Clinical Research

Length of stay and readmission risks among geriatric patients with delirium: a retrospective secondary hospital study in Jakarta

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ABSTRACT

BACKGROUND Delirium is common in geriatric inpatients and may increase hospital burden. This study aimed to analyze the association of length of stay (LOS), in-hospital mortality, and 30-day readmission among geriatric inpatients at a secondary hospital in Jakarta.

METHODS A retrospective study was conducted using secondary data from geriatric inpatients assessed with the comprehensive geriatric assessment (CGA) at Atma Jaya Hospital (March 2024–February 2025). Demographic, functional, nutritional, frailty, and comorbidity variables and clinical outcomes (LOS, mortality, and readmission) were analyzed using *t*-tests, Fisher's exact tests, and adjusted odds ratios (aORs) with 95% confidence intervals (CIs).

RESULTS Of 425 patients, delirium was identified in 7.8% of patients. Compared with non-delirium groups, the delirium groups had poorer clinical characteristics, including lower activities of daily living, malnutrition, higher frailty, and greater comorbidity burden. Delirium groups had longer LOS (13.88 [9.24] *versus* 6.36 [5.25] days; $p<0.001$) and higher 30-day readmission (15.2% *versus* 3.6%; aOR: 4.821, 95% CI: 1.62–14.353; $p = 0.011$), while in-hospital mortality was higher but not statistically significant ($p = 0.322$).

CONCLUSIONS Delirium in geriatric inpatients is associated with prolonged LOS and increased risk of readmission. These findings underscore the importance of early detection and CGA-guided interdisciplinary management to reduce hospital burden and improve clinical outcomes for older adults.

KEYWORDS 30-day readmission, delirium, geriatrics, length of stay, mortality

The shifting demographics in Indonesia are currently characterized by an increase in life expectancy[1] and challenging healthcare services, as older adults are at a higher risk of experiencing delirium.[2] Data on delirium among older adults in Indonesia remain limited, with an estimated prevalence of 14–56% and hospital mortality rates reaching 25–30%. However, these numbers are likely underestimated because of low clinical awareness, limited screening practices, the absence of standardized detection pathways, and the possibility of incomplete documentation.[3] In addition to the limited resources for comprehensive geriatric care in Indonesia,[3] delirium assessment is not routinely prioritized in hospital settings, where clinical care predominantly focuses on treating the primary illness rather than cognitive complications.[4]

Delirium is an acute neuropsychiatric syndrome characterized by sudden and fluctuating disturbances in consciousness, attention, and cognitive functions.[5] Predisposing factors in older adults include medical

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conditions (e.g., metabolic disorders, infections), side effects of medications,[5] frailty,[6] and malnutrition.[7] Individuals with a frail status have a 2.96 times higher risk of developing delirium,[6] whereas malnutrition and a low body mass index can lead to systemic inflammation and neurotransmitter disruption, further increasing the risk.[7] Owing to its overlapping symptoms with psychiatric disorders, delirium often goes undetected, resulting in underdiagnosis and poor outcomes.[5] These findings highlight the importance of the early detection of delirium in hospitalized older adults.

Beyond its clinical presentation, delirium substantially increases healthcare burden through prolonged length of stay (LOS), higher readmission rates, and greater resource utilization.[8] A hospital-based study in Bali reported an even higher rate of 48.8% with a clear link to increased mortality.[4] A retrospective cohort study showed that patients with delirium stayed an average of 13.8 days, 1.8 times longer than those without delirium.[9] Although the association between delirium and an extended LOS is biologically plausible,[8] LOS remains a critical outcome in healthcare systems. Not only does it increase hospital resource utilization and direct healthcare costs, but it also contributes to a higher bed occupancy rate (BOR), limiting hospital capacity and operational efficiency.[10] A prolonged LOS also contributes to functional decline, increased risk of hospital-acquired complications, and increased caregiver burden.[11]

None of the existing local studies have examined LOS along with mortality rate and 30-day readmission using parameters from the comprehensive geriatric assessment (CGA),[3] limiting our understanding of how delirium interacts with frailty, nutritional status, and functional capacity. The limited availability of comprehensive geriatric services and the scarcity of high-quality delirium data in Indonesia underscore the need for further research. Thus, this study aimed to assess how delirium contributes to LOS, mortality, and 30-day readmission and identify which CGA domains are most strongly associated with prolonged LOS among geriatric inpatients. These findings are expected to provide clearer insights into the clinical and systemic consequences of delirium in older adults and support the role of early detection and CGA-guided interdisciplinary management in improving geriatric care outcomes.

METHODS

Study design

This retrospective study evaluated the clinical outcomes of geriatric patients with delirium managed by the Geriatric Interdisciplinary Team at Atma Jaya Hospital, Jakarta. Secondary data were obtained from both the CGA and electronic medical records (EMRs). The CGA form included functional and nutritional status, frailty level, and delirium status. Additional data from the EMR included demographic details (age and sex), history of physical comorbidities, location where the delirium was identified, LOS, mortality outcomes, and 30-day readmission incidence. All consecutive eligible patients hospitalized between March 2024 and February 2025 were included in this study. Ethical approval for this study was granted by the Research Ethics Subcommittee of Atma Jaya Hospital (No. 018/EC/KEH-RSAJ/IX/2025). The requirement for informed consent was waived because the data was anonymized and secondary.

Participants

The participants were patients aged ≥60 years managed by the Geriatric Interdisciplinary Team and with a geriatric 8 (G8) screening score of ≤14 at admission. The G8 is a screening tool designed to identify older patients who are likely to benefit from CGA. It consists of eight items that assess functional and nutritional status, medical conditions, and cognitive function. Scores ranged from 0 to 17, with ≤14 classified as abnormal, indicating frailty and the need for a more thorough CGA.[12] All patients cared for by the geriatric team were considered eligible for inclusion. Patients were excluded if they presented with severely impaired consciousness, as shown by a Glasgow coma scale (GCS) score of ≤8 during initial assessment in the emergency department (ED), or if their CGA data were incomplete at the time of extraction. Of 619 geriatric inpatients managed during the study period, 425 met the inclusion criteria. A total of 194 were excluded: 2 due to severely impaired consciousness (GCS ≤8) and 192 due to incomplete CGA data, mostly because their clinical condition prevented full assessment. The exclusion of patients with significantly reduced consciousness was intended to minimize bias in the non-delirium group because such patients typically face a higher risk of poor clinical outcomes.[13]

Sample size and power consideration

Because this study included all consecutive geriatric inpatients who met the eligibility criteria during the study period, no prior sample size calculations were performed. Instead, a post-hoc power estimation was conducted using the final sample (n = 425) and observed results.

Demographic and clinical data

The collected variables included sex (categorical variable), age (continuous variable), comorbidity history (categorical variable), delirium type (categorical variable), and care unit (categorical variable). Continuous variables are presented as means and standard deviations (SDs), whereas categorical variables are presented as frequencies and percentages.

Confusion assessment method (CAM)

The CAM is used to assess the presence of delirium in patients based on four key components: (1) acute onset and fluctuating course of symptoms, (2) inattention, (3) disorganized thinking, and (4) altered levels of consciousness. Delirium is diagnosed when criteria 1 and 2 were present, along with criteria 3 or 4. CAM is one of the most widely used screening tools for detecting delirium, with a sensitivity of up to 94% and a specificity of 89%.[14] This method has also been validated in Indonesian.[15]

Activities of daily living (ADL) – Barthel index

The Barthel index is used to assess a patient's functional status based on ADL, such as eating, bathing, dressing, mobility, and toileting. The scores ranged from 0 to 20, with lower scores indicating greater dependency. The Barthel index is highly reliable for evaluating functional independence in geriatric patients[16] and has been validated for use in the Indonesian context.[17]

Mini nutritional assessment–full form (MNA-FF)

The MNA-FF assesses the nutritional status of older adults using 18 questions covering dietary intake, functional status, anthropometric measurements, and self-perceived health. The maximum possible score was 30 points. Scores <17, 17–23.5, and >23.5 indicate malnutrition, risk of malnutrition, and normal nutritional status, respectively. The MNA-FF, the gold standard for nutritional screening in older adults,[18] was downloaded from https://www.mna-elderly.com/mna-forms.[19]

Fatigue, resistance, ambulation, illness, and loss of weight (FRAIL) scale

The fatigue, resistance, ambulation, illness, and loss of weight (FRAIL) scale is a frailty-screening instrument consisting of five components: (1) fatigue, (2) resistance (ability to climb stairs), (3) ambulation (ability to walk), (4) illness (number of comorbidities), and (5) weight loss. This instrument has been adapted into an Indonesian-language version called RAPUH (Cronbach's alpha value of 0.530).[20] Score of 0, 1–2, and 3–5 indicate a robust status, pre-frailty, and frailty, respectively.[21]

Charlson comorbidity index (CCI)

The CCI was used to assess a patient's comorbidity history by estimating the 10-year survival probability and likelihood of readmission based on the underlying medical conditions. This index evaluates the severity of comorbidities across 19 specific health conditions, each assigned a weighted score. The total CCI score was calculated by adding the weights. The resulting score is treated as a numerical variable and can be analyzed either continuously or grouped into categories based on the median or predefined score ranges.[22]

Data analysis

Descriptive univariate analyses were performed to summarize the distribution of variables related to clinical outcomes. Categorical variables, namely, sex, initial unit of delirium detection, delirium type, mortality, and readmission, are presented as frequencies and percentages. The chi-square test was used to analyze differences in categorical variables, whereas Fisher's exact test was used when the expected cell counts were <5. Adjusted odds ratios (aORs) with 95% confidence intervals [CIs] were calculated for mortality and readmission to estimate the magnitude of the association between delirium and these outcomes.

Age, comorbidity history, nutritional status, functional status, frailty level, and LOS were treated as continuous variables and are presented as mean (SD). Although most variables were not normally distributed according to the Kolmogorov–Smirnov test, parametric tests were applied because a large sample size was considered sufficient to justify the assumption of normality.[23] Independent *t*-tests were performed to

compare continuous variables between the delirium and non-delirium groups.

Subanalyses were performed for two key outcomes: LOS and readmission. Clinical characteristics, such as age, functional status, nutritional status, comorbidity history, and frailty level, were included in the bivariate analysis to explore their association with these outcomes. Because the readmission subgroup had a small sample size, comparisons between the readmitted and non-readmitted groups are reported as medians with minimum to maximum ranges. The Mann–Whitney *U* test was used to evaluate statistical differences because of unequal data distributions. Spearman's rank correlation test was performed to determine the correlation between LOS and clinical characteristics. Despite the significance of the bivariate analysis, all variables were included in the linear regression to determine which variables were significant for LOS among patients with delirium. The standardized coefficient (B) and variance inflation factor (VIF) are also reported. Jeffrey's Amazing Statistics Program (University of Amsterdam, Netherlands) was used to perform all statistical analyses, and $p<0.05$ was considered significant.

RESULTS

Of 425 patients included in this study, 33 (7.8%) experienced delirium. The delirium group showed significantly lower functional status ($p<0.001$), lower nutritional status ($p<0.001$), higher comorbidity history ($p = 0.035$), higher frailty level ($p = 0.001$), and longer LOS than the non-delirium group. Table 1 presents the detailed characteristics of patients who died during hospitalization and those readmitted 30 days after discharge. Delirium was significantly associated with 30-day readmission ($p = 0.005$; aOR: 4.821; 95% CI: 1.620–14.353) but not with mortality. The achieved statistical power was 87.1% for 30-day readmission (15.2% *versus* 3.6%), 14.9% for mortality (12.1% *versus* 7.7%), and 99.99% for LOS (mean difference = 7.52; Cohen's d = 1.33, pooled SD = 5.65).

Considering the significance of the LOS and readmission as clinical outcomes, further analyses were conducted to determine the clinical characteristics of the delirium group that might be associated with each outcome. LOS demonstrated a significant positive correlation with comorbidity history ($r = 0.429$, $p = 0.013$) and a negative correlation with lower nutritional status ($r = –0.476$, $p = 0.005$). No significant correlations were found between age ($p = 0.691$), functional status ($p = 0.144$), and frailty level ($p = 0.263$). After including all independent variables in the multivariate analysis, nutrition ($p = 0.003$, B = 0.959, VIF = 4.361), comorbidities ($p = 0.012$, B = 0.450, VIF = 1.409), and frailty ($p = 0.026$, B = 0.603, VIF = 3.292) showed significant association with LOS. This model ($R^2 = 0.462$, adjusted $R^2 = 0.363$, Durbin-Watson = 1.401, F = 4.639) performed better than the one that included only three variables ($p<0.25$) in the calculation ($R^2 = 0.202$, adjusted $R^2 = 0.176$, F = 3.626, Durbin-Watson = 1.733). Based on the readmission data, no statistically significant differences ($p>0.05$)

Table 1. Clinical characteristics of the patients based on the mortality and readmission status

Clinical characteristics	Mortality		*p*	Readmission		*p*
	Yes (n = 34)	No (n = 391)		Yes (n = 19)	No (n = 406)	
Age, mean (SD)	73.44 (8.60)	72.06 (8.03)	0.372*	75.16 (8.58)	72.03 (8.03)	0.135*
Gender, n (%)			**0.043**†			0.455†
Male	21 (10.9)	171 (89.1)		7 (3.6)	185 (96.4)	
Female	13 (5.6)	220 (94.4)		12 (5.2)	221 (94.8)	
CCI score, mean (SD)	4.24 (0.92)	4.02 (1.38)	0.226*	4.63 (1.4)	4.01 (1.34)	0.078*
Delirium			0.322‡			**0.011**‡
Yes	4 (12.1)	29 (87.9)		5 (15.2)	28 (84.8)	
No	30 (7.7)	362 (92.3)		14 (3.6)	378 (96.4)	
ADL score, mean (SD)	7.38 (6.91)	13.15 (5.91)	**<0.001***	9 (6.42)	12.86 (6.13)	**0.019***
MNA-SF score, mean (SD)	15.82 (5.28)	18.10 (5.70)	**0.021***	14.13 (5.18)	18.19 (5.66)	**0.004***
Frailty score, mean (SD)	3.38 (1.20)	2.62 (1.47)	**0.001***	3.63 (0.83)	2.64 (1.48)	**0.004***

ADL=activities of daily living; CCI=Charles comorbidity index; MNA SF=mini nutritional assessment-short form; SD=standard deviation
*Independent *t*-test; †chi-square test; ‡Fisher's exact test (2-sided)

in the clinical characteristics were found between the readmission and non-readmission groups.

The readmission (n = 5) and non-readmission (n = 28) groups had median ages of 77 (72–85) and 71.5 (61–90) years, respectively, with no statistically significant difference (p = 0.352). Their median ADL scores were 0 (0–9) and 2.5 (0–19) (p = 0.442); MNA-SF scores, 9 (7–20) and 11.25 (4.5–27.5) (p = 0.450); and CCI scores, 5 (3–7) and 4 (3–8) (p = 0.545), respectively. Both groups had a median frailty score of 4, with the readmission and non-readmission groups scoring 2–5 and 0–5, respectively (p = 0.601). Overall, no statistically significant differences were observed between the two groups across all clinical characteristics assessed.

DISCUSSION

The prevalence of delirium among hospitalized older adults in this study was clinically significant and strongly associated with a prolonged LOS and increased 30-day readmission rates. Although mortality did not reach statistical significance, the increased burden of care and the higher readmission risk in the delirium group underscore its clinical relevance. Patients with delirium exhibited greater "clinical vulnerability," consistent with higher comorbidity, greater frailty, poorer nutritional status, and lower functional independence. This reinforces the evidence that delirium thrives in the context of diminished physiological reserves, increasing the susceptibility to acute cognitive dysfunction.[24,25]

Average LOS was significantly longer in the delirium group. Our findings mirror global meta-analyses showing that delirium independently extends hospital stay by approximately 2 to 3 days.[26–28] This prolongation is often due to the time required for patients to regain sufficient cognitive and physical functions for safe discharge.[29] This study revealed that nutritional status, comorbidity history, and frailty are significantly associated with LOS. Factors such as malnutrition and a high comorbidity burden further exacerbate this delay, highlighting the need for early nutritional and medical optimization to improve BORs and reduce hospital costs.[26,30] Interestingly, although multiple factors correlated with LOS, frailty emerged as a significant independent predictor only after adjustment for other clinical variables. Frailty is associated with the LOS in hospitalized older adults, highlighting the importance of comprehensively assessing geriatric patients.[31]

Delirium was associated with a nearly 5-fold increase in the risk of 30-day readmission, consistent with prior cohorts that reported readmission rates between 17% and 30%.[8,32] While the literature identifies predictors such as depressed mood and severe physical illness, our analysis was constrained by the inability to reliably use self-report tools, such as the geriatric depression scale (GDS), during acute delirium episodes.[32] This limitation, along with the small readmission sample size, may have limited our ability to further isolate independent predictors. Nevertheless, the strength of this association underscores delirium as a primary marker of post-discharge vulnerability.

Although the in-hospital mortality rate was higher among patients with delirium, the difference was not statistically significant. This finding contrasts with the results of prior meta-analyses showing that increased mortality risk is associated with delirium (OR = 5.23, 95% CI: 3.45–7.93), particularly during hospitalization or within 30–90 days after discharge.[27] This discrepancy may be due to the short observation window or the absence of mortality in the readmission group during the study period. In this study, advanced age and multimorbidity rather than episodes of acute delirium may have contributed to mortality. This is particularly relevant, given that the average age of our sample closely aligns with Indonesia's national life expectancy (72.67 years), potentially overshadowing the independent impact of delirium.[33,34] Further longitudinal research is needed to clarify long-term mortality trends.

The association between delirium and a prolonged LOS has significant implications for hospital efficiency. Beyond clinical outcomes, extended hospitalization increases per-patient expenditure through resource consumption and staffing demands.[10,35] At the system level, these delays increase the BOR, constrain admission capacity, and create bottlenecks in the ED.[10,36] Our findings suggest that early detection and management of delirium, along with strengthening geriatric care pathways, can shorten the LOS, alleviate financial strain, and improve bed availability, ultimately enhancing the overall system efficiency.[36]

This study has some limitations. First, data on delirium cases not managed by a geriatric team were not included, which may have led to an underestimation of the overall incidence of delirium in hospitals. Additionally, most cases were managed by the internal medicine department, which could introduce a clinical

focus bias and limit the generalizability of the findings to other specialties. Second, although the CGA was utilized, psychiatric risk factors, such as pre-existing cognitive impairment and depression, were not systematically assessed. This was due to the practical difficulty of using self-report tools (e.g., the GDS) during acute delirium, as well as the study's focus on physical CGA domains. Third, the lack of longitudinal data, such as prior hospitalization history and chronic disease severity, and the exclusion of 192 patients (31.0%) due to incomplete CGA data restricted subgroup analyses and limited our ability to rule out residual confounding. Despite these constraints, the use of standardized CGA instruments provided robust evidence for delirium outcomes in Indonesian secondary hospitals.

In conclusion, this study revealed that delirium is significantly associated with adverse outcomes in hospitalized older adults, including increased frailty, poorer nutritional and functional status, prolonged LOS, and a 5-fold higher risk of 30-day readmission. Future research should integrate psychiatric assessments and collateral reports to capture longitudinal risk factors and thereby improve risk stratification and support a more comprehensive and holistic approach for delirium management in older adults. Our findings highlight the necessity for early identification and holistic management, focusing on older adults with a frail, malnourished, and functionally impaired status, to mitigate the clinical and operational impact of delirium.

Conflict of Interest

The authors affirm no conflict of interest in this study.

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