Estimating the prevalence of urinary and faecal incontinence in Australia: A systematic review

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Abstract

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

Design and methods: Systematic review and meta-analysis. Search of MEDLINE and EMBASE from 1995-2001 was performed in duplicate. The following a priori inclusion criteria were applied to studies: community based sampling frame, response rate >65%, >125 participants per gender group, and age and gender separation of results (stratification).

Results: There were significant differences in the definitions used, the time frames of interest, and the populations surveyed. There was significant heterogeneity across studies. Overall prevalence of urinary incontinence for Australian adults was estimated to be 19.3%, and 2.2% in Australian women and men respectively. Overall prevalence of faecal incontinence was estimated to be 5.3% and 5.5% in Australian women and men respectively.

Conclusions and implications: It is disappointing that with so many studies published in this area, there is still a lack of high quality, basic descriptive epidemiology of this important health problem. These estimates of the prevalences of urinary and faecal incontinence should assist policy making in this area.

Key Points

- There are no good estimates of the prevalence of urinary and faecal incontinence in the general community in Australia to guide policy making.
- The overall prevalence of urinary incontinence was estimated to be 19.3%, and 2.2% in Australian women and men respectively. This translates into over 2 million people incontinent of urine in Australia.
- The overall prevalence of faecal incontinence was estimated to be 5.3% and 5.5% in Australian women and men respectively. This translates into over 1 million people incontinent of faeces in Australia.
- Future research should focus on better definitions of incontinence, as well as time period involved.

Introduction

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

While extensive narrative reviews of the epidemiological literature on urinary incontinence have been undertaken [1-3], there has been no quantitative summary of the cumulative data. This paucity of information is even more evident for faecal incontinence. An accurate overall estimate of the prevalence of urinary and faecal incontinence in the community has proven difficult for various reasons, including differences in the definitions of incontinence, the populations studied, the sampling strategies, and the variations in study design.

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

This systematic review was undertaken to derive age and gender-specific rates of urinary and faecal incontinence from the literature, and apply them to the Australian population.

Methods

Search strategy

General: Both Medline and Embase databases were searched (AW). Reference lists from retrieved studies and conference proceedings were also examined. The search was limited to studies of adults (>18yrs old) published in English. Only studies published from 1995 to 2001 were included in the search, since awareness, reporting, and patterns of disease may have differed significantly before then. In addition, a previous review summarised the studies before this period [74]. We applied the following a priori inclusion criteria:

a) community based sampling frame
b) response rate >65%
c) >125 participants per gender group
d) age and gender separation of results (stratification)
e) used a validated instrument to measure incontinence, i.e. compared to some objective measure of incontinence, e.g. pad count, etc.

Abstracts were read independently and in duplicate (PC and WB); any possibly relevant reference was included and the full paper obtained. Any disagreement was resolved by a third author (JA).

Urinary incontinence: Search terms were:

- urinary incontinence (MeSH heading) OR
- bladder control (text word) OR
- lower urinary tract symptoms (text word) AND any of the following
- prevalence, incidence, epidemiology, OR natural history (MeSH heading).

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

studied urinary incontinence in specific samples and 5 were culled for other reasons. Fifty three studies remained.

The validity of using the literal International Continence Society definition of incontinence to measure self-reported urinary incontinence is questionable [5], and 2 studies were excluded from further review for this reason [6, 7]. A further 39 studies were excluded for the following reasons: 16 did not have study populations that were considered to be entirely cross sectional and/or community based [8-23], 6 reported response rates in each gender below 65% [24-29], 5 were studies of lower urinary tract symptoms other than urinary incontinence or studies of genitourinary symptoms [30-34], 10 reported data in a manner which did not allow extraction by age and gender [35-43], 1 was a measures study [44], and 1 used an unclear measure of urinary incontinence and was not age stratified [45].

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

Faecal Incontinence: Search terms were:

- Faecal (faecal) incontinence (MeSH heading) OR
- bowel control (text word) AND
- prevalence, incidence, epidemiology, OR natural history (MeSH heading).

The search provided a total of 31 abstracts: 18 abstracts from the Medline database, 10 from the Embase database and 3 from references lists. Twenty-three abstracts were culled from further consideration for the following reasons: 6 were repeats, 1 made general comments about faecal incontinence, 1 studied the risk factors associated with faecal incontinence, 2 studied faecal incontinence in a specific group of people, 4 were studies of faecal incontinence or related combined symptoms of urinary and faecal incontinence and 1 was a measures study. Eight studies remained. Since few of the studies used validated measures of incontinence, this criterion was again relaxed.

A further 4 studies were excluded for the following reasons: 2 did not have study populations that were considered to be entirely cross sectional/community based [58,

59], 1 used a third party to respond to survey questions [60], and 1 reported data in a manner that did not allow any data extraction [61]. Although 3 papers reported data in a manner that did not allow extraction by age and gender [62-64], all 3 study groups complied with a request to provide this stratified information. Thus, 4 studies entered the analysis [62-65].

Data extraction

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

Data analysis

Prevalences were pooled across each of the age and gender strata. The Q-test was adapted for proportions and used to test for heterogeneity before pooling across strata. A random effects model was then used to pool the age and gender stratified estimates. The results of this analysis were then applied to the age stratified Australian National Population Statistics to provide an estimate of the prevalence of urinary incontinence. [66]. Mathematical details are given in the appendix.

Results

Female urinary incontinence

Table 1 lists the characteristics of all included studies with data on urinary incontinence in females. Of the 12 studies, 10 were in Caucasians and 2 in Orientals. The overall prevalence of incontinence ranged from ≈10% to ≈70%, although this partly reflects the varying age ranges in the studies. The Q-test indicated strong heterogeneity for similar age strata across studies ($p<.01$). The source of this heterogeneity was not apparent; exploration of ethnicity, definition of incontinence, time frame of incontinence (e.g. ever or current), use of objective tests to measure incontinence (e.g. counting pads), and degree of incontinence, all failed to account for heterogeneity. However, it was apparent that the 4 studies by Dolan [47], Holtedahl

[53], Nygaard [55], and Swithinbank [48] documented very high prevalences, ranging between 50 and 80%. This may be linked to parity. One study from Ireland [47], indicated high parity, with 28% of women in the study having 4 or more children. Although parity was not mentioned in other studies it was our judgement that these 4 studies could probably not be generalised to Australian communities, and they were dropped. The remaining studies were still heterogeneous, and we pooled them using the random effects model; the pooled, age-specific prevalences for females are listed in Table 2. The prevalences range from 16.5% in 20-40 year olds to 31% in over 80 year olds. All studies show a consistent decrease in prevalence between the 50-59 age group and the 60-69 age group; the pooled prevalence decreases from 26% to 20%, although the confidence intervals overlap to a large degree, indicating that there is no statistically significant difference.

Applying these age-stratified estimates to the Australian population leads to an estimate of the prevalence of urinary incontinence of 19.3% among women, or an anticipated 1.8 million Australian women with some degree of incontinence (Table 4). The validity of these estimates however is tempered by the fact that there was significant heterogeneity at the study level that could not be explained.

Male urinary incontinence

Table 1 lists the characteristics of all included studies with data on urinary incontinence in males. Of the 5 studies, 3 were in Caucasians and 2 in Orientals. The overall prevalence of incontinence in males ranged from ~5% to ~15%. Table 3 presents the age-specific prevalences from each study in tabular form. Despite the much narrower range of values compared to females, the Q-test still indicated strong heterogeneity for similar age strata across studies ($p<.01$). As before, the source of this heterogeneity was not apparent; exploration of ethnicity, definition of incontinence, time frame of incontinence (e.g. ever or current), use of objective tests to measure incontinence (e.g. counting pads), and degree of incontinence, all failed to account for heterogeneity. Pooling despite heterogeneity using the random effects model yielded the age-specific prevalences listed in Table 3 ; the prevalence ranged from 3% in 40-49 year olds to16% in over 80 year olds.

Applying these age-stratified estimates to the Australian population leads to an estimate of the prevalence of urinary incontinence of 2.2% and an anticipated 216,000 men in Australia with some degree of urinary incontinence (Table 4). As before, we suggest caution about the validity of this estimate given that there was significant heterogeneity at the study level that could not be explained

Female faecal Incontinence

Table 5 lists the characteristics of all included studies with data on faecal incontinence in both genders. Of the 4 studies, all were in Caucasian populations. The overall prevalence of incontinence in females ranged from ≈1.3 to ≈25%, although this partly reflects the varying age ranges in the studies. Table 6 lists the age-specific prevalences for females in tabular form. The Q-test indicated homogeneity in age groups <30, 30-39, 40-49 and 80+ age groups. There was heterogeneity in age groups 50-59,60-69 and 70-79 across studies. The source of this heterogeneity was not apparent, and exploration of the definition of incontinence and time frame of incontinence (e.g. in the last year or current) failed to account for heterogeneity.

Applying these age-stratified estimates to the Australian population leads to an estimate of the prevalence of faecal incontinence of 5.3% among Australian women, or an anticipated half a million women with some degree of incontinence (Table 8). Again some caution is warranted given the unexplained heterogeneity of this estimate.

Male faecal incontinence

Table 5 lists the characteristics of all included studies with data on faecal incontinence in males. The overall prevalence of faecal incontinence in males ranged from ≈0.5% to ≈56.3%. Table 7 lists the age-specific prevalences in tabular form. Prevalences were homogeneous in age groups <30, 30-39,and 40-49, but heterogeneous in age groups 50-59, 60-69, 70-79 and 80+ across studies. As before, the source of this heterogeneity was not apparent; exploration of definitions of incontinence and time frame of incontinence (e.g. in the last year or current) failed to account for heterogeneity. Pooling, despite heterogeneity, using the random effects model yielded the age-specific prevalences listed in Table 7; the prevalence ranged from 3.4% in males aged less than 30 years old, to 23% in over 80 year olds.

Applying these age-stratified estimates to the Australian population leads to an estimate of the prevalence of faecal incontinence of 5.5% among Australian men, or an anticipated 514,708 men with some degree of incontinence (Table 8). The validity of this estimate is again tempered by the unexplained heterogeneity.

Discussion

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

a) It was not within the scope of this study to comprehensively contact all authors to request extra information; as a result we had to limit ourselves to studies that described their results in sufficient detail to be included, or where Australian researchers could be contacted.
b) We did not include results from abstracts or search for unpublished studies (so-called "grey literature").
c) There was no method available to assess publication bias. However, since these studies focused on prevalence estimates and not effect sizes, there is no reason to believe that they would be subject to the same publication bias, i.e. studies with positive results are more likely to be published than those with negative results.

Despite these limitations, this represents the first meta-analysis of the prevalences of urinary and faecal incontinence in the literature.

Urinary Incontinence

We estimate that there are over 2 million people with some degree of urinary incontinence in Australia. We estimate that the prevalence of incontinence in women varies from 16.5% in 20-40 year olds to 31% in over 80 year olds. The studies show a consistent dip in the prevalence between the 50-59 age group and the 60-69 age group. This dip has been documented before [3, 59]. It may be due to post-

menopausal use of hormone replacement therapy alleviating mild incontinence, a change in or restriction of activities that promote urine leakage, or it may be due to selective mortality of those 50-59 year olds with poorer health (if this is associated with incontinence). The prevalence of incontinence among younger women is approximately 7 fold higher compared to younger men, although this falls to approximately 2 fold higher among older women compared to older men. In both genders, the prevalence increases with age. The pooled prevalences in our study are slightly lower than those obtained by Thom in his review of earlier literature [74]. Median prevalences of urinary incontinence at any point in younger and older women, i.e. < and ≥65 years old, were 28% and 35% respectively; for younger and older men, the figures were 4% and 17%. These slightly higher figures are also consistent with other Australian studies that did not meet our inclusion criteria [75, 76].

Faecal incontinence

We estimate that there are over 1 million Australian community dwelling adults with some degree of faecal incontinence. The prevalence of incontinence increases with age.

While there is controversy surrounding gender differences in the prevalence of faecal incontinence, the results of this analysis add more support to the evidence which appears to show no clear epidemiological difference between the prevalence of faecal incontinence in men and women. Women are traditionally thought to experience faecal incontinence significantly more commonly than men [60, 65, 67] but other studies have shown similar or higher prevalence in men [63, 68, 69]. Colorectal surgeons reportedly perform the surgical correction of faecal incontinence far more commonly on women than men. It is interesting to note that, according to these estimates, twice as many men suffer from faecal incontinence compared to urinary incontinence, whereas the numbers are reversed for women; more than 3 times as many women suffer from urinary incontinence compared to faecal incontinence. Overall, faecal incontinence affects half as many people as urinary incontinence. For comparison, the prevalence of faecal incontinence in nursing homes and institutions has been estimated to be between 3.1% for faecal incontinence alone, and 17.7% for the combined symptoms of FI and urinary incontinence (UI) concurrently. [70]

Caveats and recommendations

Although we were able to generate these age-stratified prevalences and estimate the magnitude of urinary and faecal incontinence in Australia, these summary numbers must be taken cautiously for a number of reasons:

a) We pooled the results despite significant heterogeneity and we were unable to identify the source of that heterogeneity.
b) The pooled studies reflect differing definitions and severities of incontinence. Hence we cannot say whether the pooled estimate reflects the prevalence of mild, moderate or severe incontinence, nor whether it reflects current incontinence, or incontinence at any time.
c) The studies provide insufficient description of potential confounders. For example, parity and body-mass index are potential confounders of urinary incontinence and it was impossible to adjust prevalences because this information was often not stated.

The International Continence Society (ICS) has made recommendations for future urinary incontinence prevalence studies, but these apply equally to studies of faecal incontinence [3]:

a) The use of a validated definition of incontinence that would allow comparisons across studies in different settings and cultures. The ICS recommends that further prevalence studies should only be performed with recommended and validated questionnaires, but gives no examples. The ICS further recommend that there should be standardisation of instruments for measuring urinary incontinence in the community. This applies equally to faecal incontinence.
b) With respect to epidemiological research, that the following elements be included in the definition: The individual's statement of any urine/faecal loss, the frequency of loss, the quantity lost, and the duration of the condition.
c) Not to include quality of life or "bother" in the definition of incontinence for epidemiological studies in order that patients perceptions not be allowed to distort prevalence estimates or limit the detection of risk factors.

d) Collecting comprehensive information about confounders, such as BMI and parity for urinary incontinence, and assisted vaginal delivery [71] followed in the short or long term with complaints of constipation and straining to void [72, 73] for faecal incontinence.

Health policy decision makers require a clear description of the magnitude and distribution of a health or disease state to effectively plan resources; the woman with transient incontinence in the last few weeks of her pregnancy requires different resources than a nursing home patient with dementia and incontinence. It is disappointing that with so many studies published in this area, there is still a lack of high quality, basic descriptive epidemiology of this important health problem; what studies are available do not express results in a manner that allows informed policy making or health resource allocation. This systematic review has gone some way towards providing such data, and suggesting future research directions.

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Table 1. Characteristics of studies addressing urinary incontinence

First Author	Country	Age range (years)	Number and gender	Definition of incontinence used in the study	Validation status	Timeframe
Bogren [46]	Sweden	65 yrs	216 ♀ 219 ♂	Involuntary voiding of urine.	Validated	Timeframe unclear
Bortolotti [50]	Italy	≥40 ≥50	2721 ♀ 2629 ♂	At least one episode	Validation unclear	In previous year
Dolan [47]	Ireland	35 – 74	689 ♀	Leaking of urine during: a list of eight activities	Validated	Current experience
Hagglund [51]	Sweden	18 – 70	3076 ♀	Do you have a problem with involuntary loss of urine (eg when you laugh, jump, cough, sneeze)?	Validation not mentioned	Current experience
Hannestad [52]	Norway	20 - ≥90	27936 ♀	Do you have with involuntary loss of urine	Validation not mentioned	Current experience
Koyama [54]	Japan	≥ 65	1448 ♀ 856 ♂	Even a small amount of involuntary leakage at a time when there was no intention of urinating	Validation not mentioned	Current experience

First Author	Country	Age range (years)	Number and gender	Definition of incontinence used in the study	Validation status	Timeframe
Nygaard [55]	United States	65-90	2025 ♀	How often do you have difficulty holding your urine until you can get to a toilet? Do you ever leak when you cough, sneeze or laugh?	Validation not mentioned	Current experience
Perry [56]	Britain	40-≥80	7659 ♀ 4682 ♂	Do you ever leak urine when you don't mean to?	Validation not mentioned	Current experience
Swithinbank [48]	Britain	♀19 -≥80 female	2075	Does urine leak when you are physically active, exert yourself, cough or sneeze? [65]	Validated	During the previous month
Tseng [57]	Taiwan	65 -≥80	256 ♀ 248 ♂	Inappropriate leakage of urine	Validation not mentioned	Current experience
Van Geelen [49]	Holland	♀50 –75 female	1761	Urine loss with coughing, sneezing and other activities	Validated	Current experience or in the last year

Table 2. Age-stratified prevalence of urinary incontinence in females, by study and pooled using the random effects model. Point estimates (%) and 95% confidence intervals are given.

First author	Age groups					
	<40	**40-49**	**50-59**	**60-69**	**70-79**	**>80**
Hagglund [51]	15.9 n=1279	32.2	36.5 n=578	28.5 n=478		
Hannestad [52]	16.6 n=9207	26.2 n=5909	29.1 n= 4816	26.8 n=3685	31.7 n=3210	35.4 n=1109
Bortolotti [50]		7.2 n=626	11.8 n=840	9.5 n=548	15.9 n=753	
Perry [56]		18.0 n=1390	21.0 n=1376	18.0 n=1208	25.0 n=993	28.9 n=577
Van Geelen [49]			30.7 n=817	21.2 n=726	19.7 n=218	
Bogren [46]				28.2 n=216		
Koyama [54]				7.9 n=355	10.2 n=537	20.2 n=228
Tseng [57]				24.0 n=75	40.3 n=129	
Pooled total	**16.5 (15.8-17.2)**	**20.9 (11.1-30.6)**	**25.7 (18.0-33.5)**	**20.3 (14.3-26.3)**	**23.5 (15.2-31.7)**	**28.4 (20.3-36.5)**

Table 3. Age-stratified prevalence of urinary incontinence in males, by study and pooled using the random effects model. Point estimates (%) and 95% confidence intervals are given.

First author	**Age groups**				
	40-49	**50-59**	**60-69**	**70-79**	**>80**
Bortolotti [50]		2.0 n=1198	2.7 n=748	7.0 n=683	
Perry [56]	3.0 n=1197	6.0 n=1254	11.0 n=1073	17.0 n=843	21 n=315
Bogren [46]			9.6 n=219		
Koyama [54]			0.7 n=285	6.3 n=334	9.1 n=132
Tseng [57]			14.1 n=64	15.5 n=181	
Pooled total	**3.0#**	**4.0 (0.1-7.9)**	**6.8 (2.5-11.1)**	**11.3 (5.7-16.8)**	**15.1 (3.4-26.7)**

no pooled confidence interval could be calculated given that there was only 1 study in this age group.

Table 4. Estimated prevalence of urinary incontinence in Australia

Age group	**Australian Population***		**Proportion of Incontinence^**		**Prevalence of Incontinence**		
	Males	Females	Males	Females#	Males	Females	Total
<40	5,577,093	5,414,884	-	0.165	-	893,721	893,721
40-49	1,372,212	1,373,537	0.030	0.209	41,270	286,495	327,764
50-59	1,078,134	1,042,819	0.040	0.257	42,655	268,427	311,082
60-69	711,364	725,572	0.068	0.203	48,399	147,125	195,524
70-79	502,525	611,470	0.113	0.235	56,574	143,443	200,016
80+	183,982	343,574	0.151	0.284	27,715	97,695	125,410
Total	9,425,310	9,511,856			216,612	1,836,906	2,053,517

**estimated 1999 population (see website, reference 66)*
^pooled estimates
 # excluding some studies (Dolan, Holtedahl, Nygaard, Swithinbak).

Table 5.Characteristics of studies addressing faecal incontinence

First Author	Country	Age range (years)	Number and gender	Definition of incontinence used in the study	Validation status	Timeframe
Kalantar [62]	Australia	50 – 80+	♀ 363	Involuntary release of liquid or solid faeces at inappropriate times or places. Excluding that associated with illness.	Validated	In the last year
Lam [63]	Australia	24 – 99	♀ 359 ♂ 259	Stool leakage < once weekly or >once weekly	Validated	Current experience
MacLennan [64]	Australia	15 - 97	♀ 1544 ♂ 1465	Loss of control of motions.	Not validated	Ever
Roberts [65]	United States	50 – 80+	♀ 755 ♂ 206	Accidents or soiling (liquid or solid) because of the inability to control the passage of stool until you reach the toilet	Not validated	In the previous year

Table 6. Age-stratified prevalence of faecal incontinence in females, by study and pooled using the random effects model. Point estimates (%) and 95% confidence intervals are given.

First author	Age groups						
	<30	**30-39**	**40-49**	**50-59**	**60-69**	**70-79**	**>80**
Kalantar [62]	2.9 n=86	9.0 n=78	13.5 n=89	12.1 n=58	13.8 n=29	20.0 n=25	25.0 n=16
Lam [63]	5.3 n=38	5.2 n=58	7.5 n=53	16.7 n=48	17.0 n=53	12.7 n=63	15.2 n=46
MacLennan [64]	1.3 n=393	2.0 n=299	4.3 n=281	4.1 n=194	8.2 n=158	3.8 n=160	8.3 n=60
Roberts [65]	-	-	-	13.2 n=228	17.2 n=274	12.8 n=196	21.1 n=57
Pooled total	**1.9 (0.0, 4.0)**	**4.6 (0.1, 9.2)**	**7.8 (1.8, 13.8)**	**10.8 (4.0, 17.5)**	**13.7 (7.3, 20.0)**	**10.7 (3.5, 18.0)**	**15.6 (7.0, 24.1)**

Table 7. Age-stratified prevalence of faecal incontinence in males, by study and pooled using the random effects model. Point estimates (%) and 95% confidence intervals are given.

First author	**Age groups**						
	<30	**30-39**	**40-49**	**50-59**	**60-69**	**70-79**	**>80**
Kalantar [62]	4.5 n=44	9.5 n=63	7.7 n=78	16.7 n=42	14.3 n=28	15.4 n=26	56.3 n=16
Lam [63]	11.5 n=26	17.1 n=35	16.3 n=43	26.8 n=41	26.2 n=42	16.7 n=42	23.3 n=30
MacLennan [64]	0.5 n=404	3.1 n=292	2.5 n=275	2.1 n=193	4.0 n=151	3.6 n=111	5.1 n=39
Roberts [65]	-	-	-	8.4 n=226	8.1 n=271	16.7 n=221	19.2 n=52
Pooled total	**3.4 (0.0, 8.9)**	**8.2 (0.4, 16.1)**	**7.2 (0.3, 14.2)**	**10.9 (3.3, 18.6)**	**10.2 (3.8, 16.6)**	**12.5 (3.1, 21.8)**	**23.1 (6.2, 40.0)**

Table 8. Estimated prevalence of faecal incontinence in Australia

Age group	Australian Population*		Proportion of Incontinence^		Prevalence of Incontinence		
	Males	Females	Males	Females	Males	Females	Total
<30	4,124,057	3,955,312	0.034	0.019	141,034	76,383	217,417
30-39	1,453,036	1,459,572	0.082	0.046	119,828	67,864	187,691
40-49	1,372,212	1,373,537	0.072	0.078	99,333	107,009	206,343
50-59	1,078,134	1,042,819	0.109	0.108	117,903	112,138	230,041
60-69	711,364	725,572	0.102	0.137	72,503	99,228	171,731
70-79	502,525	611,470	0.125	0.107	62,687	65,696	128,384
80+	183,982	343,574	0.231	0.156	42,453	53,441	95,894
Total	9,425,310	9,511,856			514,708	505,376	1,020,083

**estimated 1999 population (reference 66)*
^pooled estimates

Appendix

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

$$Q = \sum W_i (p_i - \overline{p})^2$$

where

W_i is the weight of each study, given by the inverse of the variance

p_i is the prevalence in study i

$\overline{p}$ is the mean prevalence across all studies

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

A random effects model was then used to pool the age and gender stratified estimates using the following formula:

$$\overline{p}^* = \frac{\sum W_i^* p_i}{\sum W_i^*}$$

where

$\overline{p}$ is the pooled prevalence

p_i is the prevalence in study i, and

W^*_i is the weight of each study, given by:

$$W^* = \frac{1}{\mathrm{var}(p_i) + D}$$

where

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

k is the number of studies

and

$$U = \sum W_i - \left(\frac{\sum W_i^2}{\sum W_i} \right)$$

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

$$\left(\overline{p}^* - \frac{1.96}{\sqrt{\sum W_i^*}}, \overline{p}^* + \frac{1.96}{\sqrt{\sum W_i^*}} \right)$$

The results of this analysis were then applied to the age stratified Australian National Population Statistics to provide an estimate of the prevalence of urinary incontinence. [66]

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