Lange, E. de, Verhaak, P.F.M., Meer, K. van der. Prevalence, presentation and prognosis of delirium in older people in the population, at home and in long term care: a review. International Journal of Geriatric Psychiatry: 2013, 28(2), 127-134

Prevalence, presentation and prognosis of delirium in older people in the population, at home and in long term care: a review

E. DE LANGE [1,*], P. F. M. VERHAAK [2,3], K. VAN DER MEER [2]

[1] Academische huisartsenpraktijk Groningen, University Medical Center Groningen, Hanzeplein 1, Postbus 880, 9700 AW Groningen, The Netherlands
[2] Department of General Practice, University Medical Center Groningen, University of Groningen, Antonius Deusinglaan 1, 9713 AV Groningen, The Netherlands
[3] NIVEL, The Netherlands Institute for Health Services Research, Utrecht, The Netherlands
Correspondence to: E. de Lange, Msc, E-mail: e.de.lange@ahg.umcg.nl

ABSTRACT

Objective: The aim of this study is to provide an overview of prevalence, symptoms, risk factors and prognosis of delirium in primary care and institutionalized long-term care.

Design: The method used in this study is a systematic PubMed search and literature review.

Results: The prevalence of delirium in the population among the elderly aged 65+ years is 1–2%. Prevalence rises with age: 10% among a "general" population aged 85+ years. Prevalence rises up to 22% in populations with higher percentages of demented elder. In long-term care, prevalence ranges between 1.4% and 70%, depending on diagnostic criteria and on the prevalence of dementia. There is a significant increase of the risk of delirium with age and cognitive decline in all groups. Concerning prognosis, most studies agree that older people who previously experienced delirium have a higher risk of dementia and a higher mortality rate. Population and long-term care studies show the same tendency.

Conclusions: Delirium in a non-selected population aged 65+ years is uncommon. However, prevalence rises very quickly in selected older groups. Primary care doctors should be aware of a relatively high risk of delirium among the elderly in long-term care, those older than 85 years and those with dementia.

INTRODUCTION

Delirium is quite a common syndrome in hospitals, especially in intensive-care units and on post-operative wards. It affects 14–56% of all elderly hospitalized patients (Fong et al., 2009). Delirium is also frequently encountered in terminal, palliative care. In the general population, delirium is probably uncommon (1–2%) (Fong et al., 2009).

Most authors of literature about delirium emphasize the problem of poor identification of delirium by hospital doctors. Delirium with hypoactive symptoms rather than psychomotor agitation is particularly prone to being missed because of the seemingly non-alarming symptoms (Lyons, 2006). Several studies have found a strong association between delirium and poor prognosis. Delirium predisposes patients for cognitive deterioration, higher mortality, hospitalization and institutionalization (Laurila et al., 2004; van der Mast et al., 2004; Lyons, 2006; Fong et al., 2009).

General practitioners (GPs) do not report delirium very often. Data from the Australian “BEACH” (Charles et al., 2006) program only show 0.03% organic psychosis in older patients aged 65+ years over 3 years. The “Dutch Second National Study on Morbidity and Interventions in General Practice”(van der Linden et al., 2004) reports a respective prevalence of 0.09% (age range 65–74 years) and 0.54% (75+ years) GP contacts concerning organic psychosis. A Greek study (Lixouriotis and Peritogiannis, 2011) found 1.1% delirium retrospectively in all primary care contacts (all ages); this amounts to 0.18% on a population basis. These low frequencies could be a result of the extramural rarity of the condition. Considering the high chance of missing delirium in a hospital (76% in a hospital emergency ward) (Han et al., 2009), the real prevalence in primary care is probably higher than the 0.03–0.54% observed.

The combination of poor prognosis, the high chance of missing delirium symptoms and the very low prevalence reported in general practice make it important to learn more about the “true” prevalence, presentation and prognosis of delirium in the population of elderly at home or in long-term care (LTC).

We are interested in delirium from a GP's point of view. Recently, there have been increasing numbers of studies published on delirium in the hospital. Few has been published about delirium in the older population at home or in LTC. In several countries, GPs are responsible for the elderly in LTC. We believe that knowing more about delirium in the general older population and in LTC is important because of the aforementioned high risk of missing a treatable disease and missing a diagnosis with a poor prognosis. We carried out a literature review on delirium in the general older population, including LTC. The research question was what is known about the prevalence, presentation, risk factors and prognosis of delirium in older people in the general population and in LTC?

We expected to find higher prevalences when screening a population than the prevalences from GPs' reports. We expected higher prevalences in LTC than in the elderly living at home. We expected a less explicit presentation due to the lower severity in the somatic illnesses causing delirium and a more protracted and less acute course in chronic disease (Lindesay et al., 1990). We expected similar (at home or in LTC) risk factors and poor prognosis in terms of cognitive deterioration, mortality, risk of hospitalization and institutionalization.

METHODS

Publications on the subject were retrieved from PubMed up to 1 February 2011. We collected all the publications matching the following search criteria: [delirium or confusion] and [community-dwelling or extramural or GPs or general practice or nursing home or LTC facility or housing for the elderly or assisted living facilities or homes for the aged or primary health care or family practice or ambulatory care or outpatients] and aged (mesh). We found 1089 articles.
Two of the authors (EL and PV) selected studies from this list after reading their titles and summaries. Publications were included when they met the following criteria: age 65+ years and concerning delirium in a primary care environment, the general population or in LTC. Publications were excluded if the research was carried out in a hospital. Publications about oncology and palliative/terminal care were also excluded because they concern a very specific group of patients with end-of-life-related delirium, specific medication-related delirium and specific prognoses. Twenty-two articles were selected. After this selection, the first author read all the articles and added two articles found by screening the literature lists. Two authors (EL and PV) then assessed the quality of the papers, using the “SUMARI” checklist. This checklist assesses the validity of descriptive and correlational studies (see Appendix 1). Each study was given a “score” on each of the 12 checklist items. The authors agreed on the scores by discussion. During this process, three articles were excluded because they did not discuss delirium or concerned a highly selected part of the population. The results were recorded in tables 1 and 2 describing the number of studied patients, aspects of the studied population (percentage demented elderly, home/population/LTC), age, prevalence of delirium (point or period prevalence), diagnostic instruments and study design (retrospective/prospective and SUMARI score). Finally all studies were described in the Section on Results, seeking similarities and differences in prevalences of delirium, presentation, risk factors and prognosis, taking into account the differences between the aspects of the studied population, the age group, the study design, diagnostic instruments used and the height of the SUMARI score.

RESULTS

Eight studies were selected which were on population or non-institutionalized groups. Some of those studies compared people at home with those in LTC and in hospital care. One of these studies is also listed in the LTC table. Fourteen LTC studies were selected.

[TABLE 1 -2]

RESULTS REGARDING PREVALENCE, PRESENTATION, RISK FACTORS AND PROGNOSIS

Prevalence in population

The prevalence reported in studies of the general population aged 65+ years varied from 0.5% to 34.5%. Low prevalences were found in studies that excluded those suffering from dementia. Higher age (75+ and 85+ years) corresponds with higher risk of delirium. A longer observation period expectedly produced higher prevalences. Nevertheless, Fick et al. (2005) searched the database of a large insurance company during 3 years and found only 2.3% delirium, probably because

these were retrospectively traced diagnoses. They found most delirium diagnosed at hospitals (36%) and emergency room (30%). Approximately 15% was diagnosed during office visits, only 1% at home and 2.2% at skilled nursing homes.

Prevalence in long-term care

Prevalence in LTC ranged between 1.4% and 70.3%. On average, the prevalences were much higher in an institutionalized population compared with the “at home” or partly institutionalized general population. Lower percentages were found when stricter delirium criteria were used (full delirium) or strict exclusion criteria were applied (such as severe dementia, not able to write). Very high percentages were found in populations with dementia.

Laurila et al. (2003) compared different diagnostic criteria (ICD-10, DSM-II, DSM-III-R and DSM-IV) and found a wide range of prevalence, from 10.1% to 24.9%. McCusker et al. (2011) measured an initial prevalence of 3.4% among moderately demented older patients, but at 6 months follow up after doing a confusion assessment method (CAM) every week, they found a 33.3% incidence of delirium. None of the studies investigated the relationship between delirium subtypes and the prevalence.

Presentation in population

None of the studies mentioned specific presentation of delirium in primary care or population settings.

Presentation in LTC

No study specifically considered the presentation of delirium in LTC, although some mentioned a few aspects. Cacchione et al. (2003a) found in their cross-sectional study of 29 acutely confused LTC patients, 31% hyperactive-type confusion, 28% hypoactive type and the others mixed or no specific type. Arinzon et al. (2011) found34% hypoactive delirium, 24% hyperactive delirium and 42% mixed-type delirium. Those types are also described in hospital studies.

Mentes et al. (1999) found the following symptoms in nursing home patients: less alert/easily distracted, changing awareness of the environment, episodes of incoherent speech, periods of motor restlessness/lethargy and variable cognitive ability. Perhaps “rejection of care” is a presentation of delirium that has not yet been recognized. Ishii found 34.5% delirium in a group of patients who presented “rejection of care”.

Risk factors in population

Von Gunten and Mosimann (2010) found a relationship between a higher NHCAM score (a validated nursing home CAM) among newly admitted Swiss nursing home patients and baseline characteristics such as greater dependency, lower cognitive functioning, depression, urine incontinence and recently added medication. This study was cross-sectional, so no cause-and-effect relation can be established. Andrew et al. (2006) found relatively more cases of urine incontinence among delirious patients, Mentes et al. (1999) observed a significant relationship with dementia, inadequate fluid intake in the preceding 3 days and falls in the preceding 30 days. Rahkonen et al. (2001) found a relationship between two baseline parameters—MMSE score <24 and systolic blood pressure >160—and the development of delirium over 3 years among older people aged 85+ years in a Finnish population. Living in an institution was of no influence.

Fick et al. (2005) observed a higher incidence of treatment for cardiovascular disease, urinary tract infection, dehydration and pneumonia in the month preceding the delirium diagnosis. These factors seem to be possible causes, not risk factors for delirium. The reliability and validity of this study is not clear.
Eriksson et al. (2010) found in a multivariate regression model that delirium was significantly associated with Alzheimer's disease, multi-infarct dementia, depression and heart failure as predisposing factors and with urinary tract infection as precipitating factor. White et al. (2004) compared patients aged 75+ years presenting at an emergency ward: those who presented with delirium ("community acquired") were more often demented and living in a care institution than those who developed delirium after 48 h in the hospital. This suggests that there is a group of relatively healthy patients who develop delirium as a result of hospitalization and that those who develop delirium at home are a more vulnerable group. Lerner et al. (1997) put forward the causes of delirium in their group of Alzheimer's patients. They mainly found urinary tract infections (28%), stress (death of a spouse, change of residence or severe pain), surgery, medical illness and medication as the causes of delirium onset.

Risk factors in LTC

Cacchione et al. (2003a) found factors associated with acute confusion, such as having a pulmonary disorder, abnormal potassium or sodium levels in serum and hearing deficit. The study does not differentiate between factors as pulmonary disorder and hearing deficit, which seem more predisposing factors and abnormal potassium or sodium levels that could be precipitating factors. Notably, many factors from the Neelon and Champaigne's (NEECHAM) list (Neelon et al., 1996) were not significantly related to acute confusion, such as lack of orienting devices, vision deficit, age, gender and cognitive impairment.
Voyer et al. (2009a, 2009b, 2010) discovered a major role for predisposing risk factors in increasing the risk of developing delirium in the elderly with dementia. They viewed delirium as a multifactorial entity, strongly predisposed by age, severity of dementia, functional autonomy deficits, dehydration, pain and depression, fever, behavioral disturbances and number of medications. Precipitating factors mentioned were physical restraint use, under-stimulation, physical environment (familiar and orienting objects in the room) and the use of high-risk drugs. Cacchione et al. (2003b) considered sensory impairment as a risk factor for acute confusion and found a significant relationship with visual impairment and dual (visual and auditory) impairment. Culp and Cacchione (2008) investigated and found a relationship with existing low body mass index (under 22) among nursing home residents and an increased risk of developing delirium. Dosa et al. (2007) observed demographic differences between delirious and non-delirious nursing home residents. The prevalence of delirium was higher in Caucasians and increased with age. It was also associated with mild to moderate cognitive impairment and oddly enough with less physical impairment. Arinzon et al. (2011) found the following as the most likely primary aetiologies for delirium in a geriatric ward/LTC setting: infection (58%; mainly pneumonia), metabolic (36%; dehydration) and drug-induced (18%).

Prognosis in population

According to Andrew et al. (2006), the prognosis of older patients with delirium was worse compared with the prognosis of older people without delirium in the same cohort. Four out of 21 people with delirium (without dementia) survived after

5 years, a figure comparable with the 5-year survival rate for severe dementia. The rest of the cohort, those without delirium, had a 5-year survival rate of 70%.
Delirium seems to predispose for dementia and vice versa. Fick's (Fick et al., 2005) database study in the US describes a group of patients with delirium superimposed on dementia. In 33% of those cases, delirium was diagnosed first and dementia later; the other 66% had the diagnoses reversed.
Rahkonen et al. (2000) found that 50% of cognitively intact elderly presenting at hospital with delirium developed dementia in the ensuing 2 years. Mortality was also significantly higher in the delirium group. Vilalta-Franch et al. (2009) calculated a relative risk of mortality of 2.65. Lerner et al. (1997) found that their group of Alzheimer's disease patients had a significant worse total “Blessed ADL score” and risk of hallucinations when they had a history of delirium compared with matched Alzheimer's disease patients without a history of delirium.

Prognosis in LTC

In their mainly demented LTC population, Arinzon et al. (2011) found only 33% complete resolution of delirium over the 3-year study period, persistence in 12% and patient death in 48%.
Ishii et al. (2010) searched for patient characteristics that could be related with rejection of care: after delusion and depression, delirium is a significant risk factor for rejection of care in LTC.
Cacchione et al. (2003a) found a significantly higher mortality rate in the 3 months after acute confusion among LTC residents. Laurila et al. (2004) found very similar prognoses for patients diagnosed according different delirium criteria. Mortality at 1 year was 31.4–41.9% and 57.8–65.1% at 2 years. Dosa et al. (2007) found that mortality rates were increased for nursing home residents who had a delirium within 90 days after hospital discharge. The risk of re-hospitalization within 30 and 90 days was also increased for those who had experienced delirium. Yang et al. (2009) found that a hypoactive form of delirium in demented patients carried with it a higher risk of death than the hyperactive forms.

DISCUSSION

We found that the prevalence of delirium in an open population aged 65+ years with no specific care and without excluding dementia ranged between 1.75% and 2.3%. The prevalences of delirium in LTC were much higher in general. Specific symptoms or signs of delirium for primary care are not found. Prognosis is unfavorable.
Prevalence in the open population is higher than the 0.03–0.44% recorded by GPs mentioned in the introduction. This difference can partly be explained by the high probability of not noticing delirium (just like in hospitals) and partly by incomplete records being kept of delirium. It is probable that GPs record cases of delirium as the somatic illness that causes it or as dementia. Another explanation for the low prevalence found in GP registration as compared with prevalences found in study setting is the big overlap of delirium with dementia and resemblance of neuropsychiatric symptoms in dementia with delirium. Distinction between delirium and dementia can be very difficult, even in a study setting (Hölttä et al., 2011)
The population studies with higher delirium prevalences were those on the population aged 85+ years, the purely demented population or a selected group of elderly receiving home medical care.

A high percentage of elderly people with dementia in LTC seemed to account for a higher prevalence of delirium. Young et al. (2011) point out that delirium and dementia are strongly interrelated.
Other differences were caused by different diagnostic criteria, “full” versus “probable” delirium and DSM-II (29%) versus CAM (70%) (Voyer et al., 2009a, 2009b). Some researchers found low percentages because they only assessed patients on 1 day—a true “point prevalence”—compared with others who screened for 28 days or searched databases over a 1–3 year period. Some studies excluded patients with severe disease, the terminally ill, the severely demented and those who could not read or write. Other studies showed that these groups are specifically at risk for developing delirium. Therefore, studies with more exclusion criteria will probably find a lower delirium prevalence. Finally, “long-term care” was not clearly defined in most studies. The definition of LTC could range from “homes for the elderly” with a minimum of medical care to “post acute care facilities” and “skilled nursing facilities” where people receive extensive medical care. This makes comparison even between LTC populations difficult. Considering the fact that hospitals are under pressure to shorten hospital stays, it is probable that more older patients will be transferred to LTC while still suffering from delirium (Lyons, 2006). On the other hand, longer hospital stays induce more delirium (Isaia et al., 2009).
Nevertheless, it seems clear that people receiving any kind of care, dementia patients and elderly aged 85+ years are significantly more at risk of developing delirium than the elderly aged 65+ years not meeting these criteria.
None of the studies mentioned specific symptoms of presentation of delirium in the population or in LTC. Tingström et al. (2010) wrote an interesting qualitative study about the non-specific signs and symptoms of infection in institutionalized older persons, as perceived by nursing assistants. Considering delirium as a non-specific sign of infection—and of other diseases—the “early” signs and symptoms found in this study could very well represent the early presentation of delirium in institutionalized elderly people. The nursing assistants used “not as usual” or “seems to be ill” to describe general signs and symptoms of discomfort related to possible infection, which included indicators as unrestrained behavior, aggressiveness, restlessness, confusion, tiredness and feebleness, eating less, pain and fever.
The risk factors for delirium noted in the studies differ. Most studies agree on a significant increase of risk of delirium with age and cognitive decline. One could debate about the “cognitive decline” as a risk factor; this could also be an early symptom of delirium. Also depression and dementia are often mentioned as risk factor, but one should be aware that symptoms delirium in elderly can strongly resemble dementia and depression.
A few studies investigated the most frequent causes/precipitating factors and primarily found infections (urinary tract and pneumonia). The studies are too inhomogeneous to produce a general conclusion. Nothing can be concluded about different risk factors at home or in LTC on the basis of these studies.
The prognosis is worse for elderly people with delirium than for those without. They have a higher risk of dementia and a higher mortality rate. Population studies and LTC studies show the same tendency.
We found a wide range of studies about delirium in the population and in primary care. This critical review provides a good survey of what has been studied so far in delirium outside hospital walls. Studies were compared using a critical SUMARI

score and diagnostic method and selection criteria were taken into account. The duration of the diagnostic process and the compilation of the study population were also compared. The limitations of this review are the relatively small number of studies considered: we did not find any recent screening studies of a primary care population, only ones of the general population or of a population in LTC. This complicates arriving at any conclusions about the number of delirium cases missed in primary care. The diversity of understandings of what is called “long-term care” in the various countries also caused us to be cautious in comparing the LTC populations too readily. We tried to describe the characteristics of the different populations and compared studies mainly on the basis of these characteristics.

CONCLUSION

Delirium in primary care has not yet been investigated extensively. GPs report data that show very low prevalences: 0.03–0.44%. Retrospective population studies find 1.75–2.3%. GPs probably therefore miss many delirium cases, just as doctors do in the hospital. Prevalence rises in older populations (10–22%), populations with dementia and in LTC (1.4–58%). The risk factors are age and cognitive decline. Prognosis after delirium shows an increased risk of dementia and a higher mortality rate. These figures indicate that GPs can probably diagnose much more delirium, depending on the population they are dealing with. This is important because of its diagnostic, treatment and prognostic implications. We conclude that there are three categories of elderly at risk of developing delirium: those living in a care facility or receiving medical care at home, the elderly with dementia and those older than 85 years.

More research is required to determine how frequently delirium is presented in primary care and how often primary care doctors miss delirium.

REFERENCES

Andrew MK, Freter SH, Rockwood K. 2006. Prevalence and outcomes of delirium in community and non-acute care settings in people without dementia: a report from the Canadian Study of Health and Aging. BMC Med 23(4): 15.

Arinzon Z, Peisakh A, Schrire S, Berner YN. 2011. Delirium in long-term care setting: indicator to severe morbidity. Arch Gerontol Geriatr 52(3): 270–5.DOI: 10.1016/j.archger.2010.04.012

Cacchione PZ, Culp K, Dyck MJ, Laing J. 2003a. Risk for acute confusion in sensoryimpaired, rural, long-term-care elders. Clin Nurs Res 12(4): 340–55.

Cacchione PZ, Culp K, Laing J, Tripp-Reimer T. 2003b. Clinical profile of acute confusion in the long-term care setting. Clin Nurs Res 12(2): 145–58.

Charles J, Miller G, Ng A. 2006. Management of psychosis in Australian general practice. Aust Fam Physician 35(3): 88–9.

Culp KR, Cacchione PZ. 2008. Nutritional status and delirium in long-term care elderly individuals. Appl Nurs Res 21(2): 66–74.

Dosa D, Intrator O, McNicoll L, Cang Y, Teno J. 2007. Preliminary derivation of a Nursing Home Confusion Assessment Method based on data from the Minimum Data Set. J Am Geriatr Soc 55(7): 1099–105.

Eriksson I, Gustafson Y, Fagerström L, Olofsson B. 2010. Urinary tract infection in very old women is associated with delirium. Int Psychogeriatr 18: 1–7.

Fick DM, Kolanowski AM, Waller JL, Inouye SK. 2005. Delirium superimposed on dementia in a community-dwelling managed care population: a 3-year retrospective study of occurrence, costs and utilization. J Gerontol A Biol Sci Med Sci 60A(6): 748–753.

Folstein MF, Bassett SS, Romanoski AJ, Nestadt G. 1991. The epidemiology of delirium in the community: the Eastern Baltimore Mental Health Survey. Int Psychogeriatr 3(2): 169–76.
Fong TG, Tlubaev SR, Inouye SK. 2009. Deliriumin elderly adults: diagnosis, prevention and treatment. Nat Rev Neurol 5(4): 201–220.
Han JH, Zimmerman EE, Cutler N, et al. 2009. Delirium in older emergency department patients: recognition, risk factors, and psychomotor subtypes. Acad Emerg Med 16(3): 193–200.
Hölttä E, Laakkonen ML, Laurila JV, et al. 2011. The overlap of delirium with neuropsychiatric symptoms among patients with dementia. Am J Geriatr Psychiatry 19(12): 1034–1041.
Isaia G, Astengo MA, Tibaldi V, et al. 2009. Delirium in elderly home-treated patients: a prospective study with 6-month follow-up. Age (Dordr) 31(2): 109–17. DOI: 10.1007/s11357–009–9086–3
Ishii S, Streim JE, Saliba D. 2010. Potentially reversible resident factors associated with rejection of care behaviors. J Am Geriatr Soc 58(9): 1693–700. DOI: 10.1111/j.1532–5415.2010.03020.x
Laurila JV, Pitkala KH, Strandberg TE, Tilvis RS. 2003. Impact of different diagnostic criteria on prevalence rates of delirium: a prospective study. Dement Geriatr Cogn Disord 16: 156–162.
Laurila JV, Pitkala KH, Strandberg TE, Tilvis RS. 2004. Impact of different diagnostic criteria on prognosis of delirium: a prospective study. Dement Geriatr Cogn Disord 18(3–4): 240–4.
Lerner AJ, Hedera P, Koss E, Stuckey J, Friedland RP. 1997. Delirium in Alzheimer disease. Alzheimer Dis Assoc Disord 11(1): 16–20.
van der Linden MW, Westert GP, de Bakker DH, Schellevis FG. 2004. Tweede nationale studie naar ziekten en verrichtingen in de huisartsenpraktijk. Klachten en aandoeningen in de bevolking en in de huisartsenpraktijk.
Lindesay J, Macdonald A, Starke I. 1990. The Neuronal Basis of Delirium. Delirium in the Elderly. Oxford University Press: Oxford; 66–79.
Lixouriotis C, Peritogiannis V. 2011. Delirium in the primary care setting. Psychiatry Clin Neurosci 65(1): 102–4. DOI: 10.1111/j.1440–1819.2010.02165.x
Lyons WL. 2006. Delirium in postacute and long-term care. J Am Med Dir Assoc 7(4): 254–61.
van der Mast RC, Huyse FJ, Droogleever Fortuijn HA, et al. 2004. Richtlijn Delirium. Uitgeverij Boom: Amsterdam.
McCusker J, Cole MG, Voyer P, et al. 2010. Use of nurse-observed symptoms of delirium in long-term care: effects on prevalence and outcomes of delirium. Int Psychogeriatr 30: 1–7.
McCusker J, Cole MG, Voyer P, et al. 2011. Prevalence and incidence of delirium in long-term care. Int J Geriatr Psychiatry. DOI: 10.1002/gps.2654
Mentes J, Culp K, Maas M, Rantz M. 1999. Acute confusion indicators: risk factors and prevalence using MDS data. Res Nurs Health 22: 95–105.
Neelon VJ, Champagne MT, Carlson JR, Funk SG. 1996.The NEECHAM Confusion Scale: construction, validation, and clinical testing. Nurs Res 45(6): 324–30.
Rahkonen T, Eloniemi-Sulkava U, Halonen P, et al. 2001. Delirium in the nondemented oldest old in the general population: risk factors and prognosis. Int J Geriatr Psychiatry 16(4): 415–21.
Rahkonen T, Luukkainen-Markkula R, Paanila S, Sivenius J, Sulkava R. 2000. Delirium episode as a sign of undetected dementia among community dwelling elderly subjects: a 2 year follow up study. J Neurol Neurosurg Psychiatry 69(4): 519–21.
Sandberg O, Gustafson Y, Brännström B, Bucht G. 1998. Prevalence of dementia, delirium and psychiatric symptoms in various care settings for the elderly. Scand J Soc Med 26(1): 56–62.
Tingström P, Milberg A, Sund-Levander M. 2010. Early nonspecific signs and symptoms of infection in institutionalized elderly persons: perceptions of nursing assistants. Scand J Caring Sci 24(1): 24–31.
Vilalta-Franch J, Llinàs-Reglà J, López-Pousa S, Garre-Olmo J. 2009. Prevalence and evolution of delirium in a community population of 70 years and older. Actas Esp Psiquiatr 37(1): 27–33.

Von Gunten A, Mosimann UP. 2010. Delirium upon admission to Swiss nursing homes: a cross-sectional study. Swiss Med Wkly 140(25–26): 376–81.
Voyer P, Richard S, Doucet L, Carmichael PH. 2009a. Detecting delirium and subsyndromal delirium using different diagnostic criteria among demented long-term care residents. J AmMed Dir Ass 10(3): 181–8.
Voyer P, Richard S, Doucet L, Carmichael PH. 2009b. Predisposing factors associated with delirium among demented long-term care residents. Clin Nurs Res 18(2): 153–71.
Voyer P, Richard S, Doucet L, Cyr N, Carmichael PH. 2010. Examination of the multifactorial model of delirium among long-term care residents with dementia. Geriatr Nurs 31(2): 105–14.
White S, O'Mahony MS, Bayer AJ. 2004. Delirium in emergency medical admission: community versus hospital acquired. Age Ageing 33: 16.
Yang FM, Marcantonio ER, Inouye SK, et al. 2009.Phenomenological subtypes of delirium in older persons: patterns, prevalence, and prognosis. Psychosomatics 50(3): 248–54.
Young J, Meagher D, Maclullich A. 2011. Cognitive assessment of older people. BMJ 7(343): d5042. DOI: 10.1136/bmj.d5042

TABLES

Table 1 Population-based studies: aspects of study population, prevalence of delirium and SUMARI score

	Authors	*N*	Study population	Age (years)	Prevalence of delirium (%)	Diagnostic instruments	Study-design	SUMARI
1	Andrew *et al.*, 2006 Canada	10263	Population, 50% in LTC, 50% living at home, no dementia	65+	<0.5	OBS DSM-III-R	C Po-p	10/12
2	Rahkonen *et al.*, 2001 Finland	199	Population, no dementia	85+	10	DSM-III-R, MMSE, patient history + medical chart	R Pe-p; 3 years	10/12
3	Vilalta-Franch *et al.*, 2009 Spain	1460	Population, 10% dementia	70+	0.96	CAMDEX protocol, DSM-IV	C Po-p	10/12
4	Lerner *et al.*, 1997 USA	199	Population, 100% dementia, non-institutional-ized	Average 76	22	DSM-III-R history interview of direct caregiver	R Pe-p; during AD diagnoses	10/12
5	Sandberg *et al.*, 1998 Sweden	717	Home medical care, 12% dementia	75+	34.5	OBS DSM-III-R	C Po-p	8/12
6	Fick *et al.*, 2005 USA	76688	Home, emergency room, hospital, nursing home, 10% dementia	65+	2.3	Diagnosis from insurance claims, ICD-coding discharge letters.	R Pe-p; 3 years	8/12
7	Folstein *et al.*, 1991 USA	228	Mental Health survey, no dementia	65+	1.75	DSM-III	C, Po-p	7/12
8	Eriksson *et al.*, 2010 Sweden	504	Women at home or institutionalized, 46,4% dementia	85+	27.2	OBS	P, Pe-p; 1 month	10/12

AD = Alzheimer's disease; LTC = long-term care; OBS = Organic Brain Syndrome Scale; DSM-III-R = Diagnostic and Statistical Manual of Mental Disorders, Third Edition, Revised; DSM-IV = Diagnostic and Statistic Manual of Mental Disorders, Fourth Edition; MMSE = Mini Mental State Examination; ICD = International Classification of Diseases; P = prospective; R = retrospective; Pe-p = period prevalence; Po-p = point prevalence; C = cross-sectional.

Lange, E. de, Verhaak, P.F.M., Meer, K. van der. Prevalence, presentation and prognosis of delirium in older people in the population, at home and in long term care: a review. International Journal of Geriatric Psychiatry: 2013, 28(2), 127-134

Table 2 Long-term care based studies: aspects of study population, prevalence of delirium and SUMARI score

	Authors	N	Study population	Age (years)	Prevalence of delirium (%)	Diagnostic instruments	Study design	SUMARI
1	Sandberg *et al*., 1998 Sweden	717	Older people's homes (28% dementia), nursing homes (66% dementia)	75+	35.2 and 58	OBS DSM-III-R	C, Po-p	8/12
2	Mentes *et al*., 1999 USA	2318	LTC, 44.3% demented	Average 83	14	MDS, probable delirium on five items	R, pe-p 1 year	12/12
3	Arinzon *et al*., 2011 Israel	322	LTC, geriatric wards, 90% demented	65+	34	CAM, DRS	C Po-p	10/12
4	Ishii *et al*., 2010 USA	2330	LTC, 52% "severe cognitive impairment"	Average 80	14.3	CAM	C Po-p	10/12
5	Cacchione *et al*., 2003a USA	74	Partly demented population	65+	39	DSM-IV	C Po-p	10/12
6	Voyer *et al*., 2009a, 2009b Canada	155	Demented, LTC	65+	70.3	CAM, DSM-III-R	C Po-p	7/12
7	Voyer *et al*., 2010 Canada	155	Demented, LTC	65+ (average 86.3)	70.3: 45.8 (definite delirium); 24.5 (probable delirium)	CAM, DSM-III-R	R, Po-p	11/12
8	Cacchione *et al*., 2003b USA	114	Skilled or intermediate care facilities.	65+ (average 87.3)	17.5	CAM	P Pe-p 28 days	10/12
9	Laurila *et al*., 2003 Finland	425	Partly at a geriatric hospital ward (230/425), partly at a nursing home (195/425), 66% demented	70+ (average 88.4)	10–24.9 (depending on diagnostic method)	MMSE, CDR, DSM-II, DSM-III-R, DSM-IV and ICD-10	C Po-p	10/12
10	McCusker *et al*., 2010 Canada	235	Nursing home, 33.3% severely, 68.2% moderately cognitively impaired	65+	6.8 (definite delirium); 24.7 (probable delirium)	CAM	C Po-p	9/12
11	Culp and Cacchione, 2008 USA	312	Skilled or intermediate care facilities, 27% severely, 22% moderately cognitively impaired	65+ (average 88.5	21.8	CAM, NEECHAM Confusion Scale, decline of MMSE, daily "Vigilance A"	P Pe-p; 28 d	12/12
12	Dosa *et al*., 2007 USA	35721	Long-term care, "custodial care", 20% severely, 40% moderately cognitively impaired	65+	1.4 (full delirium); 31.8 (subsyndromal)	NHCAM, MDS	R Pe-p; 90 days	9/12
13	Yang *et al*., 2009 USA	441	Skilled nursing facility, post-acute care, 37.6% with dementia	65+ (average 84.1)	10	MDAS, CAM	C Po-p	10/12
14	McCusker *et al*., 2011 Canada	279	Long-term care group, high percentage dementia	65+	33.3	CAM	P pe-p; 6 months	10/12
15	Von Gunten and Mosimann, 2010 Switzerland	12000	Nursing homes/homes for the elderly	65+	6.5 (full delirium); 40% (subsyndromal)	NHCAM	P Pe-p; 2 weeks	10/12

CAM = Confusion Assessment Method; NHCAM = Nursing Home Confusion Assessment Method; DRS = Delirium Rating Scale; MDS = minimum data set; NEECHAM = Neelon and Champaigne's; MDAS = Memorial Delirium Assessment Scale; Pe-p = period prevalence; Po-p = point prevalence; P = prospective; R = retrospective; C = cross-sectional.

Appendix

SUMARI package validity checklist for assessing the validity of descriptive/correlational studies

Reviewer:	Date:			
Author:	Year:			
Observational Studies	Yes	No	Unclear	N.a.

Is the study based on a random or pseudo-random sample?

Is the sample of adequate size and representative of the population? The population is

.....

Are the criteria for inclusion in the sample clearly defined?

Were hypotheses linked to explicit theoretical framework?

Did measures have acceptable reliability? Instruments were .....

Did measures have acceptable validity? Instruments were .....

If comparisons are being made, was there sufficient description of groups?

Was an appropriate statistical analysis used?

Were the findings statistically or clinically significant?

Were findings linked to theoretical framework?

Are the findings generalisable?

Total

Reviewers Comments:

From: The JBI-Meta Analysis of statistics assessment and Review instrument (JBI-MAStARI), The Joanna Briggs Institute, Adelaide, 2003.