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## **The prevalence of incontinence in people with cognitive impairment or dementia living at home: a systematic review**

### **Abstract**

#### **Aims**

To investigate the prevalence of urinary and faecal incontinence in people with cognitive impairment or dementia, living at home

#### **Method**

We searched electronic databases, MEDLINE , EMBASE, CINAHL, PsycINFO, BNI, and the Cochrane Library (including DARE, NTIS), were searched from 1st January 1990 to 1st September 2008 and then searches were updated to 2012 week 13 (4<sup>th</sup> April) for studies reporting prevalence data of urinary and faecal incontinence in the population of interest. Quality assessments of studies considered risk of bias in criteria for prevalence studies. Due to the heterogeneity of the included study populations and results, meta-analysis was not appropriate and a narrative analysis was undertaken.

#### **Results**

From 427 references, eight studies met the inclusion criteria. Seven studies provided prevalence rates as findings incidental to their primary question. Populations and assessment tools were varied. Reported prevalence of urinary incontinence ranged from 1.1% in a general community population to 38% in those receiving home care services. Reported rates

of faecal incontinence were from 0.9% in a community population to 27% in a population attending an old age psychiatry outpatient clinic.

### **Conclusions**

The prevalence of incontinence in people with dementia or cognitive impairment living at home has not been clearly established. Population level data is required to inform clinicians and to reliably underpin decision-making in service planning, resource allocation and interventions for people with dementia and incontinence.

## **Introduction**

Dementia is one of the most disabling and burdensome conditions with estimates suggesting four to six million new diagnosis each year [1]. Over two thirds of people with dementia live in their own homes [2]. This is set to rise with increasing prevalence of the disease [3] and through public policies aimed at supporting people with dementia in their own home for longer [4,5]. Countries with specific dementia strategies emphasis the need for on-going clinical involvement in individual care and service planning (see for example those from England [6] and Norway [7]). While there is increased understanding of the range of clinical assessment and co-ordination tasks, there is little understanding of the scale of this in relation to symptoms such as incontinence.

The consequences and costs of managing incontinence associated with dementia have an impact on the individual, the family and the health and social care systems of all countries. Family carers of people with dementia report that the management of incontinence increases their burden significantly [8] and more problematic than behavioural symptoms [9]. Carers also try to protect the dignity of their relative and often seek clinical help as a last resort but then find tailored advice and help rarely available [10]. For people with dementia and their carers incontinence is one of the key factors in the decision to seek residence in a care home [11].

The clinical syndrome of dementia has a course of progressive deterioration in cognition, abilities, and physical functioning [12]. Cognitive impairment generally refers to people who do not fulfil a diagnosis of dementia, have measurable cognitive deficits and are thought to have a high risk of progressing to a dementia disorder [13]. Evidence suggests that general practitioners record a diagnosis of dementia late in the course of the disease [14]. Aside from co-morbidities and loss of physical functioning in later stage dementia, cognitive impairment and dementia may also result in incontinence through the loss of independence in personal toileting [12] or through the development of behavioural and psychological symptoms (BPSD) in dementia [15] like apathy or loss of inhibitions that manifest in inappropriate voiding behaviours [16].

In the general population prevalence of incontinence rises with age, with estimates of up to 15% of older women and 2-11% for older men experiencing daily urinary incontinence (UI), with higher rates for those living in care homes[17]. Prevalence of faecal incontinence (FI) also increases with age but is not associated with gender, and the rate of faecal incontinence among people aged over 60 is 5.1% (95% CI 3.4-7.6) in men and 6.2% (95% CI 4.9-8.0) in women [18].

While the high rates of incontinence symptoms are well documented in those who are resident in care homes [17], there is currently no evidence available as to the scale of the problems to be addressed for those living in their own homes. The research question addressed in this systematic review was: “What is the prevalence of urinary and faecal incontinence in people with cognitive impairment or dementia, living in their own homes”.

## **Methods**

### **Search procedure and data extraction**

We searched six electronic databases, MEDLINE, EMBASE, CINAHL, PsycINFO, BNI, and the Cochrane Library (including DARE, NTIS), from 1st January 1990 to 2012 week 13 (4<sup>th</sup> April) using key words and medical subject headings (see table I ): In addition ‘lateral searching’ techniques [19] were used for key authors and cited references. Abstracts were screened by two researchers for inclusion, using the inclusion and exclusion criteria below.

**Inclusion:** community based observational studies reporting data on urinary incontinence (UI) and/or faecal incontinence (FI) in people with cognitive impairment or dementia, residing in their own home.

**Exclusion:** papers not published in English , not reporting empirical, observational data , or reporting settings of hospital, nursing homes, care homes or group residential homes, or reporting populations that excluded people with cognitive impairment or dementia or where they were included but they were not identifiable in the results, or without reported rates of UI and/or FI.

### **Data extraction and quality assessment**

The full text was retrieved and read for inclusion for abstracts that were ambiguous or appeared to meet inclusion criteria. Data were extracted from included studies against pre-defined categories by one researcher and confirmed by a second researcher. There are no validated and agreed tools for assessment of prevalence studies [20]. Quality judgements

rather than a score [21] were made of the validity of the study method on the following aspect: appropriateness of design, sampling frame, sample size, and the objectiveness of measures) and the interpretation of the results [22]. With regard to appropriate sample size, the assessment drew on other published systematic reviews of prevalence in which appropriate sample sizes were calculated as greater than 300 for dementia [22] and as greater than 125 in each gender group UI and FI [23].

## **Results**

We identified a total of eight hundred and seventy studies. Of these 638 were duplicates and after initial screening 26 full text papers were retrieved and assessed (figure 1). Most were excluded as they reported on people resident in care homes (n=12) or the results were not reported separately for people with dementia or cognitive impairment living in the community (n=6).

We included eight studies [24-31] from Canada, Eire, Hong Kong, Italy, Japan, the United Kingdom (UK) and the United States of America (USA). The study characteristics are presented in Table II. The heterogeneity of the populations, the study objectives and the instruments used precluded a meta-analysis. A narrative analysis is presented.

One study reported prevalence of UI in a sample of people with dementia living in the community [26]. One study reported prevalence of incontinence in a community population and reported prevalence of those with both incontinence and cognitive impairment [28]. One study examined the prevalence of cognitive impairment in a community population and reported rates of UI as part of that [30]. Three studies presented data on incontinence as part of examining the care needs [24, 26] or prevalence of problems [31] in people with dementia living in the community. Two studies examined the prevalence of UI in recipients of home care services (eligibility criteria for the service not given) and reported those with UI who also had cognitive impairment [25, 27]. The quality assessment of each study is presented in Table III.

Four studies aimed to provide data on incontinence in their populations [25, 27, 28, and 29]. Ouslander et al. [29] recruited a sample from people with a clinical diagnosis of dementia attending an outpatient clinic whose carers were experiencing high levels of stress. This sampling frame increased the risk of bias because high rates of UI and FI may have contributed to carer stress and the small sample was not adequate for a prevalence study of incontinence. A study-developed tool was used to assess UI [29]. Nakanishi et al. [28] used

a randomised community population for the sampling frame and recruited a large sample, appropriate in size to an incontinence prevalence study. However, the United Kingdom OPCS (Office of Population Censuses and Surveys) assessment tools [32] used in the study were not validated for objective assessment of cognitive impairment, dementia or incontinence. The numbers of people with incontinence in this study were very small and so we did not extract the reported adjusted odds ratios. Landi et al. [25] and Mohide et al. [27] addressed the question of incontinence prevalence in community dwelling populations of older adults in receipt of home care services. Both included a large sample appropriate for the study of prevalence of incontinence. Both had a low risk of selection bias for the target population but a high risk of bias to a frail population with high level of needs. Landi et al. [25] used study designed and validated tools [33] in which a cognitive performance score (CPS) of 2 or more indicated moderate to severe cognitive impairment [32]. Mohide et al. [27] did not use validated tools and provided little detail on this aspect.

Three studies addressed the question of prevalence of problems and care needs in community dwelling patients with an established diagnosis of dementia [24, 26, and 31]. Only Meaney et al. [26] specified that the individual met the criteria of the World Health Organisation (WHO) international classification for dementia [34]. All three recruited samples that are considered too small for the study of prevalence of incontinence. All three have a high risk of bias in sample selection for prevalence studies. Terri et al. [31] and Meaney et al. [26] recruited from a single outpatient clinic and Chung [24] recruited 49% from a community organisation. Chung [24] and Meaney et al. [26] used the CareNapD assessment tool [35] while Terri et al. used a study specific, unvalidated tool for a range of behavioural problems [31].

Rait et al. [30] investigated the prevalence of cognitive impairment in a large UK stratified population of people aged over 75years registered with general practitioners (a universal provision of the National Health Service [NHS]). Data provided on UI was one of a number of reported physical and social associations with cognitive impairment. The sample was of sufficient size for a prevalence study and the risk of sample bias was low. Cognitive impairment was determined by the use of the Mini-Mental State Examination (MMSE) [36]. This study used a single question to determine UI [37].

The prevalence rates of UI and FI from the studies are presented in Table 3. Reported rates of UI and cognitive impairment or disabilities from large, general community populations were 1.1% (frequency unspecified) [28] and 8.1% (once a week or more)[30]. Reported rates

of UI with cognitive impairment and disabilities from large community populations in receipt of home care services, which were therefore likely to be people of high levels of dependence, were 38% [25](frequency unspecified) and 10% [27] (frequency unspecified). Reported daytime UI rates from studies of small populations with a diagnosis of dementia were 34% (frequency unspecified) [26], 24% (once daily or more) [29], 11% (once a week or more) [29] and 11% (3 to 6 episodes a week)[31]. Rates of UI at night were reported in these same populations as 21% [24] and 34% [26].

Prevalence rates of FI were reported from a large general community population as 0.9% [28] and from small populations with a diagnosis of dementia as 18% [24], 27% [26] and 7% [31].

In the studies that provided sufficient information [25, 30], we calculated relative risks for UI in the presence of cognitive impairment as compared to no impairment, and the 95% confidence intervals (Table IV). These are not adjusted for any other factors because we were interested in the prevalence rate and not in causation. Calculations from data in the Rait et al. paper [30] give a relative risk of 2.03 (95% CI 1.73-2.36) for UI in people with MMSE<24 compared to MMSE≥24. Using the data in the Landi et al. paper [25] the relative risk of UI in those with a CPS 2-4 compared to CPS 0-1 was 2.03 (95% CI 1.88-2.18), and in those with a CPS >4 compared to CPS 0-1 was 2.97 (95% CI 2.78-3.18).

## **Discussion**

Eight studies were included in the review, but only one was primarily designed to answer the review question about the prevalence of UI in people with dementia. All the studies had at least one aspect of the study which weakened their ability to answer the review question. Eight reported rates of UI but only 3 reported rates of FI. There was a wide variation in reported prevalence rates for UI and FI in people with cognitive impairment or dementia resident in their own homes. This is explained in part by the different populations at risk studied and in part by the lack of uniformity in criteria for the assessment of both the incontinence and also the cognitive impairment or dementia. These methodological challenges in assessing prevalence, including variations in definitions and measurement tools, have been well documented for both incontinence [17] and dementia [38]. Further to this both cognitive impairment/dementia and incontinence are embarrassing and stigmatised conditions [17, 39] which may result in under reporting in one off study interviews. Studies may therefore underestimate prevalence. For seven of the eight studies included, the

prevalence rates of interest to this review were incidental findings [24, 25, 26, 27, 28, 30, and 31]. The one study designed to answer the UI prevalence question had a small population, identified through carers who volunteered themselves as stressed for a specific service [29].

The relative risks for UI and FI in the presence of cognitive impairment compared to no impairment from two studies both suggest an approximate doubling of risk, despite the different definitions used in these studies and the very different prevalence rates obtained.

This variation in prevalence rates is compatible with two plausible hypotheses. First, that people with dementia already in receipt of specialised medical or nursing services have greater prevalence of incontinence, either because specialist services identify the problem more readily or because specialist attention focuses on the more severely affected. Second, those with dementia have greater prevalence of incontinence than those with non-specific cognitive impairment because the progression of dementia both unmasks incontinence and also causes it. These require further investigation.

To our knowledge, this is the first review addressing this question of prevalence of incontinence in this population. The limitations of the review are the search strategy, which may have overlooked other studies with incidental prevalence findings in studies, and the criteria of exclusion of studies not reported in the English language. In the absence of validated tools for the assessment of prevalence studies, we drew on best documented practice. There is a case for developing and validating such a tool specific to studies of the prevalence of incontinence.

### **Conclusion**

The costs and consequences of managing incontinence have impacts on the person with dementia, the family and the health and social care systems of all countries. There are currently no definitive prevalence data for urinary or faecal incontinence in people with dementia living at home. The data are therefore not available for clinicians or service planners to model future needs, which is particularly important given current policies to support people with dementia for longer in their own homes. Rigorous primary research, using validated assessment measures, is needed to establish population level data.

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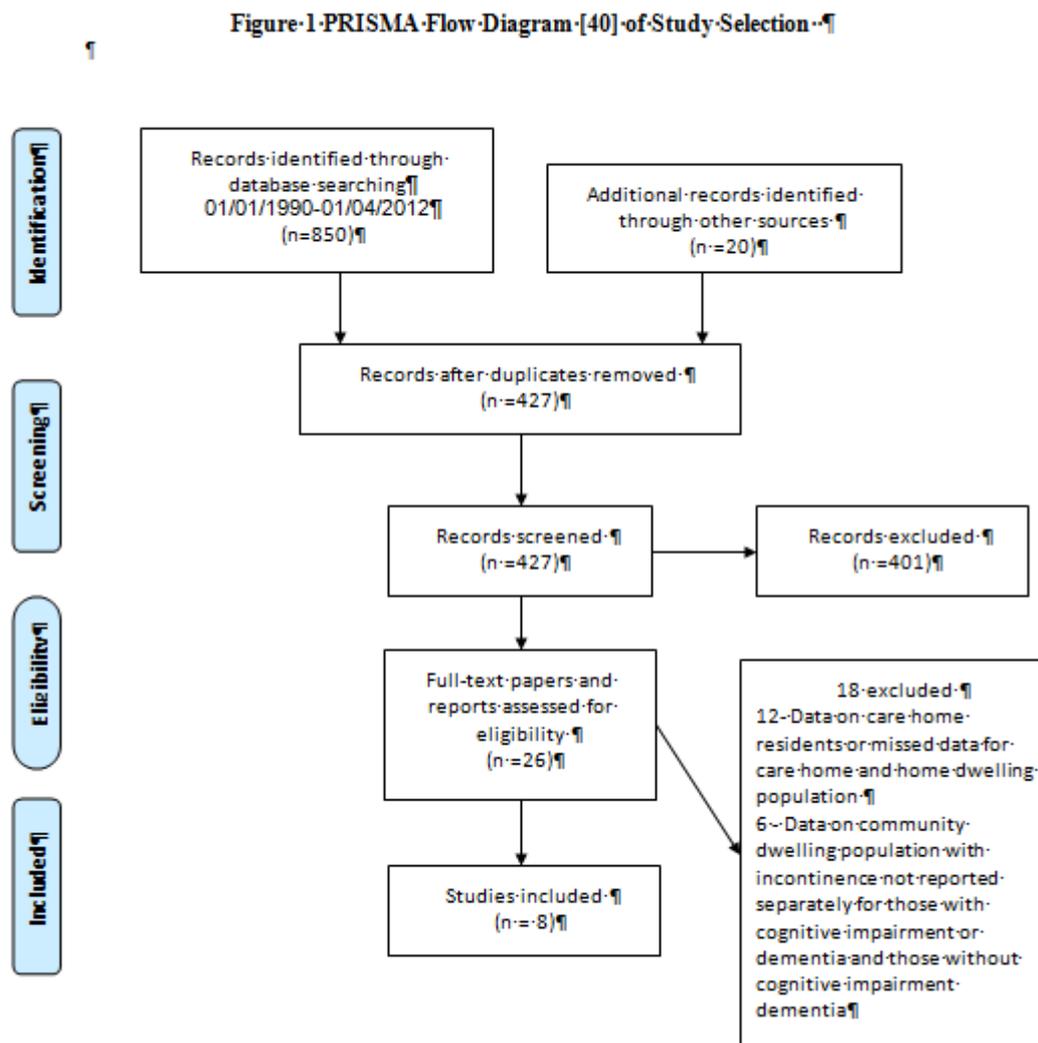
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## Figures and Tables

Figure 1 PRISMA flow diagram of the study selection



## Tables I -IV

### Table I Search Terms

Area	Search terms (medical subject headings and key words)
<i>Population characteristics</i>	exp Fecal Incontinence/ or exp Urinary Incontinence/ exp Delirium, Dementia, Amnesic, Cognitive Disorders/ or exp Dementia/ dementia.mp. exp Aged
<i>Setting</i>	Community dwelling.mp Community.mp
<i>Research field of enquiry</i>	Exp prevalence Prevalence.mp. Exp Needs assessment

**Table II. Characteristics of included studies.**

<b>Study author, year and location</b>	<b>Population, and mean age, with reported data</b>	<b>Number with cognitive impairment or dementia and method of assessment</b>	<b>Number of with both UI or FI and also dementia or cognitive impairment and method of assessment</b>
Chung [24] 2006 Hong Kong	Convenience sample recruited from Alzheimer Disease Association, memory clinics and outpatient clinics. N=197 Mean age 77, 64% female	197 with a confirmed diagnosis of dementia or Alzheimer's disease.	Night time wetting N=43 (21% of 197 ) Faecal incontinence N=36 (18% of 197). UI/FI determined by self and carer report to researcher using an amended Care Needs Assessment Pack for Dementia (CareNap-D)[35]
Landi et al. [25] 2003 Italy	Patients enrolled in home health care programmes and Silver Network Home care Project . N=5372 Mean age 78.6 ( SD 9.5),59% female	In text number not given but states 30% with moderate to severe cognitive impairment: determined by Cognitive Performance Score [33] (CPS >2). Computations from Table 2 data indicate 34% of men (745/2178) and 31% of women (1004/3194) had CPS 2-4, while 20% of men (443/2178) and 24% of women (764/3194) had CPS score ≥5.	UI and moderate to severe cognitive impairment n=2025 (38% of 5372). Association with UI in men : CPS score 2-4 adjusted odds ratio 2.04 (95% CI 1.61–2.58), CPS score ≥5 adjusted odds ratio 5.37 (95% CI 3.90–7.38). Association with UI in women: CPS score = 2-4 adjusted odds ratio 2.04 (95% CI 1.61–2.58), CPS score ≥5 adjusted odds ratio 6.11 (95% CI 4.67–7.99) . UI determined by a single self report question with 5 point scale as part of the enrolment assessment to the home care service completed by a health professional (GP , geriatrician, nurses)
Meaney et al. [26] 2005 Eire	Patients ,consecutively referred, attending an old age psychiatry outpatients meeting ICD-10 criteria and living in community N=82. Mean age 76 years (SD 7.8). 55=female 27 =male	82 with ICD-10 [34] diagnosis of dementia	Numbers are not given in the paper but can be read from Figure 3. Dementia and -day time UI n= 28 (34% of 82), -Night time UI n=28 (34% of 82), faecal soiling n= 23 (28% of 82) UI/FI determined by self and carer report to project nurse using (CareNap-D)[35]
Mohide et al. [27] 1988 Canada	Patients receiving home care services aged over 16 years. n=2801 Mean not given. Sex not given	Number not given Method of determining cognition disabilities not given	UI in 22% of the study participants. Cognition disabilities in 44% (95% CI 40.4%-48.3%) of all those with UI (271/617), which is 10% of the entire sample. UI determined by study developed continence assessment form completed by health professional (unspecified).
Nakanishi et al.[28] 1997 Japan	A randomly selected (unspecified) sample of community residing people aged over 65 from a computerised sex-age register in one city. N= 1,405	Number not given Dementia determined by Intellectual functioning subscale of The UK Office of Population Censuses (OPCS) Disability Survey	UI and dementia or suspected dementia =1.1%.(n=1405) FI and dementia or suspected dementia =0.9%(n=not given) We have not reported the odds ratios from this paper as the numbers of people with incontinence were very small. UI and FI determined by self report using OPCS Disability

<b>Study author, year and location</b>	<b>Population, and mean age, with reported data</b>	<b>Number with cognitive impairment or dementia and method of assessment</b>	<b>Number of with both UI or FI and also dementia or cognitive impairment and method of assessment</b>
	Age mean not given. Sex not given.	1985 [32]	Survey 1985 [32] to welfare commissioners.
Ouslander et al. [29] 1990 USA	Community residing patients with a dementia diagnosis attending a community facility whose family carers volunteered for 'help with stress and burden' N=184 Mean age incontinent 76.28 (SD 8.10) continent 75.84 (SD 7.73) Sex not given	184 with a clinical diagnosis of dementia	Dementia and UI n=66.( 36% of 184) 24% incontinence once a day or more often , 11% 3-6 episodes a week UI determined by report of carer to unspecified researcher. Part of study developed memory and behaviour checklist.
Rait et al. [30] 2005 (UK)	General practice registered patients, aged over 75, approached as part of a randomised control trial of the methods of assessment of older people. Computer randomised to universal or targeted arm. Analysis of subjects in universal arm (n=15,051) , of whom 14,621 completed Mini-Mental State Examination MMSE [36] 47% aged 75-79 , 61.5% female	N=2,682 with cognitive impairment determined by MMSE [36] <23/24	Cognitive impairment and UI 8.1% (217/2682) Fully adjusted odds ratio of cognitive impairment in people with UI compared to those without 1.3 (95%CI 1.0-1.7 [published upper CI of 1.1 corrected by GR]). UI once a week or more often single question by self report to research nurse [37].
Teri et al [31] (1989) (USA)	Patients with diagnosis of an Alzheimer's type dementia attending a Geriatric Clinic selected (from case notes) as meeting criteria of diagnosis, age between 55-85 and community residing) for the study n=56 . Mean age 71 years, range 55-85 43% female ,57% male	56 with a clinical diagnosis of Alzheimer's type dementia	Dementia and UI more than twice a week =11%. FI more than twice a week =7%. UI and FI determined by report by care givers to trained interviewer. No tool specified

**Table III Quality assessment of included studies**

<i>Validity of study methods [22]</i>	<i>From the study</i>	<i>Comment</i>
<b>Chung [24] 2006 (Hong Kong)</b>		
1. Is the study design appropriate for the research question?	Specific to the study research question.	Findings of interest to the review are not the prime focus of the study.
2. Is the sampling frame appropriate?	Convenience sampling methodology. Recruited from a community organisation and specialist health care facilities or outpatients across the city or territory (unspecified).	Convenience sample with a high risk of bias.
3. Is the sample size adequate?	197.	No calculation or rationale for sample size reported.
4. Are objective, suitable and standard criteria used for measurement of the health outcome?	Clinical diagnosis of dementia. CareNapD[35] for incontinence .	Objective. Suitable for assessment of care needs in dementia but not specific to UI or FI.
5. Is the health outcome measured in an unbiased fashion?	Carer report to researcher.	Risk of under reporting.
6. Is the response rate adequate? Are the 'refusers' described?	397 people approached. 200 eligible participants or their carers refused on initial contact.	Risk of bias to a sub-set of those with dementia living in the community. No data available on 'refusers'..
<b>Interpretation of the results</b>		
7. Are the estimates of prevalence or incidence given with confidence intervals and in detail by subgroup, if appropriate?	Confidence intervals not given.	Comment not made.
<b>Applicability of the results</b>		
8. Are the study subjects and the setting described in detail and similar to those of interest to you?	Community dwelling with a diagnosis of dementia.	Setting and subjects similar to those of interest.
<b>Landi et al. [25] 2003 (Italy)</b>		
1. Is the study design appropriate for the research question?	Specific to the study research question.	Findings of interest to the review are not the prime focus of the study.
2. Is the sampling frame appropriate?	All recipients of home care services enrolled with 20 agencies which agreed to participate in the Silver Network Home care Project from across all Italian territories.	Risk of bias to the frailest group in population.
3. Is the sample size adequate?	5372.	No calculation or rationale for sample size reported. A large sample is likely to produce narrow confidence intervals.
4. Are objective, suitable and standard criteria used for measurement of the health outcome?	Part of minimum data set for the study CPS [33] for cognitive impairment UI determined by a single self report question with 5 point scale.	Validated tool. Study developed tool.
5. Is the health outcome measured in an unbiased fashion?	Self report to a health professional (GP , geriatrician, nurses).	Risk of under reporting.
6. Is the response rate adequate? Are the 'refusers' described?	Use of minimum data set as part of enrolment in services so no 'refusers'.	Low risk of bias (NB sample biased).

<i>Validity of study methods [22]</i>	<i>From the study</i>	<i>Comment</i>
<b>Interpretation of the results</b>		
7. Are the estimates of prevalence or incidence given with confidence intervals and in detail by subgroup, if appropriate?	Odds ratio and confidence intervals given for predictors of UI.	
<b>Applicability of the results?</b>		
8. Are the study subjects and the setting described in detail and similar to those of interest to you?	Community dwelling recipients of home care services.	Provides information on one section of the population (the frailest or most dependent on paid caregivers) of interest only.
<b>Meaney et al. [26]2005 (Eire)</b>		
1. Is the study design appropriate for the research question?	Specific to the study research question.	Findings of interest to the review are not the prime focus of the study.
2. Is the sampling frame appropriate?	Patients, consecutively referred between Jun2 2002 and July 2003, attending an old age psychiatry outpatients meeting ICD-10 [34] diagnosis and community dwelling criteria.	High risk of bias to a subset of the community population with dementia i.e. those newly identified and referred to specialist services.
3. Is the sample size adequate?	82.	No calculation or rationale for sample size reported. Small sample sizes are likely to have wide confidence intervals.
4. Are objective, suitable and standard criteria used for measurement of the health outcome?	ICD-10 [34] diagnosis of dementia. CareNap D[35] for incontinence .	Objective. Suitable for assessment of care needs in dementia but not specific to UI or FI.
5. Is the health outcome measured in an unbiased fashion?	Self report to research nurse.	Risk of under reporting.
6. Is the response rate adequate? Are the 'refusers' described?	No refusals to participate.	Low risk of bias to a subset of those referred to the specialist service.
<b>Interpretation of the results</b>		
7. Are the estimates of prevalence or incidence given with confidence intervals and in detail by subgroup, if appropriate?	No confidence intervals given.	No comment made.
<b>Applicability of the results</b>		
8. Are the study subjects and the setting described in detail and similar to those of interest to you?	Community dwelling with a diagnosis of dementia.	Setting and subjects are similar to those of interest.
<b>Mohide et al. [27] 1988 (Canada)</b>		
1. Is the study design appropriate for the research question?	Specific to the study research question.	Findings of interest to the review are not the prime focus of the study.
2. Is the sampling frame appropriate?	Patients receiving home care services from 4 government funded home care services in the southern part of a Canadian province.	Risk of bias to the frailest group in population.

<i>Validity of study methods [22]</i>	<i>From the study</i>	<i>Comment</i>
3. Is the sample size adequate?	2801.	No calculation or rationale for sample size reported. Large samples are likely to have narrow confidence intervals.
4. Are objective, suitable and standard criteria used for measurement of the health outcome?	Method of determining cognition problems not specified. A two-page continence assessment form developed by a criteria group.	No comment.  Study developed tool.
5. Is the health outcome measured in an unbiased fashion?	Direct observation, self report, carer report and information from other professional to health professional (unspecified).	Low risk of bias through under reporting.
6. Is the response rate adequate? Are the 'refusers' described?	Data collected from all home care recipients receiving a visit from a health professional.	Low risk of bias (NB sample biased).
<b>Interpretation of the results</b>		
7. Are the estimates of prevalence or incidence given with confidence intervals and in detail by subgroup, if appropriate?	Confidence intervals given for the percentage of those with cognitive disabilities (unspecified) with UI.	
<b>Applicability of the results</b>		
8. Are the study subjects and the setting described in detail and similar to those of interest to you?	Community dwelling recipients of home care services	Provides information on one section of the population (the frailest) of interest only.
<b><i>Validity of study methods</i></b>	<b><i>From the study</i></b>	<b><i>Comment</i></b>
<b>Nakanishi et al. [28] 1997 (Japan)</b>		
1. Is the study design appropriate for the research question?	A population –based cross sectional study.	Appropriate to the review question.
2. Is the sampling frame appropriate?	Randomly selected (unspecified) sample of residents aged over 65 from a computerised age-sex register in one city.	Sampling frame drawn from all residents ages over 65 in one city so a low risk of bias from one population subset.
3. Is the sample size adequate?	1405	No calculation or rationale for sample size reported. Large samples are likely to have narrow confidence intervals.
4. Are objective, suitable and standard criteria used for measurement of the health outcome?	Dementia determined by Intellectual functioning subscale of The UK Office of Population Censuses (OPCS) Disability Survey 1985[32]. UI and FI determined by self report using OPCS Disability Survey 1985 [32].	Objective.
5. Is the health outcome measured in an unbiased fashion?	Self report to welfare commissioners.	Risk of under reporting.
6. Is the response rate adequate? Are the 'refusers' described?	95.4% response rate. 15 absent, 25 in hospital, 21 placement in institution, 7 refusals.	The high response rate suggests a low risk of bias to a population subset. No details given of 7 'refusers'..
<b>Interpretation of the results</b>		

<i>Validity of study methods [22]</i>	<i>From the study</i>	<i>Comment</i>
7. Are the estimates of prevalence or incidence given with confidence intervals and in detail by subgroup, if appropriate?	Odds ratio and confidence intervals given for independent factors associated with UI, FI and double incontinence.	
<b>Applicability of the results</b>		
8. Are the study subjects and the setting described in detail and similar to those of interest to you?	Community dwelling people aged over 65.	Setting and population of interest to the review.
<b>Ouslander et al. [29] 1990 (USA)</b>		
1. Is the study design appropriate for the research question?	Part of the study aim was to determine the prevalence of UI in community dwelling people with dementia. Design unspecified.	Question of interest to the review.
2. Is the sampling frame appropriate?	Community residing patients with a dementia diagnosis attending a community facility whose family carers volunteered for 'help with stress and burden'.	Convenience sample. High risk of bias to population with high levels of problems causing stress to family carers.
3. Is the sample size adequate?	184	Not large enough for prevalence studies of incontinence.
4. Are objective, suitable and standard criteria used for measurement of the health outcome?	Clinical diagnosis of dementia. Part of study developed memory and behaviour checklist.	Objective. Study developed checklist.
5. Is the health outcome measured in an unbiased fashion?	UI determined by report of carer to unspecified researcher.	Low risk of bias.
6. Is the response rate adequate? Are the 'refusers' described?	Not given.	
<b>Interpretation of the results</b>		
7. Are the estimates of prevalence or incidence given with confidence intervals and in detail by subgroup, if appropriate?	Confidence intervals not given.	
<b>Applicability of the results?</b>		
8. Are the study subjects and the setting described in detail and similar to those of interest to you?	People with dementia attending one health care facility whose carer volunteered for programme to help with stress.	Provides information on one section of the population of interest only.
<b>Rait et al. 2005 [30] (UK)</b>		
1. Is the study design appropriate for the research question?	Specific to the study research question.	Findings of interest to the review are not the prime focus of the study.
2. Is the sampling frame appropriate?	Cross sectional survey as part of a randomised control trial of general practice registered patients aged over 75. 106 UK practices of the Medical Research Council general practice framework stratified by UK tertiles of Jarman scores and standardised mortality rates.	Low risk of bias.
3. Is the sample size adequate?	14,621	Large sample size so low risk of bias.

<i>Validity of study methods [22]</i>	<i>From the study</i>	<i>Comment</i>
4. Are objective, suitable and standard criteria used for measurement of the health outcome?	Cognitive impairment determined by MMSE [36] <23/24. Study developed question of UI once a week or more often. <sup>30</sup>	Validated tool. Study developed question
5. Is the health outcome measured in an unbiased fashion?	Self report to research practice nurse.	Risk of underreporting.
6. Is the response rate adequate? Are the 'refusers' described?	All participants offered detailed assessment (n=20934) and nurse administered MMSE [36] to 15051 =71.9%. No further details.	Low risk of bias
<b>Interpretation of the results</b>		
7. Are the estimates of prevalence or incidence given with confidence intervals and in detail by subgroup, if appropriate?	Odds ratios with confidence intervals given.	Low risk of bias
<b>Applicability of the results?</b>		
8. Are the study subjects and the setting described in detail and similar to those of interest to you?	Community dwelling population aged over 75, registered with general practices across the UK and stratified by socio-economic and standardised mortality rates.	Setting and population of interest to the review.
<b>Teri et al [31] 1989 (USA)</b>		
1. Is the study design appropriate for the research question?	Specific to the study research question.	Findings of interest to the review are not the prime focus of the study.
2. Is the sampling frame appropriate?	Patients with diagnosis of an Alzheimer's type dementia attending a Geriatric Clinic selected from case notes as meeting criteria of diagnosis, age between 55-85 and community residing for the study.	High risk of bias.
3. Is the sample size adequate?	56	Sample size smaller than that suggested for prevalence of incontinence so high risk of bias.
4. Are objective, suitable and standard criteria used for measurement of the health outcome?	Clinical diagnosis of Alzheimer's type dementia. No tool specified.	Objective. No tool specified.
5. Is the health outcome measured in an unbiased fashion?	UI and FI determined by report by care givers to trained interviewer.	High risk of under reporting
6. Is the response rate adequate? Are the 'refusers' described?	Not given.	Not given.
<b>Interpretation of the results</b>		
7. Are the estimates of prevalence or incidence given with confidence intervals and in detail by subgroup, if appropriate?	No confidence intervals given.	
<b>Applicability of the results?</b>		
8. Are the study subjects and the setting described in detail and similar to those of interest to you?	Community dwelling with a diagnosis of dementia.	Setting and subjects similar to those of interest.

**Table IV Prevalence of UI & FI with cognitive impairment or dementia in community dwelling people**

<b>Prevalence of UI &amp; FI among people with identified cognitive impairment / dementia</b>					
	<i>UI (unspecified frequency)</i>	<i>UI (1 a day or more)</i>	<i>UI (1 a week or more)</i>	<i>UI (night only)</i>	<i>FI</i>
<b>Chung [24]</b>	-		-	21% of 197	18% of 197
<b>Meaney et al.[26]</b>	34% of 82		-	34% of 82	27% of 82
<b>Ouslander et al. [29]</b>		24% of 184	11% of 184		
<b>Rait et al.[30]</b>			8.8% of 2,465 Relative risk of UI in people with MMSE<24 compared to MMSE≥24 2.03 (95% CI 1.73-2.36)		
<b>Teri et al.[31]</b>			11% of 56		7% of 56
<b>Prevalence of UI &amp; FI and cognitive impairment / dementia In a population receiving home care</b>					
<b>Mohide et a.[27]</b>	10% of 2801				
<b>Landi et al.[25]</b>	38% of 5372 Relative risk of UI in those with a CPS 2-4 compared to CPS 0-1: 2.03 (95% CI 1.88-2.18), and in those with a CPS >4 compared to CPS 0-1: 2.97 (95% CI 2.78- 3.18)				
<b>- Prevalence of UI &amp; FI and cognitive impairment / dementia in a general population-</b>					
<b>Nakanishi et al.[28]</b>	1.1%.of 1405				0.9% of 1405

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