

The likelihood of hospital-acquired complications in older people with dementia: a matched cohort study

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The known: People with dementia may be especially susceptible to hospital-acquired complications, but specific risks have not been well quantified.

The new: In 11 393 matched pairs of people aged 60 years or more with or without dementia admitted to five South Western Sydney hospitals during January 2010 – December 2020, dementia was associated with higher risks of falls, pressure injury, delirium, and pneumonia, but not of venous thromboembolism, malnutrition, or incontinence.

The implications: Our findings can inform patients with dementia and their carers about their risk of hospital-acquired complications, and underscore the need for measures to reduce this risk. Targeted models of patient-centred care could improve outcomes for hospital patients with dementia.

In 2013, 841 million people were older than 60 years; this number is likely to reach two billion by 2050.¹ Increased longevity may be welcome, but it is not without negative consequences, among the most problematic being the increased number of older adults living with cognitive disorders.² Dementia has been described as one of the greatest global challenges for health and social care in the 21st century.²

An acute hospitalisation can be harmful for a person with dementia,^{3,4} but the risk is not always well quantified. Clinical variation among hospitalised patients is often reported, including by the Australian Commission on Safety and Quality in Healthcare,⁵ as the incidence of hospital-acquired complications, including falls, pressure injuries, delirium, thromboembolism, malnutrition, and death. People with dementia may be at greater risk than other people of such events.^{6,7} We therefore investigated whether the risk for older people of hospital-acquired complications in Australia differs by whether they were living with dementia.

Methods

We undertook a matched cohort study to compare the risk of hospital-acquired complications for older people with dementia with the risk for people without dementia at the time of hospital admission. We included all admissions of women and men aged 60 years or older (to maximise inclusiveness) to five public hospitals in the South Western Sydney Local Health District (Liverpool, Bankstown–Lidcombe, Campbelltown, Fairfield, and Bowral and District Hospitals), New South Wales, during 1 January 2010 – 31 December 2020.

Patient and admission characteristics

Patient and hospital episode characteristics were obtained from coded separation data for the index admission. People with dementia were identified by International Classification of

Abstract

Objectives: To investigate whether the likelihood of hospital-acquired complications for older people in Australia differs by whether they have dementia.

Study design: Matched cohort study.

Setting, participants: People aged 60 years or older with dementia who were admitted to five public hospitals in the South Western Sydney Local Health District, New South Wales, 1 January 2010 to 31 December 2020, and people without dementia admitted during the same period, matched by age, sex, number of medical conditions, and presence of selected specific medical conditions, emergency admission status, history of falls, and admission from a nursing home.

Main outcome measures: Hospital-acquired complications (falls, pressure injuries, delirium, pneumonia, venous thromboembolism, new incontinence, malnutrition, in-hospital death), by dementia status.

Results: A total of 217 459 people aged 60 years or older were admitted to the five hospitals during the study period. The mean age of the 11 393 patients with dementia (83 years; standard deviation [SD], 7.5 years) was higher than that of the 206 065 patients without dementia (73 years; SD, 8.9 years), and the proportion of women slightly larger (55% v 50%). Median hospital length of stay was longer for people with dementia (nine days; interquartile range [IQR], 4–19 days) than for people without dementia (three days; IQR, 1–9 days), and the number of in-hospital deaths higher (768, 7% v 584, 5%). After propensity score-based matching, the risks of falls (odds ratio [OR], 4.7; 95% confidence interval [CI], 3.8–5.7), pressure injury (OR, 1.4; 95% CI, 1.1–1.8), delirium (OR, 2.4; 95% CI, 2.0–3.0), and pneumonia (OR, 1.3; 95% CI, 1.01–1.7) were higher for people with dementia than for those without dementia; differences between the two groups in the risks of venous thromboembolism, malnutrition, and incontinence were not statistically significant.

Conclusions: Given the greater risk of many hospital-acquired complications for people with dementia, targeted models of person-centred care are needed to ensure the best outcomes for these patients.

Diseases, tenth revision, Australian modification (ICD-10-AM) codes F00 to F03. Medical conditions (onset coded as prior to the hospitalisation) were identified by ICD-10-AM codes and classified using the Charlson Comorbidity Index⁸ (further details: [Supporting Information](#), part 1).⁹ All data were obtained in de-identified form from the Clinical Health Information Exchange. (<https://www.ehealth.nsw.gov.au/solutions/clinical-care/information-exchanges/chie>).

Outcomes of interest

The outcomes of interest were the following hospital-acquired complications: falls, pressure injuries, delirium, pneumonia, venous thromboembolism, incontinence, malnutrition, and

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in-hospital death. These complications are routinely identified and coded according to national hospital coding standards (Supporting Information, part 2). In-hospital complications were defined as those that developed during the hospitalisation (incident events) and not present at the time of admission.

Statistical analysis

The characteristics of patients and hospital admissions are summarised as descriptive statistics, and the rates of adverse events are reported as incidence rates with 95% confidence intervals (CIs). Relationships between dementia status and the risks of hospital-acquired complications were assessed in conditional logistic regression models; we report odd ratios (ORs) with 95% CIs. To control for differences between patients with and without dementia on admission that could influence the risk of hospital-acquired complications, each person with dementia was matched with one who did not have dementia by using a propensity score (logit model with nearest neighbour approach).^{10,11} Potentially matching variables were chosen by stepwise selection (forward and backward), based on the Akaike information criterion.¹² The final set of matching variables were age, sex, number of other medical conditions, diabetes, prior stroke, congestive heart failure, prior acute myocardial infarction, pulmonary disease, history of malignancy, emergency admission status, history of falls, and admission from a nursing home. The balance of covariates before and after matching was

assessed by inspecting the mean differences in proportions for categorical variables and the standardised mean differences for continuous variables. An absolute mean difference close to zero indicates good balance; absolute values less than 0.1, and less than 0.05 for potentially important predictive variables, are recommended.¹¹ Data management was undertaken in SAS 9.4; statistical analyses were performed in R 4.3.1 (R Foundation for Statistical Computing).

Ethics approval

This project was reviewed by the South Western Sydney Local Health District Human Research Ethics Committee, and was determined to meet the requirements of the National Statement on Ethical Conduct in Human Research.¹³ The requirement for individual patient consent was waived for our analysis of routinely collected hospital separations data (2021/ETH11883).

Results

A total of 217 459 people aged 60 years or older were admitted to the five public hospitals during 2010–2020; one patient with dementia was omitted from our analyses and matching because the length of their hospital stay was unknown. The mean age of the 217 458 included patients was 73 years (standard deviation [SD], 9.1 years), 109 313 were women (50%), and 135 180 had unplanned emergency admissions (62%). The mean age of the patients with dementia — 83 years (standard deviation [SD], 7.5 years) — was higher than that of all patients without dementia (ie, prior to matching) — 73 years (SD, 8.9 years), and the proportion of women was slightly larger (6233 of 11 393, 55% *v* 103 079 of 206 065, 50%). The proportion of patients with dementia who had two or more other medical conditions was larger than for the control group (2343 of 11 393, 21% *v* 7807 of 206 065, 4%); the proportions with diabetes, history of falls, and emergency admissions status were each larger (Box 1).

A propensity score-matched control patient could be identified for each of the 11 393 people with dementia for whom complete data were available. After matching, the mean difference between patients with and without dementia was less than 0.05 units for each matching variable (Supporting Information, figure 1). The median hospital length of stay was longer for people with dementia (nine days; interquartile range [IQR], 4–19 days) than for matched control patients without dementia (three days; IQR, 1–9 days), and the number of in-hospital deaths higher (768, 7% *v* 584, 5%) (Box 1).

The risks of falls (OR, 4.7; 95% CI, 3.8–5.7), pressure injury (OR, 1.4; 95% CI, 1.1–1.8), delirium (OR, 2.4; 95% CI, 2.0–3.0), and pneumonia (OR, 1.3; 95% CI, 1.01–1.7) were higher for people with dementia than for matched patients without dementia. The differences between the two groups in the risks of venous thromboembolism, malnutrition, and incontinence were not statistically significant (Box 2).

1 Characteristics of people aged 60 years or older admitted to five South Western Sydney Local Health District hospitals and of their index admissions, 2010–2020

Characteristic	Patients with dementia*	Patients without dementia	
		All patients	Propensity score-matched control patients
Number of people	11 393	206 065	11 393
Age (years), mean (SD)	83 (7.5)	73 (8.9)	83 (7.9)
Sex (women)	6233 (55%)	103 079 (50%)	6175 (54%)
Other medical conditions: number			
0 or 1	9050 (79%)	198 258 (96%)	9374 (82%)
2	1509 (13%)	5734 (3%)	1390 (12%)
3 to 8	834 (7%)	2073 (1%)	629 (6%)
Other medical conditions: type			
Diabetes	2023 (18%)	28 810 (14%)	2084 (18%)
Prior stroke	888 (8%)	9091 (4%)	887 (8%)
Congestive heart failure	925 (8%)	8389 (4%)	951 (8%)
Myocardial infarction	315 (3%)	7862 (4%)	304 (3%)
Pulmonary disease	620 (5%)	8494 (4%)	606 (5%)
History of cancer	382 (3%)	14 010 (7%)	382 (3%)
History of falls	2736 (24%)	19 187 (9%)	2775 (24%)
Emergency admission	10 627 (93%)	124 552 (60%)	10 706 (94%)
Admitted from nursing home	47 (<1%)	83 (<1%)	48 (<1%)
Hospital length of stay (days), median (IQR)	9 (4–19)	1 (0–5)	3 (1–9)
In-hospital deaths	768 (7%)	4675 (2%)	584 (5%)

IQR = interquartile range; SD = standard deviation. * One patient omitted because the length of hospital stay was unknown. ♦

2 Hospital-acquired adverse events among 11393 matched pairs of people aged 60 years or more with or without dementia*

Adverse event	Events	Events per 1000 admissions (95% CI)	Odds ratio (95% CI)
Falls			
Control patients	122	10.7 (8.9–12.8)	1
Patients with dementia	542	47.6 (43.6–51.8)	4.7 (3.8–5.7)
Pressure injury			
Control patients	24	2.1 (1.4–3.1)	1
Patients with dementia	46	4.0 (3.0–5.4)	1.4 (1.1–1.8)
Delirium			
Control patients	126	11.1 (9.2–13.2)	1
Patients with dementia	304	26.7 (23.7–29.9)	2.4 (2.0–3.0)
Pneumonia			
Control patients	94	8.3 (6.7–10.1)	1
Patients with dementia	130	11.4 (9.5–13.6)	1.3 (1.01–1.7)
Venous thromboembolism			
Control patients	23	2.0 (1.3–3.0)	1
Patients with dementia	19	1.7 (1.0–2.6)	0.8 (0.4–1.5)
Incontinence			
Control patients	1	0.1 (0.0–0.5)	1
Patients with dementia	2	0.2 (0.0–0.6)	2.0 (0.2–22)
Malnutrition			
Control patients	15	1.3 (0.7–2.2)	1
Patients with dementia	19	1.7 (1.0–2.6)	1.3 (0.6–2.5)
In-hospital death			
Control patients	584	5.1 (4.7–5.6)	1
Patients with dementia	768	6.7 (6.3–7.2)	1.4 (1.2–1.5)

CI = confidence interval. * Conditional logistic regression models; groups matched for age, sex, other medical conditions, history of falls, admission from nursing, and emergency admission status. ♦

Discussion

Our analysis of hospital-acquired complications in 11393 matched pairs of people aged 60 years or more with or without dementia who were admitted to five South Western Sydney Local Health District hospitals during 2010–2020 indicated that a diagnosis of dementia was associated with higher risks of several adverse events, including falls, pressure injuries, delirium, pneumonia, and in-hospital death. Further, the median length of hospital stay was longer for people with dementia, which may contribute to or be a consequence of hospital-acquired complications.

Hospital-acquired complications are associated with poorer clinical outcomes and higher health care costs, and often also with greater risk of sequelae more than one year after discharge, with consequences for quality of life, functional outcomes, and risk of death.^{14–17} People with dementia may be especially susceptible to such outcomes for several reasons, including greater delirium risk

because of physiological brain changes, the effects of medications used by people with behavioural and psychological symptoms of dementia, dementia-unfriendly hospital environments, longer lengths of stay because of safe discharge planning, and phenomena associated with advancing cognitive impairment, such as reduced mobility, dysphagia, and incontinence.^{3,18,19} These risk factors are not always modifiable, but the hospital environment and staff factors (eg, nursing ratios, skill mix, burnout) may also play roles.^{3,20} Further, initiatives that promote person-centred care and engage carers may reduce the rate of adverse in-hospital outcomes, and also increase carer satisfaction.^{4,21}

In our study, dementia was not associated with greater risk of venous thromboembolism, malnutrition, or new incontinence as hospital-acquired adverse events in people aged 60 years or more. Some factors associated with dementia, such as restricted mobility, haemoconcentration (because of reduced oral fluid intake), and antipsychotic drug use could increase the risk of venous thromboembolism.^{22–24} On the other hand, some people with dementia remain physically active, which could reduce the risk. In many cases, venous thromboembolism is asymptomatic, particularly in older people with reduced mobility and frailty,²⁵ and someone with communication deficits may be less likely to report symptoms of venous thromboembolism. Screening of the patients in our study for this condition was not routinely undertaken.

Limitations

The large number of consecutive hospital admissions of people with dementia, comprehensive data collection, and propensity score-based matching for reducing the risk of confounding were study strengths. Further, we focused on hospital-acquired complications associated with poorer outcomes for patients that might be averted by clinical mitigation strategies. However, as our analysis was based on routinely collected hospital separations data, we relied on the documentation of dementia in clinical notes and coding by hospital clinical information coders, which may not always be accurate or complete.^{26,27} In particular, the catchment areas of the five hospitals include a high proportion of people from culturally diverse backgrounds and areas of lower socio-economic status, characteristics that have been associated with delayed diagnosis of dementia.^{28,29}

The number of hospital-acquired complications was based on hospital coding, which may not accurately reflect their incidence.⁴ Further, data for matching variables and outcomes were drawn from routinely collected hospital data; as we did not compare the completeness of these data for patients with or without dementia, we cannot exclude the possibility of residual confounding. For example, we did not include history of thromboembolism as a variable in our analysis; some patients may have been at low risk of hospital-acquired thromboembolism because they were receiving anticoagulant therapy. Our findings in five larger acute tertiary hospitals may not be generalisable to other hospitals in Australia. We did not have information about dementia severity and subtype, which may influence risk factors such as dysphagia, medication use, and mobility,^{30–32} nor about the medications used by patients.

Conclusion

Our findings are useful for informing patients with dementia and their carers about potential harm during hospitalisations.

Given the expected increase in the prevalence of dementia in Australia, the association of dementia with increased risk of hospital-acquired complications during acute admissions requires attention. Clinicians should develop targeted models of patient-centred care that ensure the best outcomes for hospital patients with dementia.

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Competing interests: No relevant disclosures.

Data sharing: The data underlying this report are stored in a local database and are not publicly available. Data could be available for sharing for specific projects with additional ethics committee approval.

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Supporting Information

Additional Supporting Information is included with the online version of this article.