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Dementia in older people admitted to hospital: a regional multi-hospital observational study of prevalence, associations and case recognition

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Abstract

Background: previous studies have indicated a prevalence of dementia in older admissions of ~42% in a single London teaching hospital, and 21% in four Queensland hospitals. However, there is a lack of published data from any European country on the prevalence of dementia across hospitals and between patient groups.

Objective: to determine the prevalence and associations of dementia in older patients admitted to acute hospitals in Ireland.

Methods: six hundred and six patients aged ≥70 years were recruited on admission to six hospitals in Cork County. Screening consisted of Standardised Mini-Mental State Examination (SMMSE); patients with scores <27/30 had further assessment

with the Informant Questionnaire on Cognitive Decline in the Elderly (IQCODE). Final expert diagnosis was based on SMMSE, IQCODE and relevant medical and demographic history. Patients were screened for delirium and depression, and assessed for co-morbidity, functional ability and nutritional status.

Results: of 598 older patients admitted to acute hospitals, 25% overall had dementia; with 29% in public hospitals. Prevalence varied between hospitals ($P < 0.001$); most common in rural hospitals and acute medical admissions. Only 35.6% of patients with dementia had a previous diagnosis. Patients with dementia were older and frailer, with higher co-morbidity, malnutrition and lower functional status ($P < 0.001$). Delirium was commonly superimposed on dementia (57%) on admission.

Conclusion: dementia is common in older people admitted to acute hospitals, particularly in acute medical admissions, and rural hospitals, where services may be less available. Most dementia is not previously diagnosed, emphasising the necessity for cognitive assessment in older people on presentation to hospital.

Keywords: dementia, cognitive impairment, acute hospital, screening, awareness, older people

Introduction

Acute hospital admissions are critical events in the life of a person with dementia. People with dementia stay longer in hospital than their peers [1] are more commonly discharged to long-term care and have higher mortality [2]. Many countries' Dementia Strategies, including England, Scotland, Northern Ireland, Norway and Australia, placed acute hospital dementia care as a key objective [1]. It is often cited that 25% of acute hospital beds are occupied by a person with dementia, extrapolated from data from a single orthopaedic ward [3], rather than any large cross-sectional study. Sampson *et al.* reported that 42% of older medical admissions to a large London teaching hospital in 2007 had dementia [4]. In 2013, Travers *et al.* reported a dementia prevalence of 21% across 493 older admissions to medical, surgical and orthopaedic wards, in four Queensland teaching hospitals [5].

There are ~48,000 people with dementia in the Republic of Ireland, estimated to triple by 2041 [6], but reliable data on dementia prevalence in Irish hospitals are lacking. It is reported that the acute hospital care of people with dementia in the Republic of Ireland costs €21 million annually [1], based on national hospital discharge datasets using Hospital In-Patient Enquiry (HIPE) data. This only includes diagnosed dementia cases, relying entirely on documentation in hospital case notes. As only 20–50% of patients with research-identified dementia in hospital-based studies had a known diagnosis [7], there is a pressing need for robust data to capture the true prevalence of dementia in acute hospitals [1]. To address this, we prospectively studied all older people admitted to six hospitals, investigating differences in dementia prevalence between hospital types, acute and elective admissions, and admitting specialities; and identifying predictors and associations of dementia.

Methods

This study took place in Cork county, South-West Ireland; population 519,000 [8]. The county has five public hospitals: two rural (72 and 118 beds) and three urban (258–611 beds), and one private (343 beds, urban). All elective and emergency admissions to the six hospitals, aged ≥ 70 years were

eligible for the study. Admissions were identified daily from hospital admission lists, supplemented by Emergency Department lists and a 'walk around' of wards. Patients were screened within 36 h of admission. Two week's recruitment occurred in each hospital, capturing each day of the week twice, spread over a 6-week period to allow sufficient time for detailed longitudinal data collection. Recruitment occurred between May 2012 and February 2013. Data collection at the largest hospital was split between summer and winter to capture seasonal variations. The following patients were excluded: day-case admissions; those refusing to take part; those moribund on admission. Patients with reduced consciousness or aphasia, even severe, were included, and directly observed, with historical and collateral information used to assign diagnosis, where possible.

Three data collectors from nursing and psychology backgrounds received extensive training in the assessment tools, including simulated and directly observed patient interactions, with refresher training mid-study. Dementia diagnosis involved three steps. First, cognition was assessed using the Standardised Mini-Mental State Examination (SMMSE) [9]. A hearing amplifier and large print versions were available. If items were impossible (e.g. blindness, dominant hand paresis etc.), the SMMSE score was divided by the number of items possible and the numerator multiplied by 30, giving an adjusted SMMSE score. Unless the patient had subjective memory impairment (screened by a single yes/no question), any patient scoring $\geq 27/30$ was taken to not have dementia.

For patients scoring $< 27/30$, a relative/carer was interviewed using the validated Informant Questionnaire on Cognitive Decline in the Elderly (IQCODE) [10]. This 16-item tool assesses cognitive decline over a 10-year period from informant reports. Each item is rated from 1—'much improved' to 5—'much worse'. Averaged overall scores of ≥ 3.5 indicate possible dementia [10, 11]. Relatives/carers were specifically questioned about any formal dementia diagnosis, details of the temporal course and features of cognitive decline, and other relevant history such as stroke, falls or hallucinations. The patient's neurological examination as documented in the case notes, and details/dates of cerebrovascular events and cerebral imaging, were recorded. Medical

case notes were reviewed, particularly the medication list, general practitioner's (GP) referral letter, initial admission documentation, all medical/nursing chart entries up to the point of screening and clinic/discharge letters over the preceding 5 years. If there was no mention of dementia or 'cognitive impairment' in these sources, or dementia medications, the patient was taken to not have a known diagnosis. Dementia status was established by the senior author (S.T.), using the Diagnostic and Statistical Manual of Mental Disorders, 4th Edition criteria [12] and all available information (cognitive testing, IQCODE, other cognition-relevant history, mental health diagnoses, sensory impairments and other relevant factors). In difficult to assign cases, all information was reviewed by an expert panel (geriatrician with special interest in dementia, Old Age Psychiatrist, psychiatrist with special interest in delirium). If expert panel consensus could not be reached, the case was excluded. Where possible, dementia type was determined using standard criteria (Supplementary data, Appendix 1, available in *Age and Ageing* online). Dementia severity was scored using the Clinical Dementia Rating (CDR) 'sum of boxes' method [13], with mild dementia scoring 4.5–9.0, moderate 9.5–15.5 and severe 16–18. All patients (regardless of SMMSE scores) had formal delirium assessment using the 'sensitive' Confusion Assessment Method (CAM) [14] (acute onset or fluctuation indicates delirium) and Delirium Rating Scale-revised-98 (DRS-R98) [15]. In this older hospitalised population, based on guidance from the tool's creator, delirium was diagnosed when DRS-R98 severity score was ≥ 15 AND the total score was ≥ 18 AND ≥ 3 points higher than the severity score. This stringency aimed to reduce false positives from severe illness and dementia. Depression was initially screened by asking patients if they 'often felt downhearted or blue?' A negative answer has a 96% negative predictive value [16]. Those answering 'yes' had further assessment using the 15-item Geriatric Depression Scale [17], or the Cornell Scale for Depression in Dementia if SMMSE was $< 15/30$ [18]. Importantly, patients with delirium or depression were not excluded, and the expert panel considered all factors when assigning dementia diagnosis.

Pre-morbid functional ability was rated by the Barthel Index (BI) Activity of Daily Living tool [19]. The presenting illness was recorded from case notes, supplemented by HIPE data if the diagnosis was unclear, classified by International Classification of Diseases, 10th revision [20] and Ambulatory Care-Sensitive Condition [21] categories. The Cumulative Illness Rating Scale-Geriatrics rated co-morbid disease burden across 13 items, scored from 0 (no problem) to 4 (extremely severe) [22]. Nutritional status was determined by the Mini-Nutritional Assessment (MNA) [23]. Patients were categorised as normal, pre-frail or frail using the SHARE-FI tool [24]. Demographic information including age, sex, education level, residence, home supports, smoking and alcohol history were recorded.

Ethical approval was obtained from the local research ethics committee (Supplementary data, Appendix 1, available in *Age and Ageing* online).

Statistical analysis

Data were entered into a FileMaker Pro 11 database and transferred into SPSS software version 22 (IBM Co., Chicago, IL, USA). The differences between groups (dementia, no dementia) were assessed using the χ^2 test for categorical variables and Student's *t*-test or Mann–Whitney *U* test for continuous variables. Univariate logistic regression models examined the effect of various factors on dementia prevalence (age, gender, medical speciality etc.). Variables with a *P*-value < 0.25 were included in a backward stepwise multivariate logistic regression model to determine which factors independently predicted dementia. The final model was assessed using the Hosmer–Lemeshow (C_{HI}) Test [25] for goodness of fit, and the model fitted the data well ($P > 0.05$). The coefficient of determination (Nagelkerke R^2) estimated the proportion of variation explained by the final model [26]. Multicollinearity with the independent variables was investigated using condition number [27] and no evidence of departures were observed. Statistical significance was determined using $P < 0.05$.

Results

During the 2-week recruitment period across the six hospitals, 676 people aged ≥ 70 were approached; 52 refused to take part, 7 were critically ill and 11 discharged pre-screening. Thus, 606 patients were included. Approximately half were female (51%); 48% were aged ≥ 80 and most lived in a home environment (91%).

The diagnostic pathway is summarised in Figure 1. On initial screening, 283 patients scored $\geq 27/30$ in the SMMSE. Nine of these had an IQCODE performed: five with subjective memory impairment and four with initial SMMSEs $< 27/30$ but later SMMSE adjusted scores $\geq 27/30$ (Supplementary data, Appendix 1, available in *Age and Ageing* online). One of the latter (SMMSE 25/28) was diagnosed with dementia. Nineteen patients could not reliably perform the SMMSE due to dysphasia ($n = 7$), combined visual and hearing deficit ($n = 1$), reduced consciousness ($n = 8$) and severe speech or learning disability ($n = 3$). All had an available IQCODE, and nine were diagnosed with dementia. Another 14 patients could not attempt the SMMSE due to severe dementia. Excluding the aforementioned unattempted/unreliable SMMSE scores, 290 patients scored $< 27/30$, of whom 253 had an available IQCODE and 3 had a previous dementia diagnosis. Where there was no available IQCODE in patients with SMMSE $< 27/30$, the expert panel considered the following: SMMSE score corrected for age and education, other collateral information such as GP report, previous and subsequent in-hospital SMMSE scores, sensory impairment or other mitigating factors, and follow-up SMMSE/collateral history at 6 and 12 months, where available ($n = 12$). The expert panel considered 36 cases in total, and reached consensus in 28 cases, of whom 8 (29%) were diagnosed with dementia. Furthermore, eight cases (1.3% of screened patients) were excluded as consensus could not be reached.

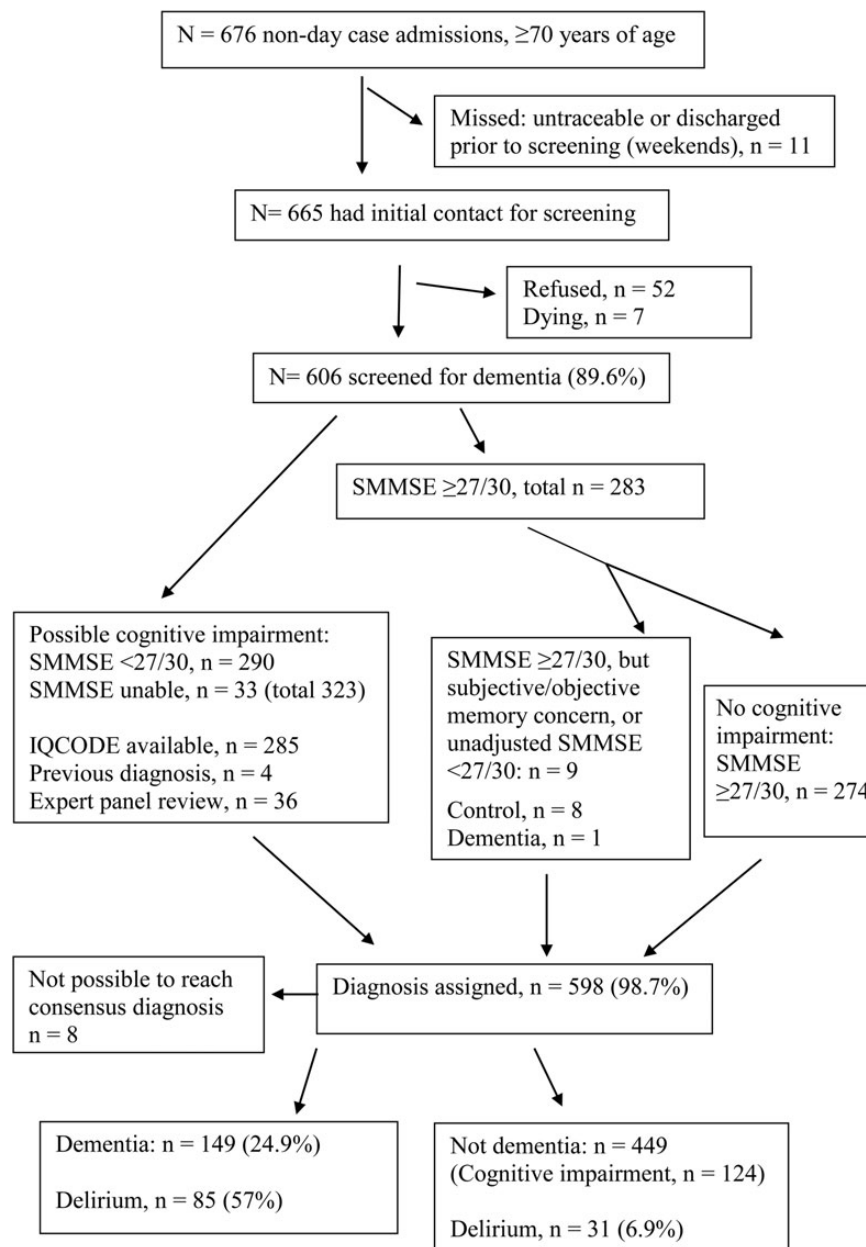


Figure 1. Flowchart of diagnostic pathway.

Of 606 initially included patients, 598 (98.7%) had dementia status determined, and 149 of these (24.9%) had dementia. A CDR score was available in 143 cases: 55% of dementia was mild, 29% moderate and 16% severe.

Associations and predictors of dementia

The prevalence of dementia varied across hospital types ($P < 0.001$). In the five public hospitals, 28.9% of 484 patients had dementia, higher in rural than urban hospitals (37.1 versus 26.9%). The private hospital ($n = 114$) had a lower prevalence (7.9%), reflecting its profile of more elective admissions and less 'oldest old' admissions. Dementia was more common in acute than elective admissions in all hospitals (28.6 versus 16.0%, $P < 0.001$). Dementia prevalence

differed by speciality ($P < 0.001$). Medical admissions had a higher prevalence than surgical (26.2 versus 11.0%). Dementia was common in orthopaedic (26.9%), and geriatric admissions (51.1%).

As expected, dementia prevalence increased with age ($P < 0.001$). People with dementia were 5 years older than controls (Table 1) and 63.0% of those aged ≥ 90 years had dementia. Dementia was common in nursing home (NH) residents (77.1% of 35 patients), and more prevalent in those receiving non-familial support at home (36.8%), rather than just familial support (25.2%).

Frailty and nutritional status differed between groups ($P < 0.001$). Compared with controls (Table 1), patients with dementia were more often frail (64.6 versus 36.7% controls) and malnourished (37.8 versus 10.3% controls). Additionally,

Table 1. Demographic and clinical statistics of patients with and without dementia

| Factor | Dementia (<i>n</i> = 149), <i>n</i> (%) | No dementia (<i>n</i> = 449), <i>n</i> (%) | Test | <i>P</i> -value |
|--|--|---|------------------|-----------------|
| Gender | | | $\chi^2 = 3.07$ | 0.08 |
| Male | 63 (42.3) | 229 (51.0) | | |
| Female | 86 (57.7) | 220 (49.0) | | |
| Age, mean (SD) | 84 (7.0) | 78.3 (5.8) | <i>T</i> = 8.95 | <0.001 |
| Smoking status | | | $\chi^2 = 4.56$ | 0.102 |
| None | 85 (59.0) | 216 (49.0) | | |
| Current | 10 (6.9) | 33 (7.5) | | |
| Ex | 49 (34.0) | 192 (43.5) | | |
| Alcohol intake ^a | | | $\chi^2 = 37.02$ | <0.001 |
| Never | 64 (44.4) | 147 (33.3) | | |
| Previous drinker (no excess) | 31 (21.5) | 45 (10.2) | | |
| Drinker excess (pre/curr) | 14 (9.7) | 21 (4.8) | | |
| Current drinker (no excess) | 35 (24.3) | 228 (51.7) | | |
| Education level | | | $\chi^2 = 16.77$ | <0.001 |
| At most primary (≤ 8 years) | 66 (46.8) | 135 (31.4) | | |
| 'Inter Cert' (9–11 years) | 43 (30.5) | 121 (28.1) | | |
| 'Leaving Cert' (12–13 years) | 21 (14.9) | 108 (25.1) | | |
| Third level (>13 years) | 11 (7.8) | 66 (15.3) | | |
| Admission | | | $\chi^2 = 9.85$ | 0.002 |
| Acute | 121 (81.2) | 302 (67.3) | | |
| Elective | 28 (18.8) | 147 (32.7) | | |
| Speciality of admitting team | | | $\chi^2 = 25.44$ | <0.001 |
| Medical | 104 (69.8) | 293 (65.4) | | |
| Surgical | 14 (18.8) | 113 (25.2) | | |
| Geriatric and orthopaedic ^b | 31 (20.8) | 42 (9.4) | | |
| Home type | | | $\chi^2 = 58.52$ | <0.001 |
| Home alone | 31 (20.8) | 142 (31.6) | | |
| Home and others | 84 (56.4) | 288 (64.1) | | |
| Sheltered | 7 (4.7) | 11 (2.4) | | |
| Nursing home | 27 (18.1) | 8 (1.8) | | |
| Hospital | | | $\chi^2 = 26.16$ | <0.001 |
| Urban public | 104 (69.8) | 283 (63) | | |
| Rural public | 36 (24.2) | 61 (13.6) | | |
| Urban private | 9 (6.0) | 105 (23.4) | | |
| Mini-Nutritional Assessment | | | $\chi^2 = 99.14$ | <0.001 |
| 0–7 malnutrition | 56 (37.8) | 46 (10.3) | | |
| 8–11 at risk | 81 (54.7) | 190 (42.7) | | |
| 12–14 normal | 11 (7.4) | 209 (47) | | |
| Barthel Index, median [Q ₁ –Q ₃] | 11 [6–17] | 20 [17–20] | MWU = 10,963 | <0.001 |
| Mean ranks | 147.23 | 348.92 | | |
| Cumulative Illness Rating Scale-Geriatrics, median [Q ₁ –Q ₃] | 11 [8–15] | 9 [6.25–12] | MWU = 41,055.5 | <0.001 |
| Mean ranks | 350.54 | 281.86 | | |
| Marital status | | | $\chi^2 = 19.79$ | <0.001 |
| Never married | 19 (12.8) | 51 (11.4) | | |
| Married | 44 (29.5) | 224 (49.9) | | |
| Widowed/separated | 86 (57.7) | 174 (38.8) | | |
| Social supports | | | $\chi^2 = 88.49$ | <0.001 |
| None | 1 (0.8) | 169 (38.3) | | |
| Family alone | 52 (42.6) | 154 (34.9) | | |
| Social/community and family | 56 (45.9) | 70 (15.9) | | |
| Outside help alone | 6 (4.9) | 36 (8.2) | | |
| Sheltered accom/supported housing | 7 (5.7) | 12 (2.7) | | |
| Frailty (SHARE-FI tool) | | | $\chi^2 = 17.18$ | <0.001 |
| Non-frail | 9 (13.8) | 66 (37.3) | | |
| Pre-frail | 14 (21.5) | 46 (26.0) | | |
| Frail | 42 (64.6) | 65 (36.7) | | |

^aExcessive alcohol intake was self-report of >14 units for women and >21 units for men, or documentation in medical notes of excessive intake, currently or in past.

^bCombined data from geriatric and orthopaedic specialities (no orthogeriatric service in any hospital).

they had higher co-morbidity (*P* < 0.001) and lower functional status (median BI 11 versus 20 in controls, *P* < 0.001). Three parameters were independent predictors of dementia

(Table 2): age (odds ratio (OR) 1.1 per year older), malnutrition (OR 5.7 if malnourished as per MNA) and BI score (OR 0.843 per point increase). The coefficient of

Table 2. Multivariate logistic regression

| | Multivariate | |
|---|-----------------------|---------|
| | OR (95% CI) | P-value |
| Age | 1.102 (1.061, 1.144) | <0.001 |
| Hospital ($P = 0.042$) | | |
| Urban public | 1.00 | |
| Rural public | 1.218 (0.667, 2.225) | 0.521 |
| Urban private | 0.371 (0.159, 0.864) | 0.220 |
| Mini-Nutritional Assessment ($P < 0.001$) | | |
| 0–7 malnutrition | 5.696 (2.423, 13.393) | <0.001 |
| 8–11 at risk of malnutrition | 4.061 (1.997, 8.258) | <0.001 |
| 12–14 normal | 1.000 | |
| Barthel Index | 0.843 (0.802, 0.864) | <0.001 |

determination (Nagelkerke R^2) for this model was 48.1%, indicating that these variables have strong associations with dementia. Patients with dementia were more commonly admitted with urinary or respiratory infections (24.2%) than those without dementia (10.3%, $P < 0.001$). Pneumonia accounted for 23.6% of all acute medical admissions in people with dementia. All but two patients had a CAM delirium assessment performed, and 89% were assessed using DRS-R98. Delirium was considerably more common in those with dementia, 57% with dementia had delirium on admission, compared with 7% of controls ($P < 0.05$). More patients with dementia screened positive for depression than controls (13.9 versus 7.6%; Supplementary data, Appendix 1, available in *Age and Ageing* online).

Prior diagnosis of dementia

In only 35.6% of patients with dementia, the diagnosis was known (listed in GP letter or medical case notes, or family report of diagnosis elsewhere). This varied between hospitals, with higher prior diagnosis in rural hospitals (47%) compared with public urban (33%), and lowest in the private hospital (2/9, 22%). A further 13 patients had documentation of prior 'cognitive impairment', and 3 had diagnosed Mild Cognitive Impairment. Of those with no prior diagnosis of any cognitive impairment ($n = 80$), in 29% the dementia was moderate or severe (CDR scale). Patients with dementia admitted from NH or sheltered accommodation were most likely to have a prior diagnosis (17/34, 50%) versus those living with a spouse/partner (14/38, 37%), or alone/with other relatives (22/77, 29%).

Discussion

This study shows that dementia is common in older people admitted to public hospitals in Cork County (28.9%), particularly acute, medical and rural hospital admissions. The results are broadly comparable with previous studies, where 42% of older acute, medical admissions in one large teaching hospital had dementia and 50% had a previous diagnosis [4]. In our study, 33% of acute medical admissions to public hospitals had dementia, of whom only 34.5% of these were previously

diagnosed. Pneumonia accounted for 23.6% of all acute medical admissions in those with dementia, similar to the 24% reported [4]. Travers *et al.* found a dementia prevalence of 21% across 493 older admissions to medical, surgical and orthopaedic wards in four Queensland teaching hospitals, with a methodology similar to our study [5]. Our study, with data on six hospitals, demonstrates striking differences in dementia prevalence between acute/elective, medical/surgical and public/private hospital patients. Unlike Sampson's study, we did not exclude patients with delirium, as we used the IQCODE to determine pre-morbid cognition. This is important as many older patients with delirium have pre-morbid dementia [28]. In our study, 90% of all older admissions were included, compared with 64% (Travers) and 77% (Sampson).

One study limitation is that patients were not directly assessed by an expert. Instead, a three-stage approach was undertaken, using initial cognitive screening (SMMSE) to exclude those with 'normal cognition', followed by informant derived data (IQCODE) and delirium testing, and finally expert diagnosis based on cognitive screening and informant data. These data were collected by carefully trained researchers, but the limitation of assigning diagnosis retrospectively must be acknowledged. In addition, Travers *et al.* sampled older in-patients with MMSE $\geq 27/30$, and diagnosed 2% of these with dementia [5]. By coding those scoring $\geq 27/30$ without subjective memory complaints as controls, we may have underestimated the prevalence. Applying the 2% prevalence rate in those with SMMSE $\geq 27/30$, we would expect another four cases of dementia in the 484 public hospital patients, raising the prevalence by $\leq 1\%$ overall.

Since only 35.6% of the people with dementia in this study were previously diagnosed, hospital staff are often treating older people with un-diagnosed dementia, with obvious implications for care. Doctors may wrongly assume capacity to understand complex risk–benefits of proposed treatments; delirium screening may be omitted; medications with cognitive side-effects may be prescribed, and opportunities for planning future care and assessing care needs are lost.

In summary, this study provides the first multi-hospital dementia prevalence data for older adults admitted to acute care hospitals in Ireland, demonstrating that 29% of older public hospital admissions have dementia. More than half of people with dementia have delirium on admission, and only 36% with dementia are known cases. These findings support the prioritisation of dementia care in acute hospitals, particularly cognitive screening of older people on presentation to hospital.

Key points

- Twenty-five per cent of older people admitted to six acute hospitals in Ireland had dementia.
- Dementia prevalence varied significantly between hospital type (rural or urban, private or public).
- Dementia is most prevalent in acute medical admissions; 24% of people with dementia were admitted for treatment of pneumonia.

- More than half of older people with dementia have superimposed delirium on admission to hospital.
- Dementia is poorly diagnosed in Ireland, with only 35.6% of patients with dementia having a diagnosis prior to the study.

Supplementary data

Supplementary data mentioned in the text is available to subscribers in *Age and Ageing* online.

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