Risks and Burdens of Incontinence in an Older Community

The Dubbo Longitudinal Study of the Elderly 1988-2003
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The Consultants are solely responsible for the content and views expressed within this report.

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1. Executive Summary

This sub-study of incontinence builds on outcomes and urinary and faecal incontinence data available from the *Dubbo Study of the Health of the Elderly 1988 – 2003* (hereafter referred to as the Dubbo Study) and the Asset & Health Dynamics among ‘Old’ Old in a Regional Community (AHEAD) subgroup of survivors. The sub-study was funded under the National Continence Management Strategy to review recently collected data, make comparisons to earlier data and undertake further analysis to:

- provide a cross-sectional view of urinary incontinence within the elderly population;
- model the impact of specific risk factors and combinations of risk factors on urinary incontinence and associated outcomes;
- determine the impact of the presence of an informal carer on outcomes where incontinence is a factor; and
- evaluate the impact of urinary incontinence on admission to residential aged care facilities and other service use.

The Dubbo Study first interviewed study participants in 1988 and followed them through to late 2005, monitoring rates of death, hospitalisation and residential care. The study confirmed a significant correlation between the identification of urinary incontinence by study participants in 1988 and in the subsequent residential care admission of these participants up to 14 years later.

This sub-study of incontinence within this population involved a review of the data collected at different time points with focus placed on analysis of self reported continence status and associated variables. The independent contribution of any factor (a) to the prevalence of incontinence at baseline
and (b) to the incidence of new incontinence between 1988 and 2003 was examined in multiple logistic models.

A summary of the results is as follows.

**Prevalence**
- Prevalence in 1988 was two-fold higher in females (10.8%) than males (5.7%) and it increased with advancing age.
- The participants with incontinence were significantly older than their continent peers.
- 28% of males and 36% of females reported urinary incontinence in 2001 or 2003, a marked increase in point prevalence since 1988. However, this is now a highly selected group of “healthy” survivors and may not represent the true community incidence.

**Predictors**
- The significant predictors of urinary incontinence cross-sectionally were genito-urinary diseases, physical disability, depression score, age and female sex.
- Female gender and fair-poor self-rated health predict urinary incontinence longitudinally, but genito-urinary diseases, depression and disability do not.
- No significant relationship was found between various social activities and incontinence in the multivariate models.
- Depression score and fair-poor self-rated health were significant and graded longitudinal predictors of faecal incontinence, but the effects appeared to be confined to females.
- Incontinence leads to physical disability and to depression and not vice versa.

**Outcomes**
- Incontinent males reported a greater use of all services compared with their continent peers, most prominently services in the home with
incontinent males living alone reporting a substantially greater use of all community services.

- The proportion ever hospitalised was slightly higher in incontinent males, while hospital bed-day occupancy/person was substantially higher in both sexes over the whole period in the presence of incontinence.
- Amongst incontinent males and females the rate of nursing home admission was approximately double that of their continent peers.
- Mortality rates were slightly higher in both sexes in the presence of incontinence.

Some recommended actions arising from the results of these analyses are:

1. Undertake further exploration into the risk factors of incontinence that have been proposed but not yet rigorously investigated. Consideration should also be given to health conditions associated directly or indirectly with incontinence.

2. Undertake targeted investigations into the wide range of personal costs that have not been fully captured in earlier costing data, such as laundry, clothing and time related costs, to provide a more comprehensive understanding of the expenditures for incontinence.

3. Continue to support research initiatives under the NCMS that target:
   - prevention of incontinence;
   - a reduction in the disabling and depressive effects of incontinence;
   - early intervention strategies that limit the impact of incontinence in conjunction with genito-urinary diseases, stroke and dementia.
2. Introduction
Incontinence is a significant health issue for children, the individual, their carers and the community. It is a common, morbid, progressive, costly, and prevalent condition, leading to increased care needs and admission to aged care facilities. The Australian population is currently estimated at 23 million (79.8%) are women and 770,000 (3.3%) are men. Incontinence is associated with severe urinary incontinence, a significant impact on community living, with incontinence affecting 1.4% (n=284,500) of the community. Research has also considered the impact of incontinence on residential aged care facilities, resolving the impact of incontinence on the community and the healthcare system in terms of years of life lost. The results indicate that incontinence is responsible for approximately 3% of the healthy life years lost due to disability, particularly apparent for people aged 65-74 years. Vision impairments may also be associated with incontinence, especially in people aged 75 years and older. In 2031, with 53% of the increase occurring in the 85 years and older population, 27% in the 70-84 years population, and 20% in the 55-64 years population. The National Continence Management Strategy 1998 by the Australian Government to address incontinence in Australia is a major contributor to increased care needs and greater public and private burden of support for older people.

**In Summary**
Incontinence, together with other significant health factors such as falls and fractures and disability rates, is a major contributor to increased care needs and greater public and private burden of support for older people.
2. Introduction

Incontinence is a significant health issue that affects women and men of all ages as well as children, with physical, social and economic implications for the individual, their carers and the community. Incontinence in older age is common, morbid, progressive, costly, and a major contributing factor to admission to aged care facilities. The prevalence of incontinence within the Australian population is currently estimated to be 3.84 million. Of these, 3.06 million (79.8%) are women and 770,000 (21.2%) are men. It is estimated that 1.4% (n=284,500) of community dwelling Australians experience ‘severe’ urinary incontinence, a significant predictor for the requirement for residential aged care facilities.¹

Research has also considered the issue of the burden of incontinence, analysing the impact of incontinence on morbidity and premature mortality, measured “in terms of years of life lost”, and the “degree to which quality of life is reduced”. The results indicate that in 2003 an estimated 117,700 healthy life years were lost due to incontinence, and the burden was particularly apparent for people aged 75 years and over. It was estimated that incontinence is responsible for approximately one-fifth of healthy life lost for this age group, findings similar to those for dementia and hearing and vision impairments.¹ It is expected that, due to population growth and ageing, the burden of incontinence will increase by 110% between 2003 and 2031, with 53% of the increase occurring in the 85 years and older population, 27% in the 70-84 years population and 20% for those under 70 years.¹

The National Continence Management Strategy (NCMS) was established in 1998 by the Australian Government to provide funding to research and service development initiatives aimed at prevention and treatment of continence issues. An area recognised as requiring further study is the need
to obtain baseline data on the impact of incontinence on reducing preventable admissions to aged care facilities prior to measuring the potential impact of improved continence treatment or management. This need for baseline data is also required prior to assessing the impact/effectiveness of conservative treatments or lifestyle interventions in addressing continence issues in older people.

An analysis of data about incontinence available from a longitudinal, community study of 2805 people (1233 men and 1572 women) born before 1930 living in the town of Dubbo, NSW was commissioned by the Australian Government in 2006 as part of the NCMS. The Dubbo Study first interviewed study participants in 1988 and followed them through to late 2005, monitoring rates of death, hospitalisation and residential care. The study confirmed a significant correlation between the identification of urinary incontinence by study participants in 1988 and in the subsequent residential care admission of these participants up to 14 years later (Figure 1).

In a multivariate model with controls, incontinence was identified as increasing risk of nursing home admission by 66%. Incontinence, together with other significant health factors such as falls and fractures (rates increased from 30% to 50%) and disability rates (increased by 75%), were found to be the significant contributors to “increased care needs and greater public and private burden of support for these older people”. Self reported urinary incontinence was one of a wide range of biological and psychosocial variables collected at baseline and further monitored through continuous review of hospitalisation, nursing home records and death records. The Dubbo study is a general investigation of ageing so the measures of incontinence are limited to self-reported items measuring presence/absence but not type or severity (Note 1 p31). However the strengths of the longitudinal data allow risk factor analyses of new incident cases and investigation of consequent burdens associated with the condition.
Within the Dubbo Study, data is available on the presence or absence of urinary incontinence at study entry. Data is also available on urinary and faecal incontinence in the Asset & Health Dynamics among ‘Old’ Old in a Regional Community (AHEAD) subgroup of survivors. Outcomes data for approximately 1300 survivors was last collected in the latter part of 2003.

This sub-study of incontinence within the Dubbo study data was funded to review this most recent data, make comparisons to earlier data and undertake further analysis to:

⇒ provide a cross-sectional view of urinary incontinence within the elderly population;
⇒ model the impact of specific risk factors and combinations of risk factors on urinary incontinence and associated outcomes;
⇒ determine the impact of the presence of an informal carer on outcomes where incontinence is a factor; and
⇒ evaluate the impact of urinary incontinence on admission to residential aged care facilities and other service use.
3. Literature Review

The literature review covered over 164 journal articles and related references relating to incontinence and keywords: risk factors (59 papers); pathological causes (30 papers); social problems (16 papers); and psychosocial states including depression, physical disability and self-rated health (59 papers). Electronic databases used included AMED (Allied and Complementary Medicine); Biological Abstracts; CINAHL (Nursing and Allied Health); OVID Medline; and PsycInfo.

The review of incontinence literature in relation to the Dubbo Study has been structured as a pattern of cause and effect for the purpose of providing support for the following objectives:

⇒ to establish the existence of the problem of incontinence within the elderly community including possible causes of the problem, and to show the main factors underpinning the proposed causes;
⇒ to clarify any confusing areas including the elimination of any improbable or irrelevant causes for incontinence within this population;
⇒ to focus attention on the proposed causes of incontinence by providing evidence for the proposed causes, as well as to summarise the argument; and
⇒ to suggest recommendations for action to deal with the problem on incontinence within the elderly community of Dubbo.

These objectives are summarised in the following subsections which describe the various risk factors that the literature have associated with incontinence; the impact and other correlates of incontinence; the various reactions to the problem within the community and public health sectors; and the importance of taking into account the social consequences of...
incontinence for everyone involved including individuals, carers and health professionals.

3.1 Summary of risk factors for incontinence
There have been many numbers of studies published on the prevalence of incontinence, particularly on urinary incontinence amongst women, with estimates generated from communities in various parts of Europe, the United Kingdom, Asia, Africa, Oceania, and North America. Causation is multifactorial, although many risk factors have been identified. An extensive list of risk factors is proposed for incontinence but only a small number of these have received any rigorous assessment. The purpose of this review is to provide a critical overview of the epidemiological evidence when considering risk factors for urinary and faecal incontinence in the elderly population within the Dubbo Study.

3.1.1 Age, cognitive impairment and disability
Out of the pool of 164 publications and their related references, there were 68 citations that identified age as a risk factor to be associated with incontinence.

One of the earliest references dated back to 1982 in which Beyers discussed ten problems that eventually lead to impairment, disability or handicap with the progressive deterioration of bodily structure and function due to age from a study of 1150 patients at a geriatric clinic in South Africa. Interestingly in an article by Palmer et al in 1991, age was not associated with prevalence or incidence when a longitudinal study was conducted on 434 nursing home residents using secondary data analysis to identify non-urologic risk factors for continence outcomes at one year after admission. However, this may be a consequence of unusual characteristics of this particular sample. Since then, various studies such as those by Goldberg et al in 2003, Nelson and Furner in 2005, and Jenkins and Fultz in 2005 have shown that age is
positively associated with incontinence, with dementia and advancing age consistently associated with the development of incontinence, but the strongest associations were impairment of activities of daily living and the use of patient restraints.\textsuperscript{7-9} According to Bond and Clark dementia severity stands out as the key predictor of the decision to relinquish care.\textsuperscript{10} This is supported by a study of nursing home usage by Dubbo study participants,\textsuperscript{3} in which almost two thirds of admissions were related directly or indirectly to dementia.

Analysis in 2004, of Holroyd-Leduc et al's population-based prospective cohort study from 1993 to 1995 of 7,447 community-dwelling subjects aged 70 and older in the United States, suggested that although urinary incontinence appears to be a marker of frailty in community-dwelling elderly, it is not a strong independent risk factor for death, nursing home admission, or functional decline. The prevalence of urinary incontinence in this sample was 14.8\% (18.5\% in women; 8.5\% in men).\textsuperscript{11} After adjusting for confounders, higher levels of baseline illness severity and functional impairment appeared to mediate the relationship between urinary incontinence and adverse outcomes. It should be noted that nursing home admission procedures vary from country to country - for example between the national assessment criteria used in Australia and countries where there is a strong private market not subject to such admission criteria.

Ueda et al in 2000 similarly found that urinary incontinence was more likely to limit the activities of daily living. The results were retrieved from a random sample of community-dwelling individuals aged 40-75 years (n=3500) in seven towns of Shiga Prefecture, Japan. The prevalence of urinary incontinence for male and female respondents was 10.5\% and 53.7\% respectively. The incidence of urge incontinence in the male group increased as age increased. In women, stress incontinence was prevalent at all ages and the incidence of urge incontinence increased over 70 years of age.\textsuperscript{12}
3.1.2 Gender
Women generally experience urinary incontinence proportionally more than men, for all age groups. However, the sex ratio for urinary incontinence in older persons falls to 2:1, most likely because of prostate and other aged related problems which men also increasingly experience at older ages. Sex differences for faecal incontinence are less distinct and have yielded mixed results.\(^1\)

Despite similar rates of voiding dysfunction in older men and women, most funded research has focused on women. According to Moore and Gray in 2004, gaps in knowledge of urinary incontinence in men in the areas of aetiology, psychosocial consequences, and treatment efficacy still remain. Clinical research addressing incontinence in men is critical to explore the barriers or facilitators to seeking care; explain the biomechanical aspects of pelvic floor function; present a clear description of the natural history of bladder dysfunction; and emphasize the quality of life impact from incontinence.\(^{13}\)

3.1.3 Pregnancy, childbirth and parity
Both urinary incontinence and faecal incontinence are commonly associated with pregnancy and childbirth and can predispose women to more chronic episodes of incontinence later in life.\(^1, 14-17\) However, there is debate over whether risk factors such as (multiple) pregnancies, associated weight bearing incontinence, or vaginal delivery will predispose women to incontinence.

*Postpartum urinary incontinence*
Chiarelli et al's 1999 work surveying 14,000 young women (aged 18-23 yrs), 13,738 mid-age women (aged 45-50 yrs), and 12,417 older women (aged 70-75 yrs) who were participants in the Australian Longitudinal Study on Women's Health found that leaking urine was significantly associated with parity; conditions which increase the pressure on the pelvic floor such as constipation and obesity; past gynaecological surgery; and conditions which
can impact on bladder control. Another study in 1999 by Kuh et al of 1,333 British middle-aged women found that older women who had vaginal deliveries suffered from higher rates of stress symptoms. Heavier adult body weight was also a risk factor for these symptoms and for severe incontinence, with postmenopausal women less likely to report stress symptoms. Similarly, Persson et al in 2000 and Peyrat et al in 2002 concluded that pregnancy, previous vaginal delivery, postpartum incontinence and hysterectomy were the most prominent risks for stress urinary incontinence.

Women cannot prevent urinary incontinence by delivering exclusively by caesarean section. However, according to Faundes et al in 2001, the risk of urinary incontinence was found to be approximately five times higher among women with one or more pregnancies than among nulligravida, and 3.5 times higher among women who had had only caesarean sections than among nulliparous women. Furthermore, Goldberg et al’s 2003 study also found that mothers of multiples reported more substantial rates of faecal (10%) and flatus (25.2%) incontinence.

According to Parazzini et al in 2003, vaginal delivery can increase the risk of stress and mixed urinary incontinence, but not of urge urinary incontinence and overactive bladder. The risk of all types of urinary incontinence was increased in women with higher body mass index (BMI), with a history of hysterectomy, urinary infection and perineal trauma in a study of 1062 women with urinary incontinence or overactive bladder aged 40 years or more (mean age 62.3 years, range 40-88) consecutively observed in first level gynaecological centres in Italy. Interestingly, the risk of urinary incontinence was found to be lower in more educated patients and increased with BMI.

Further studies in 2004 like that by Dupuis et al found primiparity, birth weight over 4000 grams and all types of assisted vaginal deliveries to significantly increase the risk of anal sphincter damage. A database of
2,886,126 deliveries was analysed to explore risk factors of incontinence. This revealed that planned caesareans did not significantly reduce incontinence of flatus, and that randomised controlled trials (RCT) focusing on how to prevent and cure faecal and urinary incontinence are urgently needed in order to be able to compare surgical techniques to a higher level of significance.\textsuperscript{23}

Whilst many of these studies have been discerning about which risk factors might be associated with a particular type of urinary incontinence, other studies like that by Song et al in 2005 have been inclusive of all possible risk factors. In a random sample of 4684 women (age <20 years) in Fuzhou, China 19\% were found to have urinary incontinence. The prevalence of urinary incontinence and its subtypes in these Chinese women was considered lower than that of occidental women. In China, age, vaginal delivery, parity, hypertension, constipation, alcohol consumption, episiotomy, higher BMI are potential risk factors for stress incontinence. Urge incontinence is associated with age, menopause, caesarean delivery, parity, constipation, foetal birth weight, episiotomy, and higher BMI.\textsuperscript{24}

**Postpartum faecal incontinence**

In 2001, Faltin et al concluded that subsequent deliveries could increase the risk of incontinence, particularly among women with a sphincter defect diagnosed after the first delivery. Anal sphincter defects after childbirth were diagnosed by endosonography in 46 out of 87 women (53\%) and were associated with reported incontinence at both three months (RR 1.9; 95\% CI 1.4-2.6) and 30 months (RR 1.9: 95\% CI 1.3-2.8) after delivery. The prevalence of anal incontinence at 30 months was highest (5 out of 13, 39\%) among those in whom a sphincter defect was diagnosed by endosonography after their first delivery and during a second delivery.\textsuperscript{25}

A study by Chiarelli et al in 2003, suggested that older and multiparous women, and women with joint hyper-mobility, are at increased risk of postpartum anal incontinence symptoms after a high-risk delivery.
Concurrent urinary incontinence, flow-stopping inability, and constipation were also considered to be associated with postpartum anal incontinence symptoms after high-risk deliveries. Lunniss et al (2004) found childbirth to be the principal risk factor in acquired faecal incontinence in 91% of the retrospective cohort analysis of 629 non-elderly patients (475 female). In most cases at least one vaginal delivery had met with complications such as perineal injury or the need for forceps delivery.

These findings contribute to evidence that occult damage to the continence mechanism, especially through vaginal delivery, can result in subsequent faecal incontinence, sometimes after a period of many years.

3.1.4 Stroke
At the baseline in 1988, the Dubbo cohort was community-based and only 6% reported a past history of stroke. This was usually a mild or transient event with little ongoing disability. Later analysis of the cohort revealed that incontinence after stroke is associated with greater disability among those admitted to nursing homes. In addition, incontinence occurred more frequently among those who had a loss in mobility function. According to Bean et al in 2003, the presence of impairment in urinary continence was associated with a significantly greater increase (94% incontinent vs. 13% continent) in disability. In this prospective cohort study, the Minimum Data Set from the State of New York between 1994 and 1997 was utilised. From a pool of over 240,000 potential subjects, 500 met inclusion/exclusion criteria. An almost 2-fold difference in level of disability was noted post stroke among those who were incontinent than those who were continent. This difference in disability level remained unchanged for one year.

Faecal incontinence is a common complication after stroke; however, epidemiological research into this distressing condition is limited. In Harari et al’s 2003 study of stroke patients in the community-based South London Stroke Register the prevalence of post stroke faecal incontinence was found
to be 30% (7 to 10 days), 11% (3 months), 11% (1 year), and 15% (3 years).  

The prevalence of urinary incontinence is high among long-term stroke survivors, especially in subjects in whom paresis, depressive symptoms, and impaired cognition cluster. Jorgensen et al's 2005 study comparing the prevalence of self-reported incontinence among non-institutionalised long-term stroke survivors found that urinary incontinence was strongly related to the number of these risk factors present. Urinary incontinence was present in 17% of the stroke survivors and in 7% of the control subjects (OR=2.8; 95% CI, 1.5-5.2) and more prevalent among the stroke survivors than among the control subjects until 10 years post stroke. In the stroke survivors, urinary incontinence was associated with signs of depression (OR=3.0; 95% CI, 1.3-7.1) and tended to be associated with motor function of the leg (OR=3.1; 95% CI, 0.9-10.4) and cognitive function (OR=2.8; 95% CI, 0.9-8.6).

These findings supported the results from The Copenhagen Stroke Study conducted by Nakayama et al in 1997 which found that the significant risk factors for urinary incontinence and faecal incontinence were increasing age, severity of stroke, diabetes, and co-morbidity of other disabling diseases. The study investigated a community-based population of 935 acute stroke patients who were admitted consecutively over 19 months. On admission in the acute state, almost half of an unselected stroke population had urinary incontinence and/or faecal incontinence. This proportion declined to one fifth for urinary incontinence and one tenth for faecal incontinence of the surviving patients at 6 months.

3.1.5 Surgery
The impact of surgery as a precursor to urinary incontinence is more commonly observed in men than women.
An early study by Mommsen et al in 1994 revealed through bivariate and multivariate analyses that stress urinary incontinence was associated with previous exposure to surgery. A cross-sectional study collected data from 85% of 3114 women who responded to a questionnaire on urinary incontinence and a history of abdominal, gynaecological and urological surgery. The prevalence of urinary incontinence was 17%; with 63% having undergone surgery, mainly gynaecological, and almost one-third of the respondents had undergone more than one operation.\(^{32}\)

In 2001, a study by Jueng-Anuwat et al suggested that menopausal status, childbirth, previous abdominal hysterectomy, transvaginal surgery and family history had no correlation with stress urinary incontinence (SUI). However, body mass index was the only identified risk factor of SUI in middle aged and elderly Thai women.\(^{33}\)

In comparison, in 2005 Chmel et al found abdominal hysterectomy in previously continent women to be a relatively high risk for the development of urinary incontinence. The results also showed high persistence of the stress incontinence symptoms in women who did not declare their incontinence, when they were specifically asked about it.\(^{34}\)

Lunniss et al (2004) found that anal surgery was the only identified risk factor for acquired faecal incontinence in 59% of males in a retrospective cohort analysis of 629 non-elderly patients (154 male).\(^{15}\) This finding contributes to evidence that occult damage through anal surgery results in subsequent faecal incontinence, sometimes after a period of many years.

### 3.1.6 Other health conditions and diseases

In regards to other health conditions and diseases, the AIHW noted in 2006 that diabetes mellitus and neurological conditions such as Parkinson’s disease, spinal cord injury and multiple sclerosis are all associated with higher prevalence of urinary and anal incontinence.\(^{1}\) Dementia, including Alzheimer’s disease, was reported to be the most common associated health
condition for people living in cared accommodation, followed by stroke and arthritis and related disorders.

Diabetes was assessed in the 1988 Dubbo cohort, but not previously studied in relation to incontinence. Diabetes mellitus has been found to independently increase the risk of urinary incontinence in women. Lifford et al in 2005 revealed that risk of incontinence appeared to be associated with longer duration of Type 2 diabetes mellitus, thus even delaying its onset could have important public health implications. The risk of prevalent incontinence (multivariate RR=1.28, 95% CI=1.18-1.39) and incident incontinence (multivariate RR=1.21, 95% CI=1.02-1.43) was significantly greater in women with diabetes mellitus than women without.

Chronic cystitis and other urinary inflammatory diseases have also been found to be associated risk factors of developing urinary incontinence in women. A recent study by Kulakov et al in 2005 of 4336 female residents of Moscow aged 25-74 years revealed that chronic cystitis and other inflammatory urinary diseases provoke a 4-fold increase in the relative risk (RR) of urinary incontinence in women. This is higher than obstetrico-gynaecological risk factors (RR 1.5-2.8) and neurological risk factors (RR 1.3-2.0).

3.2 Summary of effects or correlates of incontinence
Urinary incontinence has generally been independently and positively associated with poor self-rated health in a variety of studies. Self-rated health and other psychosocial variables were assessed in the 1988 Dubbo cohort, but not previously studied in relation to incontinence.

In 1998 a US National Survey of Self-Care and Aging (N=3485), conducted from 1990-1991 by Johnson et al, surveyed a random sample of community-dwelling Medicare beneficiaries aged 65 years or older. Unadjusted analysis showed the presence of urinary incontinence to be associated with poor self-rated health (OR 2.7, 2.1-3.3).
Risk of falls has predominantly been reported to be a correlate of urinary incontinence but may not be a risk factor itself. Edwards’ Study of Osteoporotic Fractures (2001) found that in a three year study of 6049 community dwelling, older, (≥ 65 years of age; mean age 79 years) ambulatory white women, weekly or more frequent urge but not stress urinary incontinence increased the risk of falls and non-spinal, non-traumatic fractures. Daily urge incontinence was found to increase the risk of falling by 35%, compared with a 21% increase in risk with weekly urge incontinence. After adjusting for age and other potential confounding factors, urge incontinence was associated with falls (p<0.001) and fractures (p=0.02), whereas stress incontinence was not (p >/= 0.003).42

Similarly, The Italian Silver Network Home Care project reported by Landi et al in 2003 found that early diagnosis and appropriate treatment of urge incontinence may decrease the risk of fracture. Data was collected on patients admitted to home care programs (n=5418) from a total of 22 participating Home Health Agencies. The mean age of the women was 78.5 (+/- 4.6) years. During an average follow-up of 3 years, 55% of women reported falling, and 8.5% reported fractures. One-quarter of the women (1,493) reported weekly or more frequent urge incontinence, 19% (1,137) reported weekly or more frequent stress incontinence, and 708 (12%) reported both types of incontinence. Weekly or more frequent urge incontinence was associated independently with an increased risk of falls and non-spine, non-traumatic fractures in older women. Urinary frequency, nocturia, and rushing to the bathroom to avoid urge incontinent episodes most likely increase the risk of falling, which then results in fractures.43

Similarly, obesity has not been found to be a risk factor for incontinence, but incontinence is perceived as a barrier to exercise and social activity, particularly by women with more severe leakage. A study by Nygaard et al in 2005 found that one in seven women experienced urinary leakage during physical activity; this was more common among highly active (15.9%) than
less active women (11.8%) (p=0.01). After adjusting for age, co-morbidities, education, and race, women with very severe incontinence were 2.64 times (95% CI 1.25-5.55) more likely to be insufficiently active than continent women. Incontinence was a moderate or substantial barrier to exercise for 9.8% (95% CI 8.8-10.9%) of women. Of incontinent women, the proportion for whom incontinence was a moderate or substantial barrier to exercise increased with each severity category: 9.2%, slight; 37.8%, moderate; 64.6%, severe; and 85.3%, very severe (p < 0.01).44

Both urinary and faecal incontinence have been noted to increase with age in both men and women, but occur much earlier for women. An extensive list of risk factors such as pregnancy, childbirth and parity, menopause, BMI and obesity, lower urinary track symptoms, constipation, mobility, cognitive impairment, and specific surgeries have been proposed for incontinence but only a few have received rigorous investigation.

### 3.3 Summary of prevention and responses

The high prevalence of urinary incontinence, its socio-economic implications, the continuously ageing population and the fact that a number of potential risk factors, particularly in women, have been identified suggest that targeted prevention is a major task for the future.45

Studies like Kim et al’s in 2004 which estimated the risk factors associated with onset of urinary incontinence in a rural community-dwelling elderly population in ‘Village N’ in Akita Prefecture, Japan have shown that lifestyle and functional fitness are significantly associated with the onset of urinary incontinence in this population. The findings suggested that intervention programs are needed to improve pelvic floor muscle and to provide social support for the elderly. According to Chmel et al, additional information for women is needed in regards to awareness of the possibility of surgical
treatment of urinary incontinence in conjunction with hysterectomy, in order to make the current gynaecological surgical therapy more effective.

In Australia, the NCMS has responded to the high prevalence of urinary incontinence rates by funding a range of targeted public prevention programs since 1998. Public campaigns to increase community understanding of incontinence; reduce the social stigma associated with the condition; and improve reporting and treatment of bowel and bladder problems have been established. Awareness raising and information dissemination projects included the National Continence Helpline established in 1999 with the Continence Foundation of Australia; the National Public Toilet Map initiated in 2000 and redeveloped in 2004; the Bladder and Bowel website developed in 2006 as well as a variety of more localised outreach campaigns such as the Mobile Continence Expo run in rural Victoria in 2005, and various communication strategies which utilised community media linkages.

The distribution of information resources to alert pregnant and postnatal women to continence issues provided a more targeted focus. This early intervention initiative reached an estimated 125,000 women who have a baby each year. Interestingly in 2002, a project by Tweddle indicated that new mothers absorbed and retained pelvic floor information regardless of timing. Also in 2002, Brown et al increased awareness of urinary incontinence in women aged less than 30 years who attended fitness programs, through the education of fitness instructors and placement of information resources within the fitness centre environment. This project also confirmed the prevalence and under-reporting rates within this group.

The NCMS also funded projects to investigate the prevalence, “bother” and quality of life effects of lower urinary tract symptoms after stroke, and research the effect of early intervention for continence management following stroke to minimise long term disability. Bird et al’s 2001 study found that the predictors of urinary incontinence are older age group, female sex, functional impairment, and stroke severity, with urinary incontinence
being a risk factor for mortality and nursing home placement.\textsuperscript{51} Hanna et al’s 2005 study suggested that continence assessment and intervention in the acute phases of a stroke had positive long term outcomes for reducing incontinence problems.\textsuperscript{52}

NCMS funded research has been conducted into prevention and management of urinary and bowel problems after surgery; with development of consumer focussed guidelines on care practices for the transition from hospital to home. Faecal incontinence research conducted by Nikoletti et al in 2003 into post-surgery complications resulted in improved patient knowledge of bowel function however, the longer-term impact of increased knowledge and self care practices was unable to be monitored.\textsuperscript{53} The results of the study did however contribute to the production and publication of education resources by the Australian Government in 2005. Also in 2005, Torrance et al sought to provide a more coherent approach to patient and carer needs, through development of a comprehensive client discharge and referral resource and a model of best practice for patients moving between acute and community settings with catheters \textit{in situ}.\textsuperscript{54}

An NCMS project studying stress incontinence in pregnancy confirmed that pregnancy and childbirth are the most powerful predictors of urinary stress incontinence and that stress incontinence is a serious problem affecting women in the latter part of pregnancy and post-delivery. The study, conducted by the Western Australian Research Unit of the Royal Australian College of General Practitioners in 2003, found that of the 79\% (n=581) of participants in the study who reported incontinence most had developed the condition during the current pregnancy (68\%); a further 28\% (n=152) reported that their incontinence had developed from a previous pregnancy. The results of this research suggested that parity was associated with a 48.5\% increased risk of incontinence for every previous birth.\textsuperscript{55}
3.3.1 Social consequences of incontinence

Urinary incontinence affects many older people and is a problem with considerable physical, psychosocial and economic consequences. The literature indicates that urinary incontinence affects social and psychological functioning more than physical functioning however, urge incontinence has a greater impact than stress incontinence on quality of life. Several studies find that the impact of urinary incontinence is not solely a function of its severity, but also depends on individual coping abilities. Some studies also indicate that the social problems associated with urinary incontinence grow with time, but it is not clear if this is a function of increasing severity of the condition, or the particular adaptations required for coping with the condition.56

Incontinence alone does not increase risk of death but is probably a marker of ‘frailty’ or loss of reserve capacity. Cognitive dysfunction, less than perfect Katz ADLa performance, and hearing loss were the most important independent risk factors for nursing placement but such findings reflect admission processes which vary from country to country. The findings indicate a need for careful attention to residents exhibiting even relatively mild cognitive deficits upon admission because these residents are likely to need increased support.57

A study by Newens et al in 1995 also found that incontinence and the relationship of the carer to the patient were the strongest predictors of

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a Physical activities of daily living or ADL (also called Katz ADL) is an instrument that measures the ability of an individual to perform basic activities of daily living. It evaluates the loss of functional status in order to plan care accordingly. The ADL tool is usually combined with the instrumental activities of daily living (IADL). The index ranks performance in the following functions: continence, toileting, feeding, dressing, bathing, transferring of the elderly person wherever he is (home, care settings). For each function, the elderly person is evaluated as independent (1 point) or not (0 point). With a score of 6 points they are considered fully functional.
permanent residential care. Interviews were conducted with 109 people with pre-senile dementia of Alzheimer’s disease, diagnosed before age 65, and their carers. The results showed that the need for assistance in activities of daily living (ADL) was progressive with time from diagnosis. The need for assistance in each ADL category was significantly greater for cases in permanent residential care than for those at home. The reports of carers show that there is scope for improvement in supportive services to meet this community need.58

Experiencing urinary incontinence, particularly in a severe form, has been weakly related to depression, negative affect and low life satisfaction but measuring the psychosocial impact of a disease however, is difficult and there is no single best tool to achieve such an assessment.59-62 These relationships are partly explained by the fact that incontinent respondents are less healthy than are continent respondents.63

There are however, significant short and long-term benefits to the quality of life of older patients with incontinence when treated by conservative measures.64 Intervention studies to measure and report quality of life as an outcome variable was recommended by Fonda et al in 1995. This research found statistically significant improvements in subjective quality of life measures involving depression, isolation, embarrassment, laundry and smell when comparing these variables with initial assessment in a study of the impact of conservative non-pharmacological, non-surgical management on the quality of life in elderly incontinent, community-dwelling patients.

Even though the direct psychosocial impact of urine loss may be minor in many cases, urinary incontinence is associated with a variety of physical and behavioural factors that can impose a social and emotional burden.65, 66 This suggests that urinary incontinence cannot be adequately evaluated or treated without sensitive consideration of the patient's overall quality of life.
According to a study by Fultz and Herzog in 2001 on the self-reported social and emotional impact of urinary incontinence, incontinent respondents who were younger, male, less educated, lower in social desirability, in poorer health, or losing greater quantities of urine were more likely to report psychosocial distress, although these correlates were not consistently significant. Analyses were based on 1,116 continent and 206 incontinent respondents age 40 and older. Compared with continent respondents, significantly higher percentages of incontinent respondents reported feeling depressed, lonely, or sad.67

Further to this, Mehta et al in 2003 found that persons with poorer psychosocial functioning, low personal mastery (OR = 2.0, 95% CI = 1.6-2.5) and the need for more emotional support (OR = 2.2, 95% CI = 1.7-2.8), also had higher rates of anxiety symptoms. Anxiety symptoms occurred in 15% of older people without depression and 43% of those with depression. Of non-depressed older people, women were more likely to have anxiety symptoms than men (p <0.01), especially white women (20% prevalence). After multivariate adjustment, the chronic conditions of urinary incontinence (odds ratio (OR) = 1.5, 95% confidence interval (CI) = 1.1-1.9), hearing impairment (OR = 1.4, 95% CI = 1.0-2.1), hypertension (OR = 1.3, 95% CI = 1.0-1.7) and poor sleep (OR = 1.7, 95% CI = 1.3-2.4) were associated with a higher prevalence of anxiety symptoms.68

Studies like that by Kalantar et al of the prevalence of faecal incontinence and associated risk factors as an under-diagnosed problem in the Australian community, revealed that individuals with faecal incontinence perceive their health to be significantly poorer (p=0.02). There is a high burden of faecal incontinence in the community and the prevalence in men may be greater than is usually reported. Despite significant associated morbidity, most cases of faecal incontinence are unrecognised by doctors.66, 69

Fultz et al’s further study in 2005 concluded that care-giving was not a significant variable in the adjusted analyses, but spouses’ depressive
symptoms emerged as a significant predictor of the respondents' own depressive symptoms. Health care providers must be sensitive to the emotional impact of urinary incontinence. Their findings also suggested the importance of considering the patient's mental health within a wider context, including the physical and mental health of the patient's spouse.

The factors and relationships identified in the literature review were introduced into various analyses and models of incontinence measures using data from the Dubbo Study.

In Summary

- Urinary incontinence has a negative impact on ability to perform activities of daily living
- An extensive list of risk factors such as pregnancy, childbirth and parity, menopause, BMI and obesity, lower urinary track symptoms, constipation, mobility, cognitive impairment, and specific surgeries have been proposed for incontinence but only a few have received rigorous investigation
- Urinary incontinence has generally been independently and positively associated with poor self-rated health
- Both urinary and faecal incontinence have been noted to increase with age in both men and women, but occur much earlier for women
- Occult damage to the continence mechanism, especially through vaginal delivery and anal surgery can result in subsequent faecal incontinence, sometimes after a period of many years
- The prevalence of urinary incontinence is high among long-term stroke survivors
4. Methodology

4.1 Participants and study design

The Dubbo Study is an ongoing prospective study in an elderly cohort first examined in 1988-89. All non-institutionalised residents of Dubbo, NSW born before 1930 were eligible to participate. The participation rate at that time was 73% (n=2805, or 1233 men and 1572 women). Methodology has previously been described in detail.\(^2,71,72\) Briefly, the baseline examinations comprised demographic, psycho-social and standard cardiovascular risk assessments. The medical examination included anthropometry, blood pressure, resting ECG, peak expiratory flow rate, 12-hour fasting blood for measurement of plasma lipids, lipoproteins and glucose.

A questionnaire explored measures of:

- social support; depression status (Center For Epidemiologic Studies depression score\(^73,74\): ranked in tertiles, Tertile III indicating more evidence of depression);
- education;
- cognitive function;
- alcohol and tobacco use;
- medications;
- medical history including a specific question about the presence of urinary incontinence (and in follow-up urinary and faecal incontinence);
- family and personal history of coronary heart disease;
- physical activity;
- self-rated health (three categories: very good to excellent, good, and fair to poor); and
physical disability (in three categories based on physical activities of daily living scale, ADL: no disability, 1 impairment in ADL, and >1 impairment in ADL).

The study population was broadly representative of the Australian population born before 1930 by gender; age; employment; socio-economic status; housing tenure; tobacco use; mean blood pressure; and other variables. However, a higher percentage was Australian-born versus overseas-born (90% versus 73%).

By year 2001 there remained 1767 known survivors from the original cohort of 2805, of whom 1537 remained in Dubbo. 1303 survivors were re-interviewed in 2001 and 867 repeated this procedure in 2003. From these “survivor” interviews a smaller sub-cohort was generated which excluded prevalent cases of urinary incontinence from 1988. Information on faecal incontinence was obtained for the first time in 2001 and 2003.

Hospitalisation and death records were monitored continuously from September 1988 until September 2004, with postal surveys conducted every two years to confirm vital status. Only 3% of participants were lost to follow-up at the most recent survey.

The Dubbo Study was approved in the first phase by the ethics committees at The Australian National University, The University of New South Wales, and St Vincent’s Hospital Sydney, and in the Asset and Health Dynamics (AHEAD) phase by The University of Western Sydney. All participants gave informed, written consent.

4.2 Statistical methods

This sub-study of incontinence within this population involved a review of the data collected at different time points with focus placed on analysis of self
reported continence status and associated variables. The independent contribution of any factor (a) to the prevalence of incontinence at baseline and (b) to the incidence of new incontinence between 1988 and 2003 was examined in multiple logistic models. Point estimates and 95% confidence intervals (CI) for the relative risk of incontinence were calculated from the regression coefficients.

A large number of variables were entered in a single block and a final trimmed model was re-calculated, retaining only variables of statistical significance (p<0.05) as well as potential confounders. The impact of incontinence on admission to residential aged care or other service use was also evaluated. Statistical analysis was conducted using SPSS Version 14.75.
5. Results

5.1 Prevalence (cross sectional) models at baseline in 1988

The prevalence of incontinence and its age relationships are presented in Figure 2. Prevalence was two-fold higher in females versus males and it increased with advancing age. The participants with incontinence were significantly older than their continent peers.

Figure 2: Prevalence of self-reported urinary incontinence in original cohort by age (males and females)

Mean age males (incontinent vs continent) 71.3 vs 68.4; mean difference (95% CI) = 2.9 (1.0-4.9)
Mean age females (incontinent vs continent) 71.4 vs 69.4; mean difference (95% CI) = 2.0 (0.7-3.3)
A large array of demographic, biomedical, psycho-social and activity variables (as described in section 4.1.) were compared between incontinent and continent participants and some differences were found, but very few differences were noted between males and females. Selected variables are presented for the combined sexes in Table 1. One significant differential was the past history of genito-urinary disease (kidney, bladder or prostate disease) in those with incontinence; however no additional information is available in regard to this medical history.

Table 1: Summary of selected medical, physical and psycho-social variables by continence status in original cohort, males and females combined except where noted

<table>
<thead>
<tr>
<th></th>
<th>Incontinent (n=240)</th>
<th>Continent (n=2565)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Married: males</td>
<td>74</td>
<td>79</td>
</tr>
<tr>
<td>females</td>
<td>48</td>
<td>56</td>
</tr>
<tr>
<td>Lives alone: males</td>
<td>19</td>
<td>15</td>
</tr>
<tr>
<td>females</td>
<td>37</td>
<td>40</td>
</tr>
<tr>
<td>Number of children:</td>
<td></td>
<td></td>
</tr>
<tr>
<td>males</td>
<td>2.9</td>
<td>2.9</td>
</tr>
<tr>
<td>females</td>
<td>3.4</td>
<td>3.2</td>
</tr>
<tr>
<td>Past history of disease:</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Arthritis</td>
<td>65</td>
<td>55</td>
</tr>
<tr>
<td>Chronic respiratory</td>
<td>30</td>
<td>21</td>
</tr>
<tr>
<td>Diabetes</td>
<td>9</td>
<td>6</td>
</tr>
<tr>
<td>Stroke</td>
<td>9</td>
<td>5</td>
</tr>
<tr>
<td>Heart attack</td>
<td>13</td>
<td>11</td>
</tr>
<tr>
<td>Cancer</td>
<td>41</td>
<td>36</td>
</tr>
<tr>
<td>Genito-urinary:</td>
<td></td>
<td></td>
</tr>
<tr>
<td>males</td>
<td>56</td>
<td>23</td>
</tr>
<tr>
<td>females</td>
<td>30</td>
<td>20</td>
</tr>
<tr>
<td>Falls in last 12 months</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Fracture since age 50 years</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Hospitalisation in last 6 months</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
A large array of demographic, biomedical, psycho-social and activity

rences were found, but very few

Selected variables are

Table 1: Summary of selected medical, physical and psycho-social variables by

<table>
<thead>
<tr>
<th></th>
<th>Incontinent (n=240)</th>
<th>Continent (n=2565)</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Self-prescribed medication:</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Headache/painkillers</td>
<td>53</td>
<td>42</td>
</tr>
<tr>
<td>Vitamins</td>
<td>23</td>
<td>19</td>
</tr>
<tr>
<td>Sleeping tabs</td>
<td>13</td>
<td>14</td>
</tr>
<tr>
<td>Antacids</td>
<td>25</td>
<td>20</td>
</tr>
<tr>
<td><strong>Physical and social variables:</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Physical disability: &gt;1 ADL</td>
<td>41</td>
<td>21</td>
</tr>
<tr>
<td>Depression score: Tertile III</td>
<td>51</td>
<td>34</td>
</tr>
<tr>
<td>Self-rated health: fair-poor</td>
<td>30</td>
<td>20</td>
</tr>
<tr>
<td>Walking, daily</td>
<td>45</td>
<td>49</td>
</tr>
<tr>
<td>Gardening, daily</td>
<td>45</td>
<td>48</td>
</tr>
<tr>
<td>Clubs, ≥weekly</td>
<td>26</td>
<td>26</td>
</tr>
<tr>
<td>Attending church, ≥weekly</td>
<td>29</td>
<td>25</td>
</tr>
<tr>
<td><strong>Social contacts:</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Children live nearby, 1-2</td>
<td>56</td>
<td>57</td>
</tr>
<tr>
<td>Contact with children, ≥weekly</td>
<td>72</td>
<td>72</td>
</tr>
<tr>
<td>Close friends, 1-2</td>
<td>30</td>
<td>31</td>
</tr>
<tr>
<td>Can count on others for help</td>
<td>65</td>
<td>69</td>
</tr>
</tbody>
</table>

Data shown as % of each continence group, except for number of children, which is shown as the arithmetic mean number

Many of these differences would have been confounded by the important age differences noted in Figure 2. Hence, a multivariate logistic model controlling for such confounding factors was used - equivalent to an analysis of variance. The initial logistic model included many variables that did not reach statistical significance. They included diabetes; high blood pressure; cigarette smoking; prior coronary heart disease or stroke history; peak expiratory flow; lipid and lipoprotein fractions; alcohol intake; education level; home ownership; living alone; social support; social activities; physical activity; and pet ownership. The final multiple logistic model showing only significant predictors and important confounders is presented in Table 2.
Table 2: Final logistic model for prevalent urinary incontinence 1988

<table>
<thead>
<tr>
<th></th>
<th>Males Relative risk (95% CI)</th>
<th>Females Relative risk (95% CI)</th>
<th>Combined Relative risk (95% CI)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Age</td>
<td>1.04 (1.00-1.07)</td>
<td>1.03 (1.01-1.06)</td>
<td>1.03 (1.01-1.05)</td>
</tr>
<tr>
<td>Female sex</td>
<td>-</td>
<td>-</td>
<td>1.93 (1.41-2.63)</td>
</tr>
<tr>
<td>Married</td>
<td>1.06 (0.58-1.93)</td>
<td>1.35 (0.94-1.94)</td>
<td>1.26 (0.92-1.72)</td>
</tr>
<tr>
<td>Number of children</td>
<td>1.00 (0.88-1.13)</td>
<td>1.05 (0.97-1.13)</td>
<td>1.03 (0.97-1.10)</td>
</tr>
<tr>
<td>Disability</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1 ADL</td>
<td>1.71 (0.88-3.32)</td>
<td>1.47 (0.95-2.26)</td>
<td>1.55 (1.08-2.23)</td>
</tr>
<tr>
<td>&gt;1 ADL</td>
<td>2.72 (1.35-5.45)</td>
<td>1.94 (1.20-3.13)</td>
<td>2.18 (1.47-3.23)</td>
</tr>
<tr>
<td>Depression score:</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Tertile II</td>
<td>1.95 (0.93-4.07)</td>
<td>1.56 (0.93-2.60)</td>
<td>1.62 (1.07-2.48)</td>
</tr>
<tr>
<td>Tertile III</td>
<td>1.87 (0.91-3.85)</td>
<td>2.42 (1.44-4.07)</td>
<td>2.24 (1.47-3.41)</td>
</tr>
<tr>
<td>Self-rated health:</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Good</td>
<td>1.05 (0.55-1.97)</td>
<td>1.30 (0.88-1.93)</td>
<td>1.22 (0.88-1.70)</td>
</tr>
<tr>
<td>Fair-poor</td>
<td>1.51 (0.78-2.93)</td>
<td>1.01 (0.63-1.62)</td>
<td>1.17 (0.80-1.71)</td>
</tr>
<tr>
<td>Genito-urinary disease</td>
<td>4.13 (2.45-6.94)</td>
<td>1.70 (1.18-2.45)</td>
<td>2.23 (1.67-2.97)</td>
</tr>
</tbody>
</table>

CI = confidence interval, ADL = activity of daily living
Age and number of children entered as continuous variables, the remainder as categorical variables with the "opposite, lowest or missing" category as the reference point (e.g. not married, no disability, excellent self-rated health).

In the combined (both sexes) model, the significant predictors of incontinence were genito-urinary diseases (more so in males), physical...
disability, depression score, age and female sex. These findings were otherwise consistent between the sexes.

To further test for parity and body weight in women as predictors, analysis was undertaken using the less sensitive variable of “any children” (vs. no children) and body weight in lieu of BMI. No association was found with either substituted variable.

A past history of genito-urinary problems leading to urinary incontinence is entirely plausible and is supported by the literature. In the matter of physical disability or depression leading to incontinence, this could be an example of “cause->effect” or “effect->cause”. Hence, the final models were recalculated with physical disability or depression score as the dependent variable and incontinence as an independent predictor. For the combined sexes, the relative risk of depression (Tertile III versus lower) in an incontinent participant was 1.49 (95% CI 1.10-2.01). The relative risk of physical disability (>1 ADL impaired versus less impaired) in an incontinent participant was 1.62 (1.14-2.30). Impairment in self-rated health was not predicted by the presence of incontinence.

The time trend in physical disability, depression score and self-rated health between 1988 and 2001 was examined for incontinent participants at baseline having data in both surveys (n=82). To control for the likely effect of 13 years ageing, the same trend was examined for continent participants with data in both surveys, but excluding those developing incontinence in the intervening years. The findings are presented in Table 3. Depression score and physical disability deteriorated over the intervening years, self-rated health was not materially changed. Irrespective of continence status, depression scores were higher and most patients had entered Tertile III (of the distribution at baseline). However, Tertile III should not be simply equated with clinical depression. Physical disability increased proportionately irrespective of continence status.
Table 3: Trend in scores by continence status between 1998 and 2001

<table>
<thead>
<tr>
<th></th>
<th>Incontinent (n=82)</th>
<th>Continent (n=838)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Depression score, Tertile III:</td>
<td></td>
<td></td>
</tr>
<tr>
<td>1988</td>
<td>46%</td>
<td>26%</td>
</tr>
<tr>
<td>2001</td>
<td>83%</td>
<td>85%</td>
</tr>
<tr>
<td>Physical disability, &gt;1 ADL:</td>
<td></td>
<td></td>
</tr>
<tr>
<td>1988</td>
<td>22%</td>
<td>10%</td>
</tr>
<tr>
<td>2001</td>
<td>51%</td>
<td>34%</td>
</tr>
<tr>
<td>Self-rated health, fair-poor:</td>
<td></td>
<td></td>
</tr>
<tr>
<td>1988</td>
<td>26%</td>
<td>14%</td>
</tr>
<tr>
<td>2001</td>
<td>28%</td>
<td>19%</td>
</tr>
</tbody>
</table>

Refers only to those participants represented in both surveys

Incontinence may lead to reduced social and cultural activities, however no significant relationship between various social activities and incontinence was found in the multivariate models. For example, in an incontinent participant the relative risk of “daily walking” (vs. less often) was 1.07 (0.81-1.41), “daily gardening” (vs. less often) was 1.12 (0.84-1.49), “weekly or more frequent club attendance” (vs. less often) was 1.04 (0.76-1.42), and “weekly church attendance” (vs. less often) was 1.10 (0.81-1.50).

5.2 Incidence (longitudinal) models 1988-2003

After exclusion of incontinent participants from 1988 and some participants with incomplete data, 112/399 males (28.1%) and 216/605 females (35.7%) reported urinary incontinence in 2001 or 2003. This represented a marked increase in point prevalence since 1988. However, this is now a highly selected group of survivors and may not represent the true community incidence. A multiple logistic model was calculated with the incidence of new incontinence as the dependent variable and the 1988 baseline variables as independent predictors. The final logistic model showing only significant predictors and important confounders is presented in Table 4.
Table 4: Final logistic model for incident urinary incontinence 1988-2003

<table>
<thead>
<tr>
<th></th>
<th>Males Relative risk (95% CI)</th>
<th>Females Relative risk (95% CI)</th>
<th>Combined Relative risk (95% CI)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Age</td>
<td>1.04 (0.99-1.09)</td>
<td>1.00 (0.97-1.04)</td>
<td>1.01 (0.99-1.04)</td>
</tr>
<tr>
<td>Female sex</td>
<td>-</td>
<td>-</td>
<td>1.39 (1.03-1.87)</td>
</tr>
<tr>
<td>Married</td>
<td>1.45 (0.71-2.99)</td>
<td>0.98 (0.68-1.41)</td>
<td>1.07 (0.78-1.47)</td>
</tr>
<tr>
<td>Number of children</td>
<td>1.04 (0.93-1.16)</td>
<td>1.07 (0.98-1.17)</td>
<td>1.06 (0.99-1.13)</td>
</tr>
<tr>
<td>Disability:</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1 ADL</td>
<td>1.92 (1.09-3.35)</td>
<td>0.99 (0.66-1.48)</td>
<td>1.23 (0.89-1.70)</td>
</tr>
<tr>
<td>&gt;1 ADL</td>
<td>0.84 (0.34-2.08)</td>
<td>1.34 (0.75-2.37)</td>
<td>1.19 (0.74-1.90)</td>
</tr>
<tr>
<td>Depression score:</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Tertile II</td>
<td>0.74 (0.42-1.31)</td>
<td>1.22 (0.80-1.85)</td>
<td>1.00 (0.72-1.39)</td>
</tr>
<tr>
<td>Tertile III</td>
<td>1.10 (0.61-1.97)</td>
<td>1.35 (0.84-2.16)</td>
<td>1.18 (0.83-1.69)</td>
</tr>
<tr>
<td>Self-rated health:</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Good</td>
<td>2.33 (1.39-3.90)</td>
<td>1.33 (0.89-1.95)</td>
<td>1.66 (1.22-2.27)</td>
</tr>
<tr>
<td>Fair-poor</td>
<td>1.89 (0.95-3.76)</td>
<td>1.25 (0.72-2.18)</td>
<td>1.54 (1.01-2.36)</td>
</tr>
<tr>
<td>Genito-urinary disease</td>
<td>0.87 (0.49-1.52)</td>
<td>1.12 (0.73-1.72)</td>
<td>1.05 (0.75-1.46)</td>
</tr>
</tbody>
</table>

CI = confidence interval, ADL = activity of daily living

Age and number of children entered as continuous variables, the remainder as categorical variables with the “opposite, lowest or missing” category as the reference point (e.g. not married, no disability, excellent self-rated health).
The absence of prediction by physical disability or depression score in the combined incidence (i.e. longitudinal) model is striking, supporting the notion that incontinence actually leads to physical disability and to depression, and not vice versa. Alternatively fair-poor self-rated health appears to predict incident incontinence in the combined model, although not in a graded manner (relative risk 1.66 for those with moderate impairment, 1.54 for those with more severe impairment). Female sex predicted a higher relative risk (1.43). There was some inconsistency between the sexes, with the effects of fair-poor self-rated health confined to males.

While genito-urinary disease predicts incontinence cross-sectionally (Table 2), there is no association or prediction longitudinally. Given the general nature of the genito-urinary question posed to subjects (i.e. past history of kidney, bladder or prostate disease), there are several interpretations possible: (i) the subjects may be reporting that incontinence is producing genito-urinary problems (reverse causation); or (ii) prostate problems in men and other genito-urinary problems in women may have led to incontinence (direct causation), with causation being largely completed at the time of the baseline survey. We also note that greater precision is needed in the measurement of incontinence as well as genito-urinary disease.

Faecal incontinence was reported in 47/418 males (11.2%) and 114/683 females (16.7%). No information on faecal incontinence was available from 1988, but the prevalence was assumed to be low. A multiple logistic model was calculated with faecal incontinence as the dependent variable and the final model is presented in Table 5. Depression score and self-rated health were significant and graded predictors of faecal incontinence, but the effects appeared to be confined to females.

Seven percent of males and 9.4% of females newly reporting urinary incontinence in 2001-2003 also reported the presence of faecal incontinence.
Table 5: Final logistic model for incident faecal incontinence 2001-2003

<table>
<thead>
<tr>
<th></th>
<th>Males Relative risk (95% CI)</th>
<th>Females Relative risk (95% CI)</th>
<th>Combined Relative risk (95% CI)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Age</td>
<td>1.05 (0.98-1.11)</td>
<td>1.03 (0.99-1.07)</td>
<td>1.03 (0.99-1.07)</td>
</tr>
<tr>
<td>Female sex</td>
<td>-</td>
<td>-</td>
<td>1.56 (1.06-2.30)</td>
</tr>
<tr>
<td>Married</td>
<td>2.01 (0.68-6.00)</td>
<td>1.11 (0.72-1.73)</td>
<td>1.24 (0.83-1.83)</td>
</tr>
<tr>
<td>Disability:</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1 ADL</td>
<td>1.01 (0.45-2.25)</td>
<td>0.88 (0.54-1.43)</td>
<td>0.92 (0.61-1.39)</td>
</tr>
<tr>
<td>&gt;1 ADL</td>
<td>1.66 (0.61-4.53)</td>
<td>0.97 (0.52-1.83)</td>
<td>1.14 (0.67-1.94)</td>
</tr>
<tr>
<td>Depression score:</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Tertile II</td>
<td>1.35 (0.64-2.86)</td>
<td>2.06 (1.16-3.65)</td>
<td>1.75 (1.12-2.73)</td>
</tr>
<tr>
<td>Tertile III</td>
<td>1.30 (0.58-2.92)</td>
<td>2.29 (1.25-4.19)</td>
<td>1.86 (1.16-2.98)</td>
</tr>
<tr>
<td>Self-rated health:</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Good</td>
<td>1.33 (0.65-2.72)</td>
<td>1.77 (1.09-2.86)</td>
<td>1.61 (1.08-2.40)</td>
</tr>
<tr>
<td>Fair-poor</td>
<td>1.48 (0.60-3.63)</td>
<td>2.37 (1.30-4.34)</td>
<td>2.03 (1.24-3.39)</td>
</tr>
</tbody>
</table>

CI = confidence interval, ADL = activity of daily living

Age was entered as a continuous variable, the remainder as categorical variables with the "opposite, lowest or missing" category as the reference point (e.g. not married, no disability, excellent self-rated health).
5.3 “Outcomes” with urinary incontinence over 14-16 years from 1988

Unless specified otherwise, this is a univariate examination and some outcomes may be confounded by age and co-morbidity. Around 2% of the 1988 cohort (24 males and 36 females) were already resident in low care hostel accommodation. However, nursing home residents were excluded from the original cohort as this was considered to be an outcome.

The outcomes in 70 males and 170 females incontinent at baseline are summarised in Figures 3 and 4 respectively. Mortality rates were slightly higher in both sexes in the presence of incontinence. The proportion ever hospitalised was slightly higher in incontinent males, while hospital bed-day occupancy/person was substantially higher in both sexes over the whole period in the presence of incontinence.

Amongst incontinent males and females the rate of nursing home admission was approximately double that of their continent peers. A recently published detailed analysis of nursing home admission for the total Dubbo cohort over a 14 year period highlighted that in a multivariate model, the risk of nursing home admission increased significantly with age, male gender, urinary incontinence, impaired respiratory function, physical disability and depression. The relative risk of admission with incontinence was 1.66 (1.13-2.44).³
The number of incontinent participants resident in low care hostel accommodation was quite low at study entry, but this was already 2-3-fold higher than in the continent peers (Figures 3 and 4). This relative difference was maintained over 14 years follow-up in males (incidence of newly hostel-resident is 4.5% vs. 1.9%). This represented only an extra 3 incontinent participants moving to a hostel and this outcome must be interpreted with...
caution. In females, however, there was no differential effect in transfers to hostel accommodation (4.9% vs. 6.1%).

**Figure 4: Outcomes with incontinence in females 1988 – 2004**

<table>
<thead>
<tr>
<th>Incontinent*</th>
<th>Continent</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>n=170</strong></td>
<td><strong>n=1399</strong></td>
</tr>
<tr>
<td>Age 71.4 years</td>
<td>Age 69.4 years</td>
</tr>
<tr>
<td>(hostel n=8 (4.7%))</td>
<td>(hostel n=28 (2.0%))</td>
</tr>
</tbody>
</table>

- **Died**
  - **n=87**
  - 51% vs 43%

- **Hospitalised**
  - **n=155**
  - 91% vs 91%

- **New Hostel#**
  - **n=8**
  - 4.9% vs 6.1%

- **Nursing home**
  - **n=32**
  - 18.8% vs 10.2%

**Bed days/person**
- 62.9 vs 49.8

* Those with and without urinary incontinence compared at each level
# Data available 1988-2002, excludes those in a hostel or nursing home in 1988

Also recently published is a multivariate model for transfer to hostel accommodation for the total Dubbo cohort over a 14 year period.\(^7^6\) The risk of transfer was significantly increased with age, female gender and prior stroke, and was significantly reduced in those currently married or owning a pet. There was no significant prediction by incontinence where the relative risk was 0.75 (0.36-1.59).
Financial cost of these outcomes

The costs of incontinence are significant and generate both monetary and non-monetary impacts on the individual, carers and the health care system. The AIHW (2006) recently reported that in 2003 the estimated monetary costs of urinary and faecal incontinence in Australia totalled $1.5 billion within the health and residential aged care system. The majority of incontinence costs were for residential aged care ($1,268 million), which included a significant number of people with severe incontinence living in cared accommodation and receiving intensive care; and continence aids ($111.7 million). Other costs pertained to hospital expenditure and various medical services and pharmaceuticals. However, a wide range of personal costs have not generally been captured, such as laundry, clothing and time costs. The total expenditure for incontinence is projected to increase by 201% by 2030-31, in particular for residential aged care (220% projected increase between 2003 and 2030-31),¹ which warrants targeted investigation into the burden of personal costs to provide a more comprehensive understanding of the expenditures for incontinence.

5.4 Service usage by continence status in 1988

The use of various services, both in the community and at home, was examined in the 1988 cohort according to their continence status and the findings are summarised in Figure 5.

Incontinent males reported a greater use of all services compared with their continent peers, most prominently services in the home. Females reported similar service use irrespective of their continence status.
It was of interest to examine the impact of an informal carer on service usage. No specific information was available on the presence of an informal carer. Instead, a variable “living alone” was used as a surrogate for the absence of an informal carer. Nineteen percent of incontinent males lived alone versus 15% of continent males; 37% of incontinent females lived alone versus 40% of continent females. Service usage was re-evaluated exclusively in incontinent participants according to their “live alone” status and the findings are summarised in Figure 6.
It was of interest to examine the impact of an informal carer on service availability on the presence of an informal one” was used as a surrogate for the presence of an informal carer. Incontinent males living alone reported no use of day care or home nursing care, but reported increased use of meals on wheels. Incontinent females living alone reported increased use of all services. However, caution is required as this data is based on an assumption that “living alone” represents the absence of an informal carer.
5.5 Service usage by continence status in 2001-2003 sub-cohort

A similar analysis was repeated in the new incident cases of incontinence derived in 2001-2003. The findings by continence status are summarised in Figure 7 and by “living alone” status in Figure 8.

Figure 7: Use of community services by 2001-2003 sub-cohort

Incontinent males reported a greater use of virtually all community services, in the home and outside the home. Females reported similar service use irrespective of their continence status than in males. The rates of service usage were higher than in the original cohort, but the representation of the sub-cohort was 13-15 years later (than that in Figure 5).

Figure 8: Use of community services by living alone status in 2001-2003 sub-cohort

In the 2001-2003 sub-cohort 22% of incontinent males lived alone while 54% of incontinent females lived alone. This female proportion is substantially higher than in the 1988 cohort.
irrespective of their continence status, while their use was at a lower level than in males. The rates of service use overall were substantially higher than in the original cohort, but the representation in Figure 8 was established 13-15 years later (than that in Figure 5).

Figure 8: Use of community services by 2001-2003 sub-cohort - incontinent participants only by current “living alone” status

![Bar chart showing use of community services by 2001-2003 sub-cohort - incontinent participants only by current “living alone” status]

In the 2001-2003 sub-cohort 22% of incontinent males currently lived alone, while 54% of incontinent females lived alone. This female proportion is substantially higher than in the 1988 cohort. Incontinent males living alone
reported a substantially greater use of all community services. The same was true for incontinent females living alone, but again their use was at a lower level than in males (Figure 8).

**In Summary** (incontinence is urinary incontinence unless specifically indicated)

- Prevalence in 1988 was two-fold higher in females (10.8%) versus males (5.7%) and it increased with advancing age.
- The participants with incontinence were significantly older than their continent peers.
- More than a quarter of males (28.1%) and a third of females (35.7%) reported urinary incontinence in 2001 or 2003. This represented a marked increase in point prevalence since 1988. However, this is now a highly selected group of “healthy” survivors and may not represent the true community incidence.
- Cross sectional analysis revealed that the significant predictors of incontinence were genito-urinary disease, physical disability, depression score, age and female sex. These findings were generally consistent between the sexes.
- Female gender and fair-poor self-rated health predict incontinence longitudinally, but genito-urinary disease, depression and disability do not.
- Depression score and self-rated health were significant and graded predictors of faecal incontinence, but the effects appeared to be confined to females.
- No significant relationship was found between various social activities and incontinence in the multivariate models.
- Mortality rates were slightly higher in both sexes in the presence of incontinence. The proportion ever hospitalised was slightly higher in incontinent males, while hospital bed-day occupancy/person was substantially higher in both sexes over the whole period in the presence of incontinence.
- Incontinent males reported a greater use of all services compared with their continent peers, most prominently services in the home with incontinent males living alone reporting a substantially greater use of all community services.
- Amongst incontinent males and females the rate of nursing home admission was approximately double that of their continent peers.
6. Conclusion

The analysis of data available from the Dubbo study has informed the National Continence Management Strategy through:

⇒ providing a cross-sectional view of urinary incontinence within this participant population;
⇒ modelling the impact of specific risk factors and combinations of risk factors on urinary incontinence and associated outcomes;
⇒ determining, by loose proxy, the impact of the presence of an informal carer on outcomes where incontinence is a factor; and
⇒ evaluating the impact of urinary incontinence on admission to residential aged care facilities and other service use.

However, caution must be taken when interpreting these results. The population under review had aged significantly, only proxies were used to consider the impact of the presence of a carer on outcomes, and the measures of incontinence are general ones.

Incontinence is an understudied and under-treated condition. Approximately one fifth of healthy life years lost after age 75+ are due to incontinence, which is on par with the impacts of dementia, sight loss and hearing loss.\(^1\) The Dubbo data also shows it is a significant and independent factor in predicting nursing home admission for Dubbo residents.\(^5\)

The Dubbo longitudinal data suggest that disability and depression are consequences of incontinence rather than its precursors. The ability to model both prevalent and incident incontinence allows this observation to be made. This highlights the importance of disability and depression as factors that can be prevented by better treatment of those with incontinence. A potential picture is emerging of what appear to be negative cycles operating between incontinence, disability, depression, care burdens and falls. These
factors both individually and together contribute to risk of nursing home admission. It is therefore important to prevent such negative cycles by preventing diseases and adverse consequences of medical treatment so that such reinforcing negative cycles do not develop.

The analysis of the Dubbo data also indicates the importance of ageing and related diseases in the condition. For women it appears that ageing effects outweigh parity effects as predictors in the older population. Fair-poor self-rated health is generally important in predicting incontinence emphasising general health and the role of diseases and surgical procedures as precursors to incontinence. Thus the prevention of incontinence needs to be double edged: it must focus on disease prevention e.g. stroke, genitourinary conditions as well as consider the general health of older people.

The consequences for this on service use are clearly evident in the Dubbo population:

⇒ increased risk of nursing home admission;
⇒ increased use of community services which also increases with age; and
⇒ complex effects on informal carers which are difficult to identify in the Dubbo community data.

The Dubbo data strongly support the initiatives in the NCMS for older people, specifically those which:

⇒ prevent incontinence in order to reduce preventable nursing home admission, community service use and carer burdens;
⇒ moderate the disabling and depressive effects of incontinence in order to reduce preventable nursing home admission, community service use and carer burdens; and
⇒ continue to improve the quality and accessibility of incontinence services to older people.
Finally incontinence and its negative impacts can also be reduced by effective disease prevention across the spectrum of diseases which affect older people but in particular genito-urinary diseases, stroke and neurological based diseases.

### 7. Recommendations

Some recommended actions arising from the results of these analyses are

1. Undertake further exploration into the risk factors of incontinence that have been proposed but not yet rigorously investigated. Consideration should also be given to health conditions associated directly or indirectly with incontinence.

2. Undertake targeted investigations into the wide range of personal costs that have not been fully captured in earlier costing data, such as laundry, clothing and time related costs, to provide a more comprehensive understanding of the expenditures for incontinence.

3. Continue to support research initiatives under the NCMS that target:
   - prevention of incontinence;
   - a reduction in the disabling and depressive effects of incontinence; and
   - early intervention strategies that limit the impact of incontinence in conjunction with genito-urinary diseases, stroke and dementia.
References


42. Edwards N. Urge urinary incontinence was associated with increased risk of falls and non-spinal, non-traumatic fractures in older women. *Evidence Based Nursing.* January 26 2001;4(1):1367-6539.


75. SPSS. Statistical Package for the Social Sciences. SPSS Inc.

### Abbreviations/Glossary

<table>
<thead>
<tr>
<th>Abbreviation</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>ACAT</strong></td>
<td>Aged Care Assessment Team</td>
</tr>
<tr>
<td><strong>ADL</strong></td>
<td>Activities of Daily Living</td>
</tr>
<tr>
<td><strong>BMI</strong></td>
<td>Body Mass Index</td>
</tr>
<tr>
<td><strong>CI</strong></td>
<td>Confidence Interval</td>
</tr>
<tr>
<td><strong>DHA</strong></td>
<td>Department of Health and Ageing</td>
</tr>
<tr>
<td><strong>FI</strong></td>
<td>Faecal incontinence</td>
</tr>
<tr>
<td><strong>IADL</strong></td>
<td>Instrumental Activities of Daily Living</td>
</tr>
<tr>
<td><strong>NCMS</strong></td>
<td>National Continence Management Strategy</td>
</tr>
<tr>
<td><strong>NSW</strong></td>
<td>New South Wales</td>
</tr>
<tr>
<td><strong>OR</strong></td>
<td>Odds ratio</td>
</tr>
</tbody>
</table>

**Multivariate statistical analysis**
Describes a collection of procedures which involve observation and analysis of more than one statistical variable at a time. Regression analysis attempts to determine a linear formula that can describe how some variables respond to changes in others.

**Note:** (1) The AHEAD interview questions were:

- **Urinary incontinence:** Is there any wetting of the clothes, bedding, or underwear? Yes/No
- **Faecal incontinence:** Have you had any accidents involving faeces (e.g. soiling)? Yes/No

Questions were asked by trained interviewers with nursing or health backgrounds who used standard prompts when required.
work out what kind of care will best meet their needs when they are no longer able to manage at home.

P-value
The probability of obtaining a result at least as extreme as a given data point, assuming the data point was the result of chance alone.

RCS
Residential Classification Scale
A relative resource allocation instrument that consists of 20 questions, each having a choice of four ratings. The allocation of the 20 ratings, based on the assessed care needs of each care recipient, results in a score which places them on a nationally consistent scale, relative to all other people living in aged care homes throughout Australia.
Source:

RCT
Randomised Controlled Trial

RR
Relative risk
The risk of an event (or of developing a disease) relative to exposure. Relative risk is a ratio of the probability of the event occurring in the exposed group versus the control (non-exposed) group.

SPSS
Statistical Package for the Social Sciences

SUI
Stress Urinary Incontinence

UI
Urinary Incontinence

Note: (1) The AHEAD interview questions were:

**Urinary incontinence:** Do you have difficulty controlling your bladder (e.g. wetting pants)? Yes/No

**Faecal incontinence:** Do you have difficulty controlling your bowel motions (e.g. soiling)? Yes/No

Questions were asked by trained interviewers with nursing or health backgrounds who used standard prompts when required.