it a problem</td>
<td>44.8</td>
<td>11.6</td>
<td>10.6</td>
</tr>
<tr>
<td>Think it will go away by itself</td>
<td>15.4</td>
<td>1.0</td>
<td>1.3</td>
</tr>
<tr>
<td>Feel I can manage on my own</td>
<td>40.2</td>
<td>25.1</td>
<td>30.4</td>
</tr>
<tr>
<td>Don’t know who to ask for help</td>
<td>8.3</td>
<td>3.6</td>
<td>3.3</td>
</tr>
<tr>
<td>Don’t know what to say</td>
<td>11.2</td>
<td>3.9</td>
<td>1.5</td>
</tr>
<tr>
<td>Too embarrassed</td>
<td>21.2</td>
<td>7.7</td>
<td>6.1</td>
</tr>
<tr>
<td>Want to see a female but none available</td>
<td>2.1</td>
<td>2.4</td>
<td>1.3</td>
</tr>
<tr>
<td>Afraid they will recommend surgery</td>
<td>5.0</td>
<td>12.0</td>
<td>7.3</td>
</tr>
<tr>
<td>Long waiting time for appointment</td>
<td>0.8</td>
<td>0.7</td>
<td>1.8</td>
</tr>
<tr>
<td>I Can’t</td>
<td>0.8</td>
<td>0.5</td>
<td>0.5</td>
</tr>
<tr>
<td>Too busy</td>
<td>7.5</td>
<td>3.9</td>
<td>0.3</td>
</tr>
<tr>
<td>I don’t want to</td>
<td>10.4</td>
<td>5.1</td>
<td>3.3</td>
</tr>
<tr>
<td>other</td>
<td>7.9</td>
<td>2.2</td>
<td>0.8</td>
</tr>
<tr>
<td>Had sought help</td>
<td>19.5</td>
<td>57.1</td>
<td>53.9</td>
</tr>
</tbody>
</table>
These findings highlight the fact that more women than men seek help for urinary incontinence or LUTS, older women are more likely than younger to seek help and that few incontinent Aboriginal women seek help. These findings also provide some indication of the target groups for interventions designed to increase the rate of help seeking among incontinence sufferers.

The results indicated that many younger incontinent women don’t consider their incontinence a problem, that they erroneously believe that the problem will resolve itself, and that they are happy to self-manage the problem. It is recommended that these concepts be considered by healthcare professionals involved in developing continence promotion programs.
Discussion

In general most of the studies featured in this review could be described as methodologically sound. The small study population of Australian Aboriginal (Benness and Manning 1999) might be seen to reduce the power of that study to accurately estimate the prevalence of urinary incontinence amongst Aboriginal women. The low response rates in some of the larger studies may have resulted in the introduction of response bias into the findings of these studies.

Urinary incontinence is common among males and females, in child and adult Australian populations. Given the more homogeneous population samples involved, it is not surprising that the estimates of the overall prevalence of urinary incontinence produced by the Australian studies were more consistent than the estimates provided by the assembled international studies. The variables seen to be significantly associated with urinary incontinence in Australian populations are congruent with the findings from the international studies. The causative link between urinary incontinence and any of the associated risk factors compiled here is beyond the scope of the epidemiological population studies featured in this review. A review of the significant body of evidence within the biomedical literature that examines the causal association between the risk factors described throughout this manuscript and urinary incontinence is beyond the scope of this review.

An improved understanding of the variables significantly associated with urinary incontinence should enable continence promotion programs to be more effectively targeted toward the ‘at risk’ groups within the community. Similarly this improved understanding is central to the ongoing evaluation and improvement of programs specifically designed for these target groups. An assessment of which of these variables might be most readily modified and which of these modifications or groups of modifications would result in the greatest and most cost-effective improvements in the prevalence and individual
experience of urinary incontinence would be of great benefit to continence promotion.

This subject has been addressed by Bump (Bump and Norton 1998), who has separated urinary incontinence risk factors into predisposing, inciting, promoting and decompensating issues, which can be independently evaluated with respect to their ability to alter the prevalence of urinary incontinence in the future. In particular, he identified the “promoting” factors as representing the best opportunities for altering the prevalence of urinary incontinence. The factors quoted by Bump were constipation, obesity, UTI, diabetes, lung disease and smoking, surgery, occupation and recreation, medications, mode of delivery, oestrogen status, and toilet habits. Many of these factors are identified in this review as being of statistical significance in urinary incontinence.

Modifiable risk factors might be seen to include:

- Adequate treatment or prevention of constipation
- Prevention of obesity and overweight problems
- Prompt and effective treatment of UTI and its risk factors
- Lung disease including asthma, hay fever, chronic cough, and smoking
- Mode of delivery
- Medications, especially polypharmacy in the elderly
- Toilet training
- Prevention of falls in the elderly
- Reduction of risk of stroke (CVA)

Risk factors which are not to be modifiable may be

- Increasing age
- Parity
- Some disorders of the nervous system
Well-targeted public health campaigns, which target incontinence prevention, should address the modifiable risk factors and also be incorporated into undergraduate education of health professionals and into public health literature that addresses the specific health issues. In particular, efforts to enhance the welfare of the elderly and the disabled must in future pay more specific and detailed attention to all aspects of incontinence.

In the few International studies that give an indication of ‘severe incontinence’, estimates of prevalence ranged from 5.5% - 8% in the total population. More women than men experience more serious levels of urinary incontinence.

Studies in Australian populations indicated that 15% - 20% of the female population reported ‘leaking often’, required some kind of continence aid or were ‘substantially dissatisfied with their urinary symptoms’. The corresponding range for men was 3.1% - 9%. The differences between the estimations of more severe urinary incontinence are most likely attributable to the different definitions of more severe urinary incontinence used within the studies. The use of pads or appliances alone is not a good indicator of severity of incontinence. Pad use may be altered by socio-economic factors, subsidies, fastidiousness and mores of the individual, and by the type of incontinence and its predictability.

Both Australian and international studies demonstrated that both the prevalence and severity of urinary incontinence increases with age. Stress incontinence increases in prevalence women during their reproductive years. Urge incontinence increases in prevalence in both men and women with increasing age. Those studies conducted amongst mixed gender populations estimated that women had between one and six times the prevalence of incontinence of men. This ratio decreases with age.

Overall, 18.4% of the population studied (aged 5-12) were reported by nocturnal enuresis (at least once a month). Day wetting once a month was
reported by 5.5% of children. Marked nocturnal enuresis and daytime wetting (at least one episode per week) were estimated to be prevalent in 5.1% and 1.4% of children respectively.

The issue of race as a risk factor was examined and the conclusions drawn included that studies conducted within Asia provide lower estimates of urinary incontinence prevalence (9.8% to 34%) than studies conducted in occidental countries. Studies of severe incontinence conducted in Asian populations estimate this figure to be between 1.5% - 1.9%.

Australian studies indicated that the prevalence of urinary incontinence amongst rural Aboriginal women might be as high as 54%. This higher prevalence in Aboriginal women is most likely confounded by the prevalence of higher parity, higher than normal BMI and diabetes amongst Australian Aboriginal women.

Other contentious issues of association are the roles of such factors as hysterectomy and occupation. Since these factors are not modifiable, they do not warrant further public expenditure on their investigation.

The incidence of incontinence is not well known in either men or women. There are cogent reasons for Government support to continue such longitudinal studies as currently exist for women (eg Women’s Health Australia) and for governments to initiate a similar study among men.

There appears to be considerable data on post-prostatectomy (TURP and RP) incontinence. Whilst post-prostatectomy incontinence is rare after surgery for benign disease (<2%)(Herschorn et al 1998), there are a significant number of men who have persistent and relatively severe incontinence 12 to 24 months after radical prostatectomy for cancer (5-8%). However, the prevalence of incontinence after both types of surgery appears to improve with time from the surgery. Incontinence after RP is clearly causally related to the surgery, most men having cancer surgery are asymptomatic pre-operatively. By contrast, 80%
of incontinence after TURP is an extension of incontinence which antedated the surgery. These men form only a small number of the elderly incontinent population. HIC data show that fewer than 100 men underwent surgery for post-prostatectomy incontinence each year. For this reason we have not emphasised the contribution they make to the overall prevalence of urinary incontinence in Australia.

Help seeking amongst incontinent individuals is surprisingly low, for a variety of reasons and even amongst those with regular or severe problems. The costs of incontinence (financial, social, psychological and behavioural) are mainly borne by the individual, especially when they do not seek professional intervention. Therefore there is a need for a major public awareness campaign encouraging people to seek professional help aimed at cure rather than containment.

Urinary incontinence increases the risk of hospitalisation and substantially increases the risk of admission to nursing home (Thom et al. 1997), and while it carries a low burden of mortality, the burden of morbidity associated with urinary incontinence is substantial. In view of these considerations, steps should be taken to promote continence wherever possible. The results of this review give a clearer understanding of the magnitude of urinary incontinence as a health problem and also highlight those groups within the community that might benefit from well designed, specifically targeted continence promotion programmes.

The studies undertaken in Australia used (in the main) sample sizes sufficient to allow accurate estimations of the prevalence of urinary incontinence. While sample selection protocols and instrument delivery systems varied between studies, they each provided an adequate cross section of the population under study. Not all survey instruments used within the studies were tested for reliability and validity, but this fact appeared to have little effect when comparing outcomes between studies that did and did not use validated instruments. Outcomes of the studies within Australian populations appeared more homogenous than those from international studies.
Risk factors for urinary incontinence appear well established from scientifically robust studies and include increasing age, increasing Body Mass Index, smoking and upper respiratory symptoms, diabetes, parity and mode of delivery, urinary tract infection, constipation, diseases of the nervous system, and falls, and prostate surgery in males.
Conclusion

The range of estimates of the overall prevalence of female urinary incontinence in International studies ranged from 9.8% to 69% (median 27.7%) while estimates for men ranged from 3.6% to 47%. These estimates cover all levels and types of incontinence ranging from small volume infrequent loss to regular troublesome or total incontinence.

The range of estimates of the overall prevalence of female incontinence in Australian studies was narrower than that from the international studies. The estimates for women ranged from 34% to 45% (median 36%) while estimates for men ranged from 4.4% to 15%.

The Australian Bureau of Statistics data for 1998 shows a population of 19 million. 21% of these are under 15, 67% are between 15 and 64 and 13.5% are over the age of 65. Given the estimates of the prevalence of urinary incontinence in the studies featured in this review, and a current total Australian population of 19 million, we would estimate that there are approximately 100,000 Australian children who are wet, 3.5 million Australian women who have wet themselves in the last month, 1 million Australians who are incontinent on a regular basis and 80% of them are women.

On the basis of this review, the committee recommends that sufficient data exist for the purposes of estimating the prevalence of urinary incontinence in general Australian population. Current Australian estimates are consistent with International studies undertaken using Caucasian populations in developed Western nations. Data on prevalence in some key subgroups within the Australian population are available and the risk factors for the development of incontinence are well characterised. No further studies on the prevalence of incontinence in general Australian population need to be undertaken. The data collected from the Australian Longitudinal Women’s Health Study should provide
emerging data on the true incidence of urinary incontinence amongst Australian women. Provided this study continues to be funded, valuable incidence data will continue to accumulate. A similar study should be set up to investigate the parallel data for men amongst whom considerable changes occur as a result of enlargement of the prostate over the age of 50 years.

Whilst firm data on prevention is lacking, further studies of prevalence are unlikely to inform our future actions. Evidence based research into effective intervention better warrants Government support than further epidemiological studies, with the single exception of the need to support longitudinal studies such as WHA and to insist that these studies more carefully examine urinary and faecal incontinence.
References


List of Appendices

Appendix 1a. Summary of International studies of the prevalence of urinary incontinence in women

Appendix 1b. Summary of Australian studies of the prevalence of urinary incontinence in women

Appendix 2a continued. Summary of International studies of the prevalence of urinary incontinence in mixed populations.

Appendix 2a continued. Summary of International studies of the prevalence of urinary incontinence in mixed populations.

Appendix 3. Summary of studies of the prevalence of urinary incontinence in men

Appendix 4. Results of prevalence studies in women.

Appendix 5. Results of prevalence studies in mixed populations.

Appendix 6. Results of prevalence studies in men.

Abbreviations used in appendices

BMI: Body Mass Index
CI: Confidence Interval
HRT: Hormone Replacement Therapy
ICS: International Continence Society
IPSS: International Prostate Symptom Score
LUTS: Lower Urinary Tract Symptoms
OR: Odds Ratio
QoL: Quality of Life
SF-36: Short form health Survey Form number 36
WHR: Waist Hip Ratio.