

The DEMS-DOSS study: validating a delirium monitoring tool in hospitalised older adults

Author

Montgomery, Amy, Todd, Jo-Anne, Jones, Cindy, Koroitamana, June, Grealish, Laurie, Wand, Anne, Billett, Stephen, Teodorczuk, Andrew

Published

2022

Journal Title

Age and Ageing

Version

Accepted Manuscript (AM)

DOI

[10.1093/ageing/afac012](https://doi.org/10.1093/ageing/afac012)

Rights statement

© 2022 Australian Journal of Outdoor Education. This is a pre-copy-editing, author-produced PDF of an article accepted for publication in Age and Ageing following peer review. The definitive publisher-authenticated version The DEMS-DOSS study: validating a delirium monitoring tool in hospitalised older adults, Age and Ageing is available online at: <https://dx.doi.org/10.1093/ageing/afac012>.

Downloaded from

<http://hdl.handle.net/10072/412692>

Griffith Research Online

<https://research-repository.griffith.edu.au>


The DEMS-DOSS study: Validating a delirium monitoring tool in hospitalised older adults.

Authors: Amy Montgomery

School of Nursing, University of Wollongong, Northfields Ave, Wollongong, NSW 2522, Australia

Aged Care Department, St. George Hospital, Kogarah, NSW 2217, Australia

Illawarra Medical and Health Research Institute, University of Wollongong, Wollongong, NSW 2522, Australia

asaunder@uow.edu.au;  <https://orcid.org/0000-0001-7720-9513>


Jo-Anne Todd

Menzies Health Institute Queensland, Griffith University, Queensland

Cindy Jones

Faculty of Health Sciences and Medicine, Bond University, 14 University Drive, Robina, Queensland 4226, Australia

Menzies Health Institute Queensland – Healthcare Practice and Survivorship, Griffith University, 170 Kessel Road, Nathan, Queensland 4111, Australia

cjones@bond.edu.au;  <https://orcid.org/0000-0002-7249-2580>

June Koroitamana

Aged Care Department, St. George Hospital, Kogarah, NSW, 2217, Australia

Laurie Grealish

Menzies Health Institute Queensland and School of Nursing & Midwifery, Griffith University,
Queensland

Gold Coast Health, Southport, Queensland

Anne Wand

Specialty of Psychiatry, Faculty of Medicine and Health, University of Sydney, Australia

School of Psychiatry, Faculty of Medicine, University of New South Wales, Australia

a.wand@unsw.edu.au

Stephen Billett

Education and Professional Studies, Griffith University, Brisbane, Queensland

s.billett@griffith.edu.au

ORCID 0000-0002-9926-3518

Andrew Teodorczuk

Metro North Mental Health, The Prince Charles Hospital, Brisbane, Queensland

Faculty of Medicine, University of Queensland, Brisbane, Queensland

School of Medicine and Dentistry, Griffith University, Queensland

ORCHID 0000-0003-0802-718X

Corresponding Author: Amy Montgomery

School of Nursing, Faculty of Science, Medicine & Health, University of Wollongong

33 Moore Street Liverpool, NSW 2170

asaunder@uow.edu.au

Keywords and keywords:

Delirium, Screening, Education, Monitoring, Detection

ABSTRACT

Objective: To evaluate the sensitivity, specificity and test-retest reliability of the Delirium Early Monitoring System- Delirium Observation Screening Scale (DEMS-DOSS).

Design: Cross-sectional study of admitted older adults with DEMS-DOSS and reference standard assessments.

Setting: 60-bed aged care precinct at a metropolitan hospital in Sydney, Australia.

Participants: 156 patients (aged ≥ 65 years old) were recruited to participate between April 2018 and March 2020.

Measurements: Participants were scored on the DEMS-DOSS. Trained Senior Aged Care Nurses conducted a standardised clinical interview based on the DSM-IV delirium criteria, within two-hours of DEMS-DOSS completion. The Senior Aged Care Nurse undertaking the DSM-IV interview was blinded to the results of the DEMS-DOSS.

Results: Participants mean age was 84 (± 7.3) years and 38.2% ($n=39$) had a documented diagnosis of dementia. Delirium was detected in 37.3% ($n=38$). The DEMS-DOSS had a sensitivity of 75.8% and a specificity of 75.8% for delirium. The area under the receiver operating characteristics curve for delirium was 0.76. The test-retest reliability of the DEMS-DOSS was found to be high ($r=0.915$).

Conclusion: DEMS-DOSS is a sensitive and specific tool to assist with monitoring delirium in hospitalised older adults. Further studies are required to evaluate the impact of the DEMS-DOSS on health outcomes.

Introduction

Delirium has a high prevalence in older hospitalised adults and is associated with negative healthcare and economic outcomes [1,2]. Yet, delirium continues to be under recognised. Indeed, opportunities to improve the care of older hospitalised adults are missed in up to two thirds of cases [3,4]. This is despite the development and introduction in practice of validated screening tools such as 4AT [5,6] and Confusion Assessment Method (CAM) [7]. Recently, there has been a call to focus on delirium monitoring as well as initial screening [8].

Monitoring embeds delirium as a vital sign for ongoing assessment to improve detection, understanding of delirium and communication [9]. However, the evidence for effective delirium monitoring has not received adequate attention as studies are difficult to undertake [9]. To date only one delirium monitoring tool, Recognising Delirium As part of your Routine (RADAR), has been validated [10]; though it is not widely used in practice.

The Delirium Early Monitoring System (DEMS) was developed as a monitoring tool to promote ongoing delirium detection and assessment [11]. Crucially, DEMS has a contemporary educational theoretical underpinning and has been designed specifically to facilitate learning through practice [12]. Similar to the Modified Early Warning scale it links the scores on monitoring scales directly to actions [13]. This is particularly important as evidence suggests that simple teaching of delirium alone fails to lead to practice change and there is a need for tools such as DEMS to support ongoing learning by initiating actions and, thereby, informing practice changes [12].

DEMS was successfully piloted in the North East of England using a modified screening tool [11], Delirium Observation Screening Scale (DOSS) [14,15]. DOSS was selected because it is an observational delirium scale rather than a subject based cognitive assessment that may not lend itself to repeated application in a clinical setting. The DEMS-DOSS was found to be well received and acceptable in practice and that it could initiate the action triggers as needed [11]. However, the validity and reliability of the DEMS-DOSS as a tool for monitoring delirium has yet to be established.

Aims

The objectives of this study were to evaluate the sensitivity and specificity of DEMS-DOSS as a delirium monitoring tool as well as its test-retest reliability.

Methods

Cross sectional study to validate DEMS-DOSS as a delirium monitoring tool in patients aged 65 years and above admitted to aged care wards at a metropolitan hospital in Sydney, Australia, from April 2018 to March 2020. Patients were excluded if they had severe hearing impairment, were unable to verbally communicate, and/or unable to provide consent or without a recognised substitute decision maker.

Participants' Recruitment & Sample Size

Within 72 hours of hospital admission patients were screened for eligibility by Senior Aged Care Nurses (SACNs). Informed consent to participate was provided and data were collected for each participant over a 24-hour period. Demographic information including gender, primary language, country of origin, number of co-morbidities and documented evidence of dementia or other neurodegenerative disease was recorded. The target sample size was 120 (i.e., approximately 10 participants per item for the 12-item DEM-DOSS).

Instruments

DEMS-DOSS

A modified version of DEMS-DOSS, consisting of 12-items (Figure 1) was completed. Each item was rated as 0 (not observed) or 1 (observed) and a score of above 3 on the DEMS DOSS indicated the presence of possible delirium requiring further investigation. Nursing staff were trained in the use of DEMS-DOSS. Training consisted of a seven-minute video, crib sheets and bedside training with the SACNs.

Delirium Early Monitoring System (DEMS)

Participant ID Number:
Date:

	PM	AM
Easily distracted by stimuli		
Does not maintain attention to conversation		
Does not finish when asking a question or providing an answer		
Provides irrelevant answers		
Reacts slowly to instructions		
Disoriented to place		
Does not know which part of the day it is		
Fails to remember a recent event		
Is agitated, disordered and restless		
Can become suddenly emotional		
Evidence of hallucinations		
Dozes off during conversations or actions		
Total DEMS Score		

Figure 1. DEMS scoring sheet

Diagnostic and Statistical Manual of Mental Disorders (DSM-IV) criteria for delirium

The reference standard assessment was the DSM-IV criteria for delirium. Participants were rated positive for delirium if two or more criteria were present. The SACNs with expertise in delirium recognition and diagnosis completed the DSM-IV criteria. Prior to commencement of the study, the SACNs independently assessed a subgroup of patients (n=3) to check inter-rater reliability using the DSM-IV criteria. A level of 100% agreement was reported for each item.

Procedures

Participants were scored once on DEMS-DOSS between 8- 10am the morning after recruitment to the study (Time A) (Figure 1). To determine test-retest reliability, at least 25% of participants were rated on DEMS-DOSS by a second nurse within a two-hour timeframe (Time B). A trained SACN, blinded to the DEMS-DOSS results, conducted a standardised clinical interview based on the DSM-IV delirium criteria, within two-hours of DEMS-DOSS (Time A) completion.

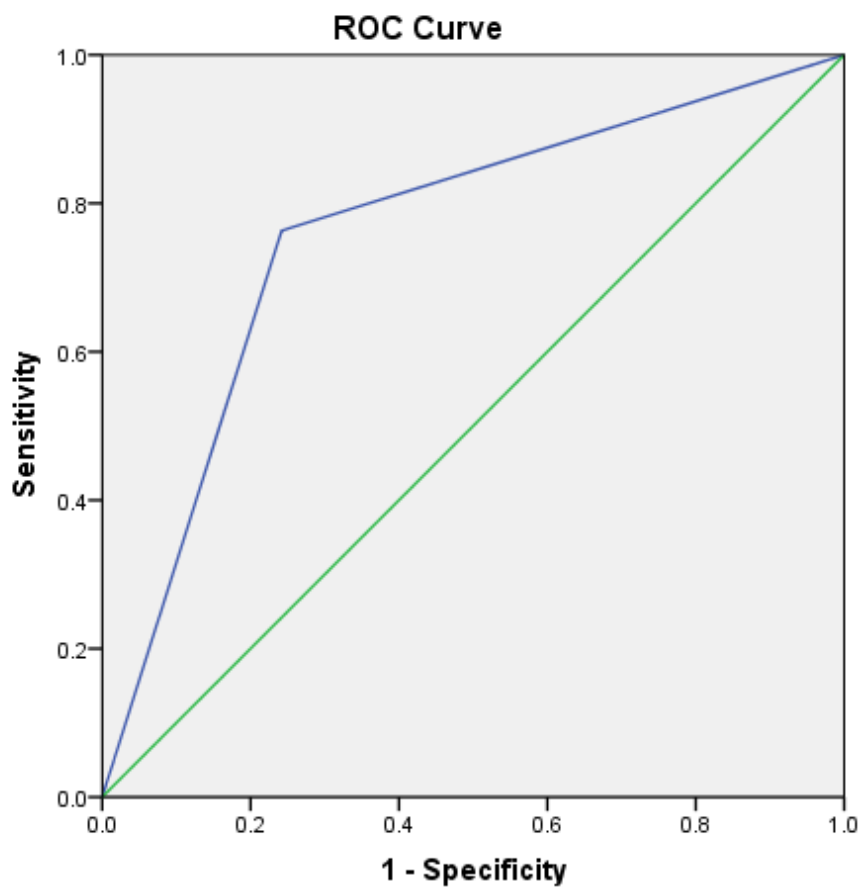
Statistical Analysis

Statistical analysis was conducted using IBM SPSS Version 26 [16]. Descriptive statistics provided an overview of participants' demographics. Pearson's r and Cronbach's α were calculated to evaluate the test-rest and internal reliability of the DEMS DOSS. Receiver operating characteristic (ROC) was computed to ascertain the diagnostic accuracy of DEMS-DOSS to yield sensitivity, specificity, and area under the ROC curve. Data from participants who completed both DEMS-DOSS and DSM-IV assessment were included for analysis. Approval was received from the Human Research Ethics Committees of Griffith University and Southern Eastern Sydney Local Health District (17/218).

Results

156 older hospitalised adults consented to participate in the study, however only 102 participants were included in the analysis (Appendix B). Appendix C shows the demographic characteristics of participants. The mean age was 84 years (± 7.3), 38.2% had an existing dementia diagnosis and 49.0% had seven or more co-morbidities. The study included culturally and linguistically diverse older adults, with 54% reporting English as their first language and the remaining as, Greek (20%), Italian (10%) and others (16%). 37.3% were evaluated as being positive for delirium based on the DSM-IV.

The sensitivity and specificity of DEMS-DOSS for delirium was 76.3% and 75.8%, respectively. The Receiver Operating Curve (ROC) is depicted in Figure 2. The area under the curve (AUC) was 0.76 (95% CI 0.66 - 0.86) which is deemed as fair. Cronbach's α for internal consistency was good; 0.84. Overall, the test-retest reliability of DEM-DOSS was found to be high ($r=0.92$).



Diagonal segments are produced by ties.

Figure 2. Receiver operating characteristic (ROC) curve for the DEMS-DOSS versus reference standard the DSM-IV delirium criteria.

Discussion

Previously, we have demonstrated that DEMS DOSS as a monitoring tool has a good ease of use in practice [11]. We now report evidence that DEMS-DOSS is a valid and reliable tool that can, therefore, be considered for introduction into practice for the monitoring of delirium in hospitalised older adults. This is an important finding as, currently, there is a lack of validated monitoring tools and a greater need for delirium monitoring to guide effective delirium practice beyond screening alone.

To date, the only validated monitoring tool is RADAR, which has sensitivity of 73% and specificity of 68% [10]. In this respect DEMS-DOSS is a marginally superior monitoring tool. With sensitivity and

specificity of 76% for DEMS-DOSS, these are still less than those reported for screening tools such as CAM and 4AT [5,6,7]. However, it is important to note that delirium monitoring tools serve a different purpose to screening tools. Their value is derived from ease of use and educational impact to sustain changes in clinical practice. Monitoring tools serve as practice-based mediators of work-based learning to upskill ward staff and develop a new discourse, in clinical spaces. [17].

This study has several strengths, including being pragmatic, real world and with limited exclusion criteria. The SACNs conducting the DSM-IV were experts in delirium recognition and were blinded to DEMS-DOSS scores. The delirium rate of 37.3% aligns with the estimated prevalence of delirium amongst older inpatients [18]. We acknowledge the limitations of this study. While we aimed to ascertain dementia status from the participants' medical history, this was likely an underestimate as dementia-like delirium is underdiagnosed [19]. There was a smaller than expected sample size. This sampling reflects the challenges of conducting research in an acute care setting, as 18.5% of recruited participants were discharged, transferred to another ward or died prior to data collection being completed (Appendix B). However, delirium research is known to be challenging and the recruitment difficulties encountered are not unexpected [20].

This study is an important step leading to the implementation into practice of a tool that will change delirium monitoring practices. Future research should investigate the impact of DEMS-DOSS on healthcare outcomes, ward culture and developing effective delirium practice within hospital settings.

Declaration of Conflicts of Interest: No conflicts to declare

Declaration of Sources of Funding: Internal funding was provided from Griffith University to support the study.

Acknowledgements: Peter Smerdely, Milreet Kaur, Carissa Saunderson, Thresiamma Paulose, Kristine Tobin, Michael Wang and Michael O'Brien, Elke Detroyer and, Koen Milisen. We would like to also thank all of the nurses working in the Aged Care Precinct and the patients and carers who took part in the study.

Ethics Statements

Human Research Ethics approval was gained from the Human Research Ethics Committee of Griffith University. and Southern Eastern Sydney Local Health District (17/218) prior to commencing recruitment and data collection.

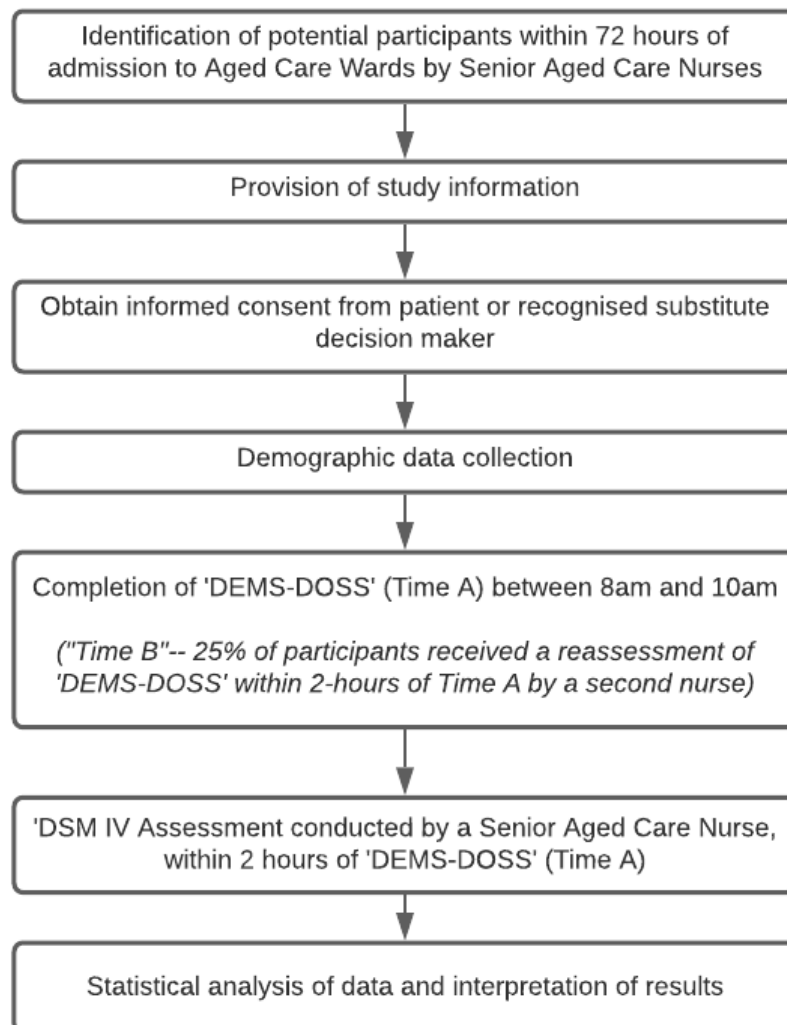
References

1. Witlox J, Eurelings L, de Jonghe J, Kalisvaart K, Eikelenboom P, van Gool W. Delirium in elderly patients and the risk of postdischarge mortality, institutionalization, and dementia: a meta-analysis. *Jama* 2012; 304: 443–51.
2. Pezzullo L, Streatfeild J, Hickson J, Teodorczuk A, Agar M., Caplan G. Economic impact of delirium in Australia: a cost of illness study. *BMJ Open* 2019; 9: e027514.
3. Casey P, Cross W, Mart MW, Baldwin C, Riddell K, Dārziņš P. Hospital discharge data under-reports delirium occurrence: results from a point prevalence survey of delirium in a major Australian health service. *Intern Med J* 2019; 49: 338–344.
4. Malik A, Harlan T, Cobb J. Stop. Think. Delirium! A quality improvement initiative to explore utilising a validated cognitive assessment tool in the acute inpatient medical setting to detect delirium and prompt early intervention. *J Clin Nurs* 2016; 25: 3400–3408.
5. Shenkin SD, Fox C, Godfrey M *et al.* Delirium detection in older acute medical inpatients: A multicentre prospective comparative diagnostic test accuracy study of the 4AT and the confusion assessment method. *BMC Med* 2019; 17.
6. Tiegés Z, MacLulich AMJ, Anand A *et al.* Diagnostic accuracy of the 4AT for delirium detection in older adults: systematic review and meta-analysis. *Age Ageing* 2021; 50: 733–742.
7. Wei L, Fearing M, Sternberg E, Inouye S. The Confusion Assessment Method: A Systematic Review of Current Usage. *J Am Geriatr Soc* 2008; 56: 823–830.
8. Wilson JE, Mart MF, Cunningham C *et al.* Delirium. *Nat Rev Dis Prim* 2020; 6: 90.
9. Marra A, Kotfis K, Hosie A *et al.* Delirium Monitoring: Yes or No? That is the Question. *Am J Crit Care* 2019; 28: 127–135.
10. Voyer P, Champoux N, Desrosiers J *et al.* Recognizing acute delirium as part of your routine

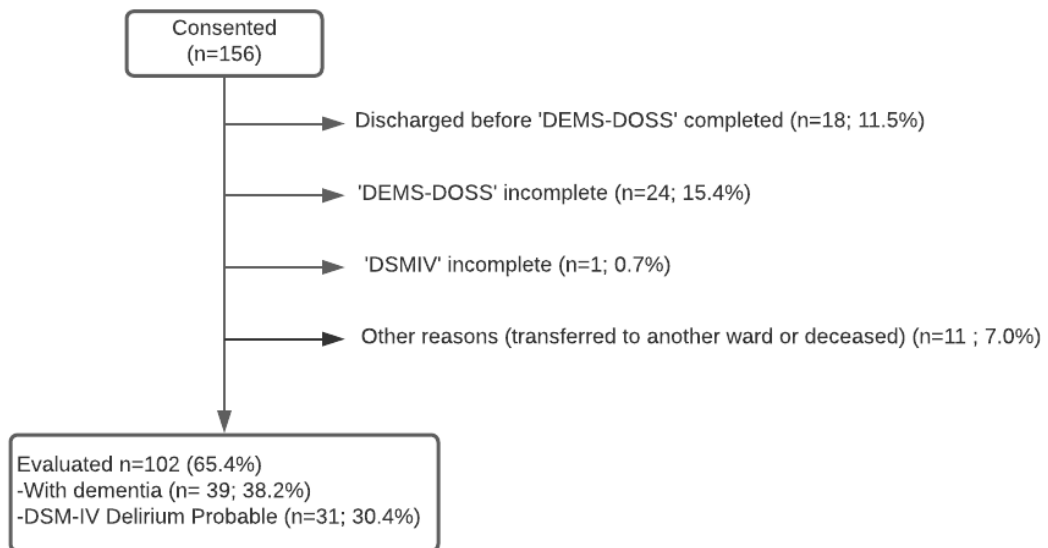
- [RADAR]: A validation study. *BMC Nurs* 2015; 14.
11. Rippon D, Milisen K, Detroyer E *et al.* Evaluation of the delirium early monitoring system (DEMS). *Int Psychogeriatrics* 2016; 28: 1879–1887.
 12. Teodorczuk A, Billett S. Mediating workplace situational pressures: The role of artefacts in promoting effective interprofessional work and learning. *Focus Heal Prof Educ A Multi-Disciplinary J* 2016; 18: 80–91.
 13. Subbe C., Kruger M, Rutherford P, Rutherford L. Validation of a modified Early Warning Score in medical admissions. *QJM An Int J Med* 2001; 94: 521–526.
 14. Schuurmans MJ, Shortridge-Bagget LM, Duursma SA. The Delirium Observation Screening Scale: a screening instrument for delirium. *Res Theory Nurs Pract* 2003; 17: 31–50.
 15. Scheffer AC, Van Munster BC, Schuurmans MJ, De Rooij SE. Assessing severity of delirium by the delirium observation screening scale. *Int J Geriatr Psychiatry* 2011; 26: 284–291.
 16. IBM Corp. IBM SPSS Statistics for Windows, Version 26.0. 2019.
 17. Lee SY, Fisher J, Wand APF *et al.* Developing delirium best practice: a systematic review of education interventions for healthcare professionals working in inpatient settings. *European Geriatric Medicine* 11 2020 1–32.
 18. Koirala B, Hansen B., Hoise A *et al.* Delirium point prevalence studies in inpatient settings: A systematic review and meta-analysis. *J Clin Nurs* 2020; 29: 2083–2092.
 19. Lang L, Clifford A, Wei L *et al.* Prevalence and determinants of undetected dementia in the community: a systematic literature review and a meta-analysis. *BMJ Open* 2017; 7: e011146.
 20. Harwood R., Teale E. Where next for delirium research? *Int J Geriatr Psychiatry* 2017; 33: 1512–1520.

Appendix:

Appendix A: Participant Timeline



Appendix B: Participant Recruitment



Appendix C: Demographic characteristics of participants (n=102)

	N (%)	M (SD)
Age (years)		84 (7.3)
Sex (male)	54 (52.9)	
Dementia Diagnosis	39 (38.2)	
Country of Birth (Australia)	50 (49.0)	
Country of Birth other than Australia	52 (51.0)	
7 or more comorbidities	50 (49.0)	
DSM-IV Delirium Probable	38 (37.3)	

M (SD): Mean (Standard Deviation)