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Post-Stroke Cognitive Impairment, Depression, and Care Dependency in Stroke Survivors

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Abstract

Background: Stroke survivors frequently experience cognitive impairment, depressive symptoms, and dependence in daily care, yet evidence integrating these conditions remains limited in Indonesian clinical settings. Understanding their coexistence is important for identifying patients with greater nursing needs and more complex post-stroke care demands

Aim: examine associations between post-stroke cognitive impairment, depressive symptoms, and care dependency among adult stroke survivors

Approach: This cross-sectional study included 64 stroke survivors recruited by consecutive sampling at RS Permata Kuningan, Indonesia. Eligible participants were adults with clinically stable ischemic or hemorrhagic stroke. Cognitive impairment, depressive symptoms, and care dependency were assessed using standardized instruments, and associations were analyzed using multiple linear regression in IBM SPSS Statistics version 21

Results: The mean (SD) age was 63.4 (10.8) years, 57.8% were male, and 73.4% had ischemic stroke. Post-stroke cognitive impairment was present in 48.4%, and depressive symptoms in 29.7%. Greater care dependency was associated with cognitive impairment (adjusted β, −6.87; 95% CI, −11.92 to −1.82; P = .009), depressive symptoms (adjusted β, −7.42; 95% CI, −13.01 to −1.83; P = .010), and lower Barthel Index score (adjusted β per 10-point increase, 3.86; 95% CI, 2.45 to 5.27; P < .001).

Conclusions: Greater care dependency among stroke survivors was associated with post-stroke cognitive impairment, depressive symptoms, and lower functional status in this hospital-based sample

Implication for Nursing Practice: Integrated nursing assessment of cognition, mood, and dependency may support earlier identification of stroke survivors requiring closer monitoring, individualized education, caregiver support, and coordinated multidisciplinary follow-up

Keywords: activities of daily living; cognition disorders; depression; stroke; stroke rehabilitation

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Introduction

Stroke is an important public health problem and remains the second leading cause of death and the third leading cause of death and disability worldwide (Feigin et al., 2025). From 1990 to 2021, the absolute global burden of stroke increased substantially, with a 70.0% increase in incident cases, a 44.0% increase in deaths, an 86.0% increase in prevalent cases, and a 32.0% increase in disability-adjusted life-years (DALYs) (Feigin et al., 2025). The burden is especially important in low- and middle-income countries, which accounted for 83.3% of incident strokes, 76.7% of prevalent strokes, and 87.2% of fatal strokes in 2021, while the South-East Asia region contributes more than 40% of global stroke mortality (GBD 2021 Stroke Risk Factor Collaborators, 2024; The Lancet Regional Health–Southeast Asia, 2023). In Thailand, stroke remains a major clinical and public health problem because it is a leading cause of death and long-term disability, and national stroke mortality increased from 20.8 per 100,000 population in 2008 to 30.7 per 100,000 in 2012 (Suwanwela, 2014). Stroke prevalence in Thailand is estimated at 1.88% among adults aged 45 years and older, with the highest regional prevalence reported in Bangkok at 3.34%, making this issue

particularly relevant for an urban tertiary center such as Siriraj Hospital (Suwanwela, 2014). More recent national claims data identified 386,484 incident stroke cases in Thailand during 2017–2020, with a mean age of 65 years, while haemorrhagic stroke was associated with longer hospital stay and higher mortality risk (Kumluang et al., 2023). Stroke may lead to post-stroke cognitive impairment, depression, and increasing care dependency, all of which can worsen recovery and reduce independence after discharge (Yu & Wang, 2024; Butsing et al., 2024). Among Thai stroke survivors, this issue is particularly relevant because most patients return home and are cared for by family members rather than institutional facilities, so increasing dependency directly affects both patient outcomes and family caregiving demands (Suwanwela, 2014). Therefore, a better understanding of post-stroke cognitive impairment, depression, and care dependency is important for improving nursing care, rehabilitation planning, and long-term outcomes after stroke (Tu et al., 2025).

Previous studies have shown that post-stroke cognitive impairment (PSCI) is common, with a pooled prevalence of 39%–47%, and is associated with older age, lower education, diabetes, smoking, hypertension, coronary artery disease, and greater stroke severity (Ma et al., 2025). Existing evidence also suggests that post-stroke depression (PSD) is highly prevalent, affecting about 27% of stroke survivors overall and approximately one-third of survivors at any one time after stroke (Liu et al., 2023; Towfighi et al., 2017). Prior research has further shown that PSCI is associated with a 68% higher risk of poor functional outcome, whereas PSD is consistently linked to poorer functional recovery and lower independence in daily activities (Yu & Wang, 2024; Butsing et al., 2024). Research on this topic has been conducted in systematic reviews, longitudinal cohorts, and hospital-based studies across different countries and settings (Ma et al., 2025; Liu et al., 2023; Butsing et al., 2024). However, those studies are limited by heterogeneous diagnostic instruments, different assessment time points, and a predominant focus on general functional outcomes rather than nursing-sensitive care dependency (Ma et al., 2025; Butsing et al., 2024). Thus, the current evidence remains insufficient to clarify the combined relationship between cognitive impairment, depressive symptoms, and care dependency in Southeast Asian and Thai stroke populations (Mtambo et al., 2025).

Little is known about how PSCI and depression coexist and contribute to care dependency among stroke survivors in Thailand. This is important because persistent cognitive impairment predicts later functional dependence, and post-acute stroke care dependence increases in patients with depression, cognitive dysfunction, comorbidity, falls, and physical dysfunction (Liao et al., 2022; Yuan et al., 2024). Care dependency is also clinically important because it is common after stroke and is positively related to caregiver fatigue, indicating that worsening patient dependency may extend its burden to families and informal caregivers (Tu et al., 2025). In Thailand, available studies have more often focused on depression screening or general rehabilitation outcomes, such as validation of the Thai PHQ-9 at Siriraj Hospital, rather than the integrated assessment of cognition, depression, and care dependency in the same sample (Dajpratham et al., 2020; Mtambo et al., 2025). In particular, it remains unclear whether stroke survivors with cognitive impairment and depressive symptoms are more likely to experience greater care dependency in an urban tertiary hospital setting such as Siriraj Hospital, Bangkok, Thailand (Yuan et al., 2024; Tu et al., 2025). Addressing this gap may inform early nursing assessment, multidisciplinary rehabilitation, and family-centered discharge planning for stroke survivors in Thailand (Tu et al., 2025).

Therefore, the objective of this study was to examine the associations of post-stroke cognitive impairment and depression with care dependency among stroke survivors at Siriraj Hospital, Bangkok, Thailand. In this cross-sectional study, we examined adult stroke survivors receiving follow-up or rehabilitation care in a tertiary hospital setting. The primary outcome was care dependency, with secondary outcomes including the prevalence and clinical profile of post-stroke cognitive impairment and depressive symptoms. We hypothesized that stroke survivors with greater cognitive impairment and higher depressive symptoms would have higher levels of care dependency.

Method

Study Design

This hospital-based cross-sectional study examined the associations of post-stroke cognitive impairment and depressive symptoms with care dependency among stroke survivors treated at RS Permata Kuningan, Kuningan, West Java, Indonesia. The main objective of the study was to determine whether cognitive impairment and depressive symptoms were associated with higher care dependency in adult stroke survivors during follow-up care. Data collection was conducted from August 26 to September 26, 2025. The study was designed and reported in accordance with the Strengthening the Reporting of Observational Studies in Epidemiology (STROBE) guideline for cross-sectional studies (Vandenbroucke et al., 2007). The observational study protocol was not prospectively registered.

Ethics Approval and Informed Consent

The study was approved by the Research Ethics Committee of Universitas Bhakti Husada, Kuningan, Indonesia, under approval number No.043/SK/UBA/VII/2025. All participants received an explanation of the study aims, procedures, confidentiality, and voluntary nature of participation before enrollment. Written informed consent was obtained from all participants prior to data collection. No waiver of consent was applied because the study involved direct interviews and bedside assessments.

Setting and Participants

The study was conducted at RS Permata Kuningan, a referral hospital in Kuningan, West Java, Indonesia. The source population comprised adult stroke survivors who attended outpatient follow-up, rehabilitation, or inpatient post-acute care services during the study period. The target population was adult survivors of ischemic or hemorrhagic stroke who were clinically stable and able to undergo cognitive, psychological, and nursing assessments. Recruitment and data collection were performed consecutively between August 26 and September 26, 2025.

Eligibility Criteria and Sampling

Eligible participants were adults aged 18 years or older with a documented physician diagnosis of ischemic or hemorrhagic stroke in the medical record and a clinically stable condition at the time of assessment. Participants were required to be able to communicate in Indonesian sufficiently to complete the interview-based assessments, either independently or with minimal clarification. Patients were excluded if they had transient ischemic attack rather than stroke, documented pre-stroke dementia, severe aphasia or reduced consciousness that precluded valid assessment, severe hearing or visual impairment that interfered with testing, acute medical instability, or incomplete primary outcome or key predictor data. A consecutive sampling approach was used, and all eligible patients who attended the study setting during the study period were invited to participate in order of presentation. This strategy was chosen to reduce selective recruitment and to improve the representativeness of the accessible hospital-based stroke population.

Sample Size

The accessible source population during the study period consisted of 80 stroke survivors, and all eligible patients were approached for inclusion. In addition, the minimum sample requirement was estimated using a single-population proportion formula based on the reported care dependency incidence of 78.1% among post-acute stroke patients in a prior study by Yuan et al. (2024). Using a 2-sided α of .05, an absolute precision of 5%, and finite population correction for an available population of 80 patients, the minimum required sample was approximately 62 participants. Therefore, the final analytic sample of 64 participants was considered adequate for the planned association analyses. Sixteen participants were excluded from the final analysis because they had incomplete data on the primary outcome or key exposure variables.

Variables

The primary outcome was care dependency, defined as the level of assistance required by a stroke survivor to meet basic physical and psychosocial care needs. Care dependency was measured using the Indonesian version of the Care Dependency Scale (CDS), and the total score was analyzed as a continuous variable, with lower scores indicating greater dependency. The main predictors were post-stroke cognitive impairment and depressive symptoms compatible with post-stroke depression. Post-stroke cognitive impairment was operationally

defined as an abnormal Montreal Cognitive Assessment Indonesian version (MoCA-Ina) score, whereas depressive symptoms were defined using the Indonesian version of the Patient Health Questionnaire-9 (PHQ-9). The prespecified covariates were age, sex, education level, stroke type, stroke severity, functional status, and number of comorbidities because these variables have been repeatedly associated with dependency outcomes in stroke populations (Yuan et al., 2024; Tu et al., 2025).

Data Sources and Measurement

Data were obtained from structured interviews, medical record review, and standardized bedside assessments. Demographic and clinical variables included age, sex, marital status, educational attainment, employment status, stroke type, time since stroke, history of recurrent stroke, smoking history, and physician-documented comorbidities such as hypertension, diabetes mellitus, dyslipidemia, coronary disease, atrial fibrillation, and chronic kidney disease. These data were collected from patient interviews and verified against the hospital medical record whenever available. The number of comorbidities was calculated as the sum of documented chronic conditions and was used as a covariate in multivariable analysis because multimorbidity has been associated with greater care dependency after stroke (Tu et al., 2025; Yuan et al., 2024).

Data collection was performed by the principal investigator and trained nursing research assistants using a standardized case-report form. Before field implementation, all assessors received training on participant screening, informed consent procedures, interview techniques, medical record abstraction, and standardized scoring of each instrument. A pilot procedure was conducted on a small number of patients outside the final analytic sample to ensure consistency of administration and documentation. All study instruments were administered once during the same visit in a quiet clinical area, and the total assessment time was approximately 30 to 40 minutes per participant, depending on communication ability and fatigue level.

Assessment of Post-Stroke Cognitive Impairment

Post-stroke cognitive impairment was assessed using the Montreal Cognitive Assessment Indonesian version (MoCA-Ina), a brief multidomain cognitive screening tool that evaluates visuospatial and executive function, naming, attention, language, abstraction, delayed recall, and orientation. The MoCA-Ina is a paper-based bedside instrument administered once at study enrollment and typically requires approximately 10 minutes. The total score ranges from 0 to 30, with higher scores indicating better cognitive performance. In accordance with standard MoCA scoring, 1 point was added for participants with 12 years of education or less. For stroke populations, a MoCA cutoff of 21/22 has shown better diagnostic performance than the original cutoff of 26, and an adjusted score of less than 22 was used to indicate post-stroke cognitive impairment in this study (Wei et al., 2023). Recent work has shown that the original cutoff of less than 26 may overclassify older adults, whereas a cutoff of less than 22 in older low-education groups substantially improves specificity (Gallucci et al., 2024). The Indonesian MoCA has shown good psychometric performance in local populations, and recent Indonesian evidence reported sensitivity of 90% to 96% and specificity of 87% to 95% for cognitive impairment screening, supporting its use as a practical cognitive screening tool in Indonesian clinical settings (Khoiriyah et al., 2025).

Assessment of Depressive Symptoms

Depressive symptoms were assessed using the Indonesian version of the Patient Health Questionnaire-9 (PHQ-9), a 9-item screening instrument that measures the frequency of depressive symptoms during the previous 2 weeks. Each item is scored from 0 to 3, yielding a total score range of 0 to 27, with higher scores indicating greater symptom burden. The PHQ-9 was administered once at enrollment in an interviewer-administered format to reduce missing responses in participants with post-stroke physical limitations. In this study, a total score of 10 or higher was used to indicate clinically relevant depressive symptoms, while the standard descriptive categories of 0 to 4, 5 to 9, 10 to 14, 15 to 19, and 20 to 27 were used to describe symptom severity. A 2025 meta-analysis showed that the PHQ-9 has high clinical utility for screening post-stroke depression, with

pooled sensitivity and specificity generally in the acceptable-to-high range across studies, although optimal thresholds may vary by setting (Chen et al., 2025). For the Indonesian version, Cronbach's α of 0.885, sensitivity of 90.7%, and specificity of 86.5% have been reported, supporting its reliability and screening accuracy in Indonesian populations (Dian et al., 2022).

Assessment of Care Dependency

Care dependency was assessed using the Indonesian version of the Care Dependency Scale (CDS), a nurse-rated instrument designed to quantify the degree of assistance required to meet basic human needs. The CDS contains 15 items covering physical and psychosocial care needs, and each item is scored on a 5-point scale, resulting in a total score from 15 to 75. Lower scores indicate greater care dependency, whereas higher scores indicate greater independence. The CDS was completed once at enrollment based on interview and observation by trained assessors. For descriptive purposes, CDS scores can be interpreted as completely dependent (15–24), greatly dependent (25–44), partially dependent (45–59), limited dependence (60–69), and almost independent (70–75). The Indonesian CDS has demonstrated excellent psychometric properties in stroke survivors, including Cronbach's α of 0.98, and has been recommended for use in both inpatient and outpatient stroke settings in Indonesia (Nursiswati et al., 2020). Recent stroke research has also confirmed the clinical relevance of care dependency as an outcome associated with age, stroke severity, and number of comorbidities (Tu et al., 2025).

Assessment of Stroke Severity

Stroke severity was assessed using the National Institutes of Health Stroke Scale (NIHSS), a standardized clinical instrument used to quantify neurological deficit severity after stroke. The NIHSS score ranges from 0 to 42, with higher scores indicating greater stroke severity. For descriptive purposes, stroke severity was categorized as mild, moderate, severe, and very severe using commonly applied NIHSS strata. The NIHSS assessment was obtained from the treating clinical team on the assessment day or was reverified by a trained assessor from the medical record when the same-day score was available. The NIHSS has shown excellent interrater reliability, and a 2023 study reported an intraclass correlation coefficient of 0.95 between physician teams, supporting its reliability in routine stroke assessment (Cummock et al., 2023).

Assessment of Functional Status

Functional status in activities of daily living was assessed using the Barthel Index, a 10-item instrument that measures independence in basic daily activities such as feeding, bathing, dressing, toileting, transferring, mobility, and stair use. The total Barthel Index score ranges from 0 to 100, with higher scores indicating greater independence. The Barthel Index was administered once at enrollment by interview and observation. Because functional disability may overlap with care dependency and may confound the relationship between cognition, mood, and dependency, the Barthel Index was included as an important covariate in the adjusted model. A recent Indonesian validation study in the West Java stroke population reported excellent internal consistency, with Cronbach's α of at least 0.896, supporting its local use in post-stroke assessment (Alifiar et al., 2025).

Bias

Several steps were taken to reduce potential bias. Selection bias was minimized by recruiting all consecutive eligible stroke survivors during the study period rather than selecting participants by investigator preference. Information bias was reduced by using standardized instruments with established validity, employing a uniform case-report form, and verifying clinical variables from medical records. Recall bias was minimized by focusing self-report questions on current status or recent symptoms, such as the PHQ-9 recall period of the past 2 weeks, and by cross-checking stroke characteristics and comorbidities with hospital documentation whenever available. Quality control procedures included assessor training, pilot testing, same-day review of form completeness, and verification of ambiguous responses before data entry (Chen et al., 2025).

Statistical Analysis

All analyses were performed using IBM SPSS Statistics for Windows, version 21.0 (IBM Corp). Continuous variables were summarized as mean and standard deviation for normally

distributed data or median and interquartile range for nonnormally distributed data, whereas categorical variables were summarized as frequencies and percentages. Normality was evaluated using the Shapiro-Wilk test and visual inspection of histograms. Bivariable associations between participant characteristics and care dependency were examined using the independent-samples t test or 1-way analysis of variance for normally distributed continuous outcomes, the Mann-Whitney U test or Kruskal-Wallis test for skewed distributions, and the χ^2 test or Fisher exact test for categorical comparisons, as appropriate. Correlations between continuous scores were assessed using Pearson or Spearman coefficients, depending on distributional assumptions.

Because the primary outcome, CDS total score, was analyzed as a continuous variable, multiple linear regression was used to estimate the independent associations of post-stroke cognitive impairment and depressive symptoms with care dependency while adjusting for potential confounders. The main predictors entered into the adjusted model were MoCA-Ina score and PHQ-9 score. The prespecified covariates were age, sex, education level, stroke type, NIHSS score, Barthel Index score, and number of comorbidities. To avoid overfitting, clinically important covariates were retained a priori and the final model was checked for multicollinearity and residual distribution. Missing data were handled by complete-case analysis; only participants with complete data on the primary outcome and key predictors were included in the final model, yielding an analytic sample of 64 participants. No subgroup, interaction, or sensitivity analyses were prespecified because of the modest sample size. All statistical tests were 2-sided, and P values less than .05 were considered statistically significant. Effect estimates were reported with 95% confidence intervals

Results

Participant Inclusion and Analytic Sample

Of 80 stroke survivors assessed for eligibility at RS Permata Kuningan, 64 were included in the final analysis. Sixteen patients were excluded because of incomplete primary outcome or exposure data (n = 6), severe aphasia or communication limitation (n = 4), documented pre-stroke dementia (n = 3), or refusal to participate (n = 3). The participation rate was 80.0%. Participant flow and baseline characteristics are summarized in Table 1.

Participant Characteristics

Among the 64 participants included in the analytic sample, the mean (SD) age was 63.4 (10.8) years, and 37 (57.8%) were male. Ischemic stroke was present in 47 participants (73.4%), and the median (IQR) time since stroke was 5 (3–11) months. Thirty-one participants (48.4%) had post-stroke cognitive impairment, 19 (29.7%) had depressive symptoms, and the median (IQR) Barthel Index score was 70 (55–90). Additional demographic and clinical characteristics are presented in Table 1.

Table 1. Participant Characteristics

Characteristic	Overall Sample (N = 64)
Age, mean (SD), y	63.4 (10.8)
Sex, No. (%)	
Male	37 (57.8)
Female	27 (42.2)
Education, No. (%)	
Primary school or less	26 (40.6)
Secondary school	24 (37.5)
College or higher	14 (21.9)
Married, No. (%)	48 (75.0)
Occupation, No. (%)	
Employed	18 (28.1)
Unemployed/retired	35 (54.7)

Characteristic	Overall Sample (N = 64)
Homemaker/other	11 (17.2)
Stroke type, No. (%)	
Ischemic	47 (73.4)
Hemorrhagic	17 (26.6)
Time since stroke, median (IQR), mo	5 (3–11)
Recurrent stroke, No. (%)	18 (28.1)
NIHSS score, median (IQR)	4 (2–7)
Stroke severity, No. (%)	
Mild (NIHSS 0–4)	39 (60.9)
Moderate to severe (NIHSS ≥5)	25 (39.1)
Barthel Index score, median (IQR)	70 (55–90)
Comorbidities, No. (%)	
<2 conditions	25 (39.1)
≥2 conditions	39 (60.9)
Post-stroke cognitive impairment, No. (%)	31 (48.4)
Depressive symptoms (PHQ-9 ≥10), No. (%)	19 (29.7)

Primary Outcome

The mean (SD) Care Dependency Scale score in the overall sample was 53.8 (12.1). Lower mean CDS scores were observed among participants with post-stroke cognitive impairment than among those without impairment (48.1 [11.0] vs 59.2 [10.2]) and among participants with depressive symptoms than among those without depressive symptoms (45.3 [10.7] vs 57.4 [10.8]). Participants with moderate-to-severe stroke severity also had lower mean CDS scores than those with mild stroke severity (46.1 [11.6] vs 58.7 [10.0]). The distribution of the primary outcome across key subgroups is shown in Table 2

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Table 2. Distribution of Care Dependency Scale Scores Overall and by Key Subgroups

Subgroup	Participants, No.	CDS Score, mean (SD)
Overall	64	53.8 (12.1)
Post-stroke cognitive impairment	31	48.1 (11.0)
No post-stroke cognitive impairment	33	59.2 (10.2)
Depressive symptoms (PHQ-9 ≥10)	19	45.3 (10.7)
No depressive symptoms	45	57.4 (10.8)
Mild stroke severity (NIHSS 0–4)	39	58.7 (10.0)
Moderate to severe stroke severity (NIHSS ≥5)	25	46.1 (11.6)
Barthel Index <60	24	43.9 (9.8)
Barthel Index ≥60	40	59.8 (8.7)

Unadjusted Analysis

In unadjusted analyses, post-stroke cognitive impairment was associated with a lower CDS score (β, −11.08; 95% CI, −16.65 to −5.51; P < .001), as were depressive symptoms (β, −12.14; 95% CI, −18.10 to −6.18; P < .001). Higher NIHSS score, recurrent stroke, and multimorbidity were also associated with lower CDS scores, whereas higher Barthel Index score was associated with a higher CDS score (β per 10-point increase, 4.72; 95% CI, 3.52 to 5.92; P < .001). Full unadjusted estimates are reported in Table 3.

Table 3. Unadjusted Associations Between Participant Characteristics and Care Dependency Scale Score

Variable	β	95% CI	P Value
Age, per 10-year increase	−3.21	−5.42 to −1.00	.005
Female sex (vs male)	−3.14	−8.79 to 2.51	.27
Education: secondary school (vs college+)	−2.48	−8.62 to 3.66	.42
Education: primary school or less (vs college+)	−5.10	−11.00 to 0.80	.09
Hemorrhagic stroke (vs ischemic)	−4.62	−10.78 to 1.54	.14
Recurrent stroke (vs no)	−5.88	−11.63 to −0.13	.045
NIHSS score, per 1-point increase	−1.84	−2.46 to −1.22	<.001
Barthel Index, per 10-point increase	4.72	3.52 to 5.92	<.001
≥2 comorbidities (vs <2)	−6.49	−12.19 to −0.79	.026
Post-stroke cognitive impairment (vs no)	−11.08	−16.65 to −5.51	<.001
Depressive symptoms (vs no)	−12.14	−18.10 to −6.18	<.001

Adjusted Multivariable Analysis

In the adjusted linear regression model, post-stroke cognitive impairment remained associated with a lower CDS score (adjusted β, −6.87; 95% CI, −11.92 to −1.82; P = .009), and depressive symptoms also remained associated with a lower CDS score (adjusted β, −7.42; 95% CI, −13.01 to −1.83; P = .010).

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Higher Barthel Index score remained associated with a higher CDS score (adjusted β per 10-point increase, 3.86; 95% CI, 2.45 to 5.27; P < .001). Age, sex, education, stroke type, NIHSS score, and multimorbidity were not associated with CDS score after adjustment. The final multivariable model is presented in Table 4

Table 4. Multivariable Associations Between Participant Characteristics and Care Dependency Scale Score

Variable	Adjusted β	95% CI	P Value
Age, per 10-year increase	−1.72	−3.74 to 0.30	.09
Female sex (vs male)	−1.25	−5.91 to 3.41	.60
Education: secondary school (vs college+)	−1.17	−6.36 to 4.02	.65
Education: primary school or less (vs college+)	−3.48	−8.73 to 1.77	.19
Hemorrhagic stroke (vs ischemic)	−2.96	−7.87 to 1.95	.23
NIHSS score, per 1-point increase	−0.58	−1.29 to 0.13	.11
Barthel Index, per 10-point increase	3.86	2.45 to 5.27	<.001
≥2 comorbidities (vs <2)	−2.87	−7.79 to 2.05	.25
Post-stroke cognitive impairment (vs no)	−6.87	−11.92 to −1.82	.009
Depressive symptoms (vs no)	−7.42	−13.01 to −1.83	.010

Adjusted linear regression included age, sex, education, stroke type, NIHSS score, Barthel Index score, comorbidity count category, post-stroke cognitive impairment, and depressive symptoms

Discussion.

This study aimed to examine the associations of post-stroke cognitive impairment, depressive symptoms, and care dependency among stroke survivors treated at RS Permata Kuningan, Indonesia. The significant findings were that lower care dependency scores were observed in participants with post-stroke cognitive impairment and depressive symptoms and in those with lower functional status. In adjusted analyses, post-stroke cognitive impairment, depressive symptoms, and lower Barthel Index scores remained associated with lower Care

Dependency Scale scores. To our knowledge, this study adds evidence from an Indonesian hospital-based stroke population by evaluating cognitive impairment, depressive symptoms, and care dependency simultaneously using standardized clinical and patient-reported measures within the same analytic model. These findings are clinically relevant because care dependency is a nursing-sensitive outcome that reflects the multidimensional burden of stroke survivorship in routine care.

The association between post-stroke cognitive impairment and lower care dependency scores warrants consideration of several plausible explanations. This finding may be explained by the role of cognitive deficits in attention, executive function, memory, and orientation, all of which may be associated with reduced ability to perform self-care, follow instructions, and participate consistently in rehabilitation activities, although such pathways cannot be confirmed in a cross-sectional analysis (Lim et al., 2021; Yu & Wang, 2024). The association between depressive symptoms and greater care dependency may likewise reflect reduced motivation, lower engagement in daily activities, greater perceived burden, and overlap between mood symptoms and functional limitations after stroke, while biological mechanisms such as inflammation, HPA-axis dysregulation, network dysfunction, and psychosocial stress have also been proposed in the post-stroke depression literature (Lin & Huang, 2025; Butsing et al., 2024). The persistence of the Barthel Index association in the adjusted model is also clinically plausible because basic activity limitation and care dependency represent related but not identical dimensions of post-stroke functioning in hospital follow-up settings. Several explanations are possible, but the cross-sectional design precludes causal inference or determination of temporal ordering among cognition, mood, functional status, and dependency.

Overall, these findings were generally consistent with previous literature. The observed association between cognitive impairment and greater dependency aligned with a recent meta-analysis reporting that post-stroke cognitive impairment was associated with a 68% higher risk of poor functional outcome and with a systematic review identifying low baseline functional status, lower education, diabetes, and previous stroke as important correlates of post-stroke cognitive impairment and dementia after stroke (Yu & Wang, 2024; Filler et al., 2024). The association between depressive symptoms and lower care dependency scores was also consistent with a 2024 systematic review showing that post-stroke depression was associated with poor functional outcomes and with a 2024 correlational study in post-acute stroke patients in which depression and cognitive dysfunction were among the factors associated with care dependence (Butsing et al., 2024; Yuan et al., 2024). In contrast to prior work, some studies have reported that depressive symptoms were not independently associated with functional outcome after covariate adjustment, suggesting that the magnitude of this relationship may vary by timing of assessment, outcome definition, stroke severity, sample size, and the extent of adjustment for baseline disability and comorbidity (Redmond et al., 2022). This study therefore extends prior work by providing context-specific data from Indonesia and by examining cognition, depressive symptoms, and care dependency together rather than in isolation.

This study had several strengths, including the use of standardized instruments for cognition, depressive symptoms, and care dependency, as well as the inclusion of clinically relevant covariates such as stroke severity, comorbidity burden, and functional status. However, the cross-sectional design precluded establishing temporality and did not allow causal inference regarding whether cognitive impairment or depressive symptoms preceded greater care dependency or whether dependency itself was associated with worse cognitive and emotional status. Additional limitations included the single-center design, the modest sample size, complete-case analysis, and the possibility of residual confounding from unmeasured factors such as lesion location, social support, rehabilitation intensity, aphasia severity, or pre-stroke functional reserve. These limitations may have introduced imprecision and may have biased some estimates toward or away from the null, particularly for variables that were clinically plausible but not statistically significant after adjustment. Accordingly, the findings should be generalized cautiously to similar hospital-based stroke survivor populations rather than to all

community-dwelling or highly acute stroke populations.

The main implication of this study is that routine post-stroke assessment in nursing and rehabilitation practice may benefit from integrated screening of cognition, depressive symptoms, and care dependency rather than reliance on physical function alone. Hospitals, rehabilitation teams, and nursing services should consider multidimensional follow-up strategies that identify stroke survivors with concurrent cognitive, emotional, and dependency-related needs, particularly in outpatient and post-acute care settings. This study adds practical evidence from an underrepresented Indonesian setting and supports the value of combining standardized assessment tools in routine stroke follow-up without overstating the scope of inference. Future studies should use longitudinal or multicenter designs, include larger and more diverse stroke populations, and evaluate whether changes in cognition and depressive symptoms over time are associated with subsequent changes in care dependency. In summary, among stroke survivors in this cross-sectional study, post-stroke cognitive impairment, depressive symptoms, and lower functional status were associated with greater care dependency, supporting the relevance of comprehensive assessment in stroke survivorship care.

Strengths And Limitations of The Study

A key strength of this study was the use of standardized assessments for cognition, depressive symptoms, functional status, and care dependency within the same clinical sample, which allowed a more integrated evaluation of stroke survivorship in routine care. The principal limitation is that the cross-sectional design did not permit conclusions about temporality or causality between post-stroke cognitive impairment, depressive symptoms, and care dependency. In addition, part of the measurement process relied on interview-based responses and bedside assessments, which may have introduced recall, reporting, or observer-related imprecision, particularly among participants with communication difficulty or fatigue. Selection bias may also have occurred because the study was conducted in a single hospital with a modest sample and complete-case analysis, which may have limited representativeness and excluded patients with more severe deficits. Residual confounding cannot be excluded because factors such as lesion location, rehabilitation intensity, family support, and pre-stroke functional reserve were not fully captured. These considerations may have attenuated or inflated some observed associations and may limit broader generalizability; accordingly, the findings should be interpreted cautiously

Implications For Nursing Practice

These findings suggest that nursing practice may benefit from a more integrated post-stroke assessment approach that considers cognitive status, depressive symptoms, and care dependency together rather than focusing on physical function alone. Nurses should be attentive to early signs of cognitive decline, emotional distress, and increasing dependence in daily care needs, particularly during follow-up and rehabilitation encounters, because these dimensions may coexist in stroke survivors with greater vulnerability. Routine screening using brief and feasible instruments may help identify patients who require closer monitoring, individualized education, caregiver support, or referral for multidisciplinary rehabilitation. At the organizational level, nursing leadership and educators may consider strengthening structured assessment pathways, staff training, and interdisciplinary communication to support continuity of care after stroke. Such approaches may support more responsive, patient-centered stroke care, although longitudinal and interventional studies are still needed to guide the timing and effectiveness of specific nursing strategies.

Conclusions

Among stroke survivors treated at RS Permata Kuningan, greater care dependency was associated with post-stroke cognitive impairment, depressive symptoms, and lower functional status. These findings highlight the clinical relevance of multidimensional nursing assessment in identifying stroke survivors with more complex care needs. A more integrated approach to follow-up care may be warranted, while longitudinal studies are needed to clarify temporality and inform future stroke nursing practice.

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Conflict of Interest Statement
The authors declare no competing interests related to this study

Author contribution
Khadijah Rahmawati conceived the study, coordinated data collection, performed the analysis, and drafted the manuscript. Intan Nur Aini contributed to study design, supervised methodological development, critically revised the manuscript, and approved the final version. Both authors read and approved the final manuscript.

Data Avaibility
The data supporting the findings of this study are available from the corresponding author upon reasonable request, subject to ethical approval requirements and institutional data protection considerations

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