INTERNAL MEDICINE JOURNAL

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doi:10.1111/imj.14066

doi:10.1111/imj.14066

Hospital discharge data under-reports delirium occurrence: results from a point prevalence survey of delirium in a major Australian health service

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Key words
delirium, prevalence, mental status and dementia test, International Classification of Diseases, adult.

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Received 9 April 2018; accepted 31 July 2018.

Abstract

Background: Delirium in hospitalised patients is common, and a risk factor for adverse outcomes. Health services require accurate delirium data to monitor the impact of initiatives designed to improve detection and prevention of delirium.
Aim: To determine the extent to which International Classification of Disease codes represent delirium occurrence.
Methods: A cross-sectional point prevalence survey was used to audit delirium occurrence in 25 inpatient wards of an Australian health service. All adult patients were eligible. Exclusion was for coma, end of life or behaviour that posed a risk to delirium assessors. Specially trained nurses and allied health professionals (AHP) screened patients for any cognitive impairment using the 4 A's Test (4AT). Those with abnormal screen test results were assessed using the '3-Minute Diagnostic Interview for the Confusion Assessment Method' (3D-CAM). Delirium detected by 3D-CAM was the reference standard.
Results: Of potentially eligible patients, 559 of 667 (83.8%) patients were assessed. The mean age was 73 years (±16.4), 54.5% were female and 43.8% (245/559) had cognitive impairment (4AT score ≥1). The occurrence of delirium during hospitalisation as identified by ICD codes was 10.4% (58/559; 95% confidence interval (CI), 7.9–12.7) compared with a point prevalence of 16.2% (91/559; 95% CI, 13.2–19.1). Only 31 of 91 (34.1%) of those with delirium had ICD delirium codes assigned.
Conclusion: ICD coding is inadequate to determine in-hospital delirium incidence. Instead, a point prevalence detection of delirium using the methods described above could be used. Health services could apply the described survey method to evaluate their local initiatives for the improvement of delirium detection and prevention.

Introduction

Delirium is the sudden onset of a disturbance in attention, perception, consciousness and cognition that is reversible and potentially preventable.[1] It commonly

Funding: None.
Conflict of interest: None.

affects hospitalised adults. A recent systematic review reported delirium prevalence rates to be 29–64% among general-medicine and geriatric-medicine patients, and 11–51% in surgical patients.[1] Given the ageing population in Australia,[2] and the increased risk of delirium in older people and those with cognitive impairment, the occurrence of delirium is set to rise. Patients with delirium are at increased risk for serious harm, including falls,[3] cognitive and functional decline and death.[4,5] Delirium is associated with a more than doubling of healthcare costs.[6] Despite its high frequency, and association with adverse outcomes and economic burden, delirium continues to be misdiagnosed, under-detected and poorly documented.[7–10] This has repercussions for the quality of patient care and cost of health service delivery.[11]

The Australian Government measures delirium using hospital-reported International Classification of Disease[12] discharge codes for delirium (ICD codes) (Box 1). These measures include: (i) performance against the Delirium Clinical Care Standard – Quality Statement 2 – Assessing for Delirium, specifically rates of prevalent and incident delirium among acute hospitalised adults[13] and (ii) the rates of incident delirium as a 'high frequency hospital-acquired complication'.[14] Although potentially useful for monitoring trends in delirium rates, ICD coding currently grossly under-represents delirium occurrence – a UK study of delirium at any time during hospitalisation measured by the ICD code F05 (delirium, not induced by alcohol and other psychoactive drugs) in 2006/2007, reported a prevalence of only 0.19% in those aged over 65 years across all specialties.[11] Similarly, in our own service in 2014–2015, the ICD-coded occurrence of delirium at any time during adult patients' hospitalisations (including codes F05.0, F05.1, F05.8, F05.9; Box 1) was only 1.3%. This could suggest delirium is a trivial matter and that there is no need to allocate additional effort and resources to improving its detection, prevention and management. Valid occurrence data are needed for health services to estimate the true impact of delirium, to prompt appropriate allocation of resources to initiatives that reduce the occurrence of delirium and to prompt improvement in the care of inpatients with delirium. It is especially significant because there are recent conversations afoot nationally to consider a decrease in hospital funding for readmissions related to high-frequency-hospital-acquired complications.

We sought to measure delirium occurrence in our multi-campus health service and to provide a better understanding of the extent of under-detection when compared with ICD code data.

Box 1 ICD diagnosis codes for delirium at discharge[12]

F05.0: Delirium not superimposed on dementia, so described

F05.1: Delirium superimposed on dementia

F05.8: Other delirium (includes delirium of mixed origin)

F05.9: Delirium, unspecified

Methods

Design and setting

A cross-sectional point prevalence survey was used for this descriptive study. The study was conducted in a major Australian metropolitan public health service in July–August 2016. The health service has five hospitals, with 1423 beds. More than half the people who access the service are aged 65 years or older, and almost one third are from countries in which English is not the native language.[15]

For four hospitals, the study was completed on a single day, but 2 days were required for the largest hospital. To ensure valid assessments the registered nurses (RN) and AHP (occupational therapists and a speech pathologist) who conducted the survey were all specially trained. Training included pre-reading about delirium, attendance at a 5-h interactive workshop and two supervised practice assessments.

Eligible participants were those aged 18 years or older, admitted as overnight-stay patients on medical-, surgical-, specialist medicine-, rehabilitation- or palliative care-wards. Patients were excluded if they were comatose, imminently approaching the end of life or aggressive to the extent that a risk was posed to staff.

All eligible patients were to be included, unless they indicated in any way they were unwilling to participate, in which case an 'opt-out' provision applied. Surveyors read an approved script describing the study to eligible patients, and all received a participant information sheet in English. Interpreters were provided for all those not fluent in English. Those surveyed twice due to inter-hospital transfer were dealt with as separate cases. Ethics approval for the study was granted by the Eastern Health Human Research Ethics Committee (LR51-2016).

Survey protocol

Screen for cognitive impairment and delirium

All participants were first screened for cognitive impairment and delirium and using the 4 A's Test (4AT,

version 1.2).[16] The 4AT validly detects possible delirium (sensitivity 0.86–1.00; specificity 0.69–0.84),[17–19] and cognitive impairment (sensitivity 0.86; specificity 0.78),[19] in a variety of settings[17–21] and in culturally diverse populations.[20] The 4AT requires patients to be rated on four items, which assess alertness, orientation, attention and acute change and fluctuating course of relevant symptoms. Items are scored based on patient responses during an interview. The fourth item (Acute Change and Fluctuating Course) has an additional requirement of verification of patients' status with a collateral source, such as a relative or entries in health records. Outcomes for the 4AT are: 0 – delirium or severe cognitive impairment unlikely; 1–3 – possible cognitive impairment; ≥4 – possible delirium with or without cognitive impairment.[16] The cut-score for an abnormal screening result was set at a 4AT score of ≥1. Those with a normal screen result had no further testing; those with an abnormal screen result underwent assessment for delirium.

Delirium assessment

The '3-Minute Diagnostic Interview for the Confusion Assessment Method' (3D-CAM) was used to assess for delirium. The 3D-CAM operationalises the delirium assessment criteria specified in 'The Confusion Assessment Method' (CAM).[22] The CAM reliably detects delirium (sensitivity 94%, 95% confidence interval (CI), 91–97; specificity 89%; 95% CI, 85–94).[23] The 3D-CAM reliably identifies delirium in those with dementia (sensitivity, 96% (95% CI, 82–100); specificity, 86% (95% CI, 67–96)) and without dementia (sensitivity, 93% (95% CI, 66–100); specificity, 96% (95% CI, 91–99)).[22] Delirium detected by 3D-CAM was the reference standard in this study.

ICD codes

Each participant's delirium-specific ICD codes (F05.0, F05.1, F05.8, F05.9; Box 1) allocated for the entire episode of care during which the point prevalence study took place, were requested from the health service's Health Information Department.

Demographic characteristics were also collected.

Statistical analysis

Frequencies and percentages were calculated for categorical data. Means and standard deviations were calculated for continuous data. Skewed data were reported by median and range. To tighten the confidence interval, the point prevalence estimate underwent a finite population size correction according to the formula:

$$\hat{p} \pm z_{\alpha/2} \times \sqrt{\frac{\hat{p}(1-\hat{p})}{n} \times \frac{\mathcal{N}-n}{\mathcal{N}-1}}$$

Data were analysed using Excel (Microsoft Excel 2010, Microsoft Corporation, Redmond, WA, USA), except the point prevalence estimate, which was calculated manually.

Results

Sample characteristics

There were 667 overnight-stay patients available on the days of survey. Of these, 25 were excluded (coma, 2; aggression/unsafe, 9 and end of life, 14), 21 were unavailable and 58 opted out. The protocol was completed for 559, representing 86.9% of those eligible (Fig. 1). Over 85% of eligible patients participated from each clinical specialty, except palliative care in which 76.5% (13/17) participated. Of the participants, 54.6% (305/559) were female, and 76.9% (430/559) were aged 65 years or older, with a mean age of 73 years. Interpreter services were required by 37 of 559 (6.6%). The median Charlson Comorbidity Index[24] was 3 (range 1–16), indicating moderate comorbid burden in the study population. The highest proportions of patients were from general medicine (23.8%, 133/559) followed by surgical services (20.8%, 116/559) and specialty medicine (20.9%, 117/559). Abnormal 4AT results indicating cognitive impairment was present (4AT score ≥1) were detected in 43.8% (245/559) (Table 1).

Delirium screening and assessment

Of the 245 patients with an abnormal screen-test result, delirium was detected in 91, giving a point prevalence estimate of 16.3% (91/559; 95% CI, 16.2–16.4). Of these, 83/91 (90.2%) were aged over 65 years. The proportion of those with delirium was highest among those aged 90–94 years (14/44, 31.8%), followed by 85–89 years (20/94, 21.3%) and 75–79 years (14/66, 21.2%).

General medicine accounted for 34.1% (31/91) of cases, followed by geriatric medicine 23.1% (21/91), specialist medicine 17.6% (16/91), rehabilitation 12.1% (11/91), surgery 9.9% (9/91) and palliative care 3.3% (3/13). The proportion of patients with delirium was highest in geriatric medicine (28.0%, 21/75), followed by general medicine (23.3%, 31/133) palliative care (23.1%, 3/13), specialist medicine (13.7%, 16/117), rehabilitation (10.5%, 11/105) and surgery (7.8%, 9/116).

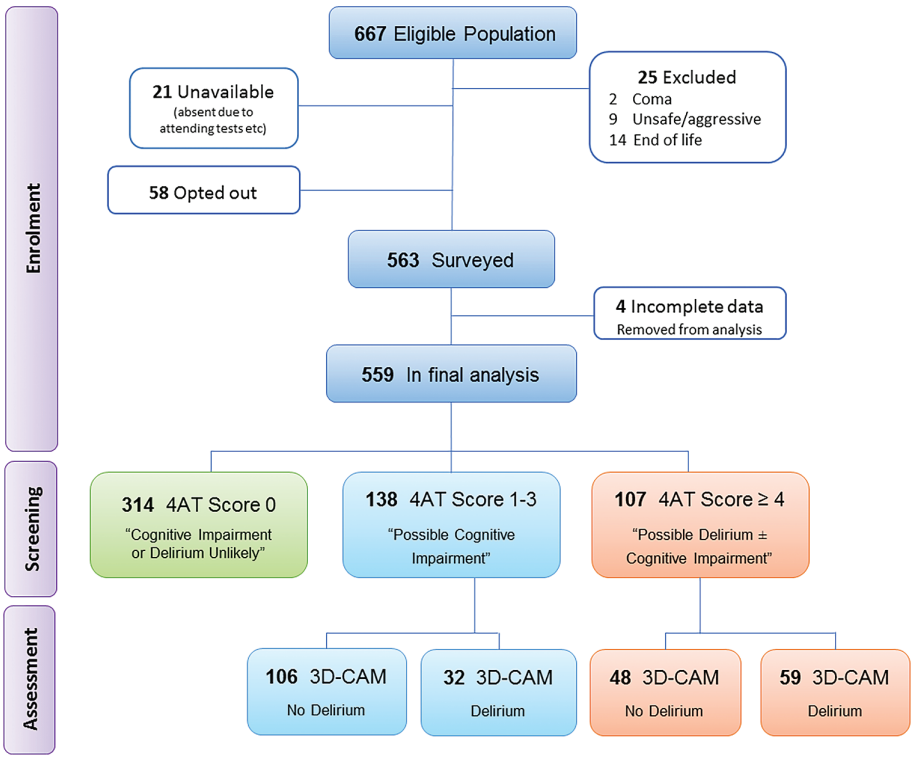

Figure 1 Flow chart of survey protocol. 3D-CAM, 3-Minute Diagnostic Interview for the Confusion Assessment Method; 4AT, 4 A's Test.

Table 1 Patient characteristics†

Variable	*n*	%
Mean age (years; SD)	73	±16.4
Female	305	54.6
Interpreter used	37	6.6
Charlson Comorbidity Index (median, range)	3	0–16
Cognitive impairment (4 A's Test score ≥1)	245	43.8
Age category total (years)		
<65	129	23.1
65–69	49	8.8
70–74	70	12.5
75–79	66	11.8
80–84	95	17.0
85–89	94	16.8
90–94	44	7.9
>95	12	2.1
Clinical programme		
General medicine	133	23.8
Surgery (grouped, total)‡	116	20.8
Orthopaedic surgery	18	3.2
Vascular surgery	22	3.9
Specialist medicine (grouped, total)§	117	20.9
Neurology	15	2.7
Rehabilitation	105	18.8
Geriatric medicine	75	13.4
Palliative care	13	2.3

†Figures are numbers (*n*) and proportions (%) unless otherwise stated. ‡Includes ear, nose, tongue, hepatobiliary, general, orthopaedic, plastics, urological and vascular. §Includes cardiology, endocrinology, gastroenterology, haematology and oncology, haemostasis and thrombosis, neurology, renal, respiratory and thoracic medicine.

ICD diagnosis codes for delirium

Only 58 of 559 (10.3%) participants had ICD delirium codes recorded showing that they had delirium diagnosed at any time during their hospitalisations. Of those 91 patients in whom delirium was detected by the gold-standard assessment, only 31 (34.1%) had ICD delirium codes assigned (Table 2). The proportion of patients with delirium for whom no ICD codes were assigned ranged from 55.6–81.8% across all clinical specialties.

Discussion

This paper appears to be the first in Australia to describe the difference in delirium occurrence between ICD delirium discharge codes and a point prevalence survey method in which the 4AT and 3D-CAM were applied sequentially by specially trained clinicians.

Compared to the method of face-to-face assessment using validated tools, the overall occurrence of delirium according to assigned ICD codes was 30% lower in our study. This is particularly noteworthy as the survey records just one point in time, whereas the ICD codes are assigned to reflect the occurrence of delirium at any time during multi-day hospital admissions. Furthermore, two thirds of patients detected as delirious on the day of the survey had no ICD discharge codes for delirium assigned. Clearly, ICD codes for delirium under-represent the

Table 2 Comparison of International Classification of Disease (ICD) delirium code assignment by screening and assessment outcomes (*n*, %)

	Screen-test normal (*n* = 314)	Screen test abnormal (*n* = 245)		Total (*n* = 559)
		No delirium (*n* = 154)	Delirium (*n* = 91)	
ICD code assigned				
4AT 0	11 (3.5)	NT	NT	11 (2.0)
4AT 1–3	0	9 (5.8)	12 (13.2)	21 (3.8)
4AT 4 or more	0	7 (4.5)	19 (20.9)	26 (4.7)
Sub-total	11 (3.5)	16 (10.4)	31 (34.1)	58 (10.4)
No ICD code assigned				
4AT 0	303 (96.5)	NT	NT	303 (54.2)
4AT 1–3	0	97 (63.0)	20 (22.0)	117 (20.9)
4AT 4 or more	0	41 (26.6)	40 (44.0)	81 (14.5)
Sub-total	303 (96.5)	138 (89.6)	60 (65.9)	501 (89.6)
Total	314 (100)	154 (100)	91 (100)	559 (100)

4 A's Test, 4 A's Test; NT, not tested.

occurrence of delirium in hospital. These findings could be explained by the limitations inherent in the stringent requirements for coding assignment, or under-detection and insufficient clinical documentation of delirium.

Our method for detecting delirium, in which RN and AHP sequentially applied the 4AT and 3D-CAM, is valid. The 16.2% delirium prevalence is within the 15.5–17.6% reported by other point prevalence studies internationally, in which the CAM was administered by trained medical staff or by physicians.[7,8] Furthermore, had we used only the 4AT and its recommended cut-score of ≥4 as the reference standard for delirium detection, our result would have closely matched the 20% reported by Bellelli *et al*.,[25] in which the 4AT was administered by physicians. As expected, we found delirium was most prevalent in older people,[1] with those aged over 65 years accounting for 90% of cases, and frequencies were highest in those aged 75–94 years. The rates of delirium detected within clinical specialties closely approximated those reported in point prevalence studies of international and Australian populations.[8,26,27] Overall, the observed similarity of our findings with other studies supports the validity of our survey method for the detection of delirium.

To maximise sensitivity, the cut-point on the 4AT that would indicate an abnormal result and lead to further assessment using the 3D-CAM, was set at ≥1. Had the research protocol used a 4AT cut-point of ≥4 to categorise patients as possibly abnormal, with the 3D-CAM applied only to patients who scored ≥4, the delirium detection rate would have been lower (59/559, 10.6%). Not assessing patients with the 3D-CAM who scored either 1, or 2 or 3 on the 4AT, would have resulted in one third of cases of delirium being missed (32/91, 35.2%). The strongest implication of this is that the CAM should be used in association with the 4AT. This may have substantial implications for any future surveys of the point-prevalence of delirium in which the 4AT is used.

The point prevalence rates were similar in rehabilitation (9.65%) and surgical patients (7.32%), yet rehabilitation patients with delirium were assigned ICD codes at half the rate of surgical patients. The numbers in these groups are small – 11 and nine respectively – so this observation may be a statistical accident. Several explanations may account for this result. Perhaps delirium detection and documentation are enhanced in the acute surgical setting where there are more frequent patient observations, especially in the post-operative phase. In the acute setting, there may be more frequent visits by relatives who notice and report early changes in cognition thereby prompting assessments for delirium. It is also possible that the occurrence of changes in cognition may seem more noteworthy to visitors and staff in the acute surgical setting, and may thus be documented and subsequently coded, than in the rehabilitation setting where abnormal cognition and function may have become normalised. In addition, rehabilitation inpatients with delirium may have more underlying cognitive impairment to which clinicians may erroneously ascribe any acute changes in cognition or attention rather than correctly labelling these as delirium. Rehabilitation patients may present more often with hypoactive delirium, which is relatively more complex to detect and diagnose. Further investigation into the relationship between delirium sub-types and clinical specialties, and the factors affecting detection in different settings seems warranted.

This study had several strengths. First, the study design minimised selection bias and enabled capture of a representative sample – 86.9% of the eligible population. Representativeness was further enhanced by the inclusion of those with cognitive impairment or who required an interpreter, which were two common exclusion criteria in studies of delirium.[1] Second, rigorous training of clinicians in the use of two validated delirium detection tools ensured control of measurement bias and enabled clinicians who were not medical staff to detect delirium validly.

There were some limitations to this study. As this was a study of a metropolitan Australian population with a particular multicultural demographic, the findings may not be generalisable to rural, remote areas or to international populations or other hospital systems. Questions could be raised about the validity of the assessments. The presence or absence of cognitive

impairment or delirium was established by RN or AHP using standardised tools: there was no separate comparison with a reference standard, such as a structured medical review, and there was no formal inter-rater reliability testing of surveyors. However, this lack is balanced in several ways. All the surveyors were volunteers with an interest in brain function and all were experienced clinicians who brought their prior clinical expertise to the research endeavour. In addition, there was extensive instruction of the surveyors regarding cognitive impairment and delirium, and a clinical standardisation process of the surveyors was done during the surveyor training. Surveyors also scored practice assessments and discussed their observations as a group as part of the training. Further, there was no external time pressure on the surveyors.

This study has important implications for clinical practice, health policy and funding. Those clinicians rigorously trained in delirium detection in the course of the study, will return to the workforce skills and knowledge to use and disseminate with colleagues, which could prompt better delirium detection and management. In turn, this may improve delirium documentation and hence assignment of ICD codes, thereby improving the utility of the codes as a delirium occurrence measure.

Health services can use the face-to-face method using the validated tools described in this study to measure delirium prevalence validly. Should repeat point prevalence measures be compared with ICD coded data, health services may be able to demonstrate improvements in clinical detection of delirium, as required by the Delirium Standard, if their ICD coded rates approach their point prevalence measures.

Although funding implications for health services that have increased ICD coding rates of delirium due to better detection are not clear at this time, health services can at least use point prevalence data to guide appropriate allocation of resources and funds to initiatives that seek to improve the prevention, detection and management of delirium. It is likely that this will favourably impact on the adverse patient outcomes and costs associated with delirium.

Conclusion

ICD codes are not a good measure of delirium occurrence: valid occurrence data can be acquired using a point prevalence method in which specially trained RN and AHP apply validated delirium assessment tools. The difference between point prevalence measures and ICD coded data, while not directly comparable, can provide health services with a means to estimate the under-detection of delirium and track changes in delirium detection rates. Point prevalence data can be used by health services to guide the allocation of resources needed to improve delirium detection, prevention and management.

Acknowledgements

The authors thank Dr Tomas Zahora, Research and Learning Coordinator, Hargreave Andrew Library, Monash University, for his contribution to editing of this manuscript.

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