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Knowledge of Activities of Daily Living and Functional Independence among Post-Stroke Patients: A Cross-Sectional Study at RSUD dr. Doris Sylvanus, Palangka Raya, Indonesia

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ABSTRACT

Background: Stroke is a major cause of disability that affects patients' ability to perform activities of daily living and reduces their level of independence. Adequate knowledge regarding activities of daily living is essential in supporting the rehabilitation process and improving post-stroke independence. This study examined the association between knowledge of activities of daily living and functional independence among post-stroke outpatients.
Methods: A cross-sectional study was conducted using a purposive sampling technique. A total of 103 post-stroke patients attending follow-up visits at the Neurology Outpatient Clinic were recruited. Data were collected using an Activities of Daily Living Knowledge Questionnaire and the Barthel Index to assess patients' level of independence. Statistical analysis was performed using the Spearman Rank test with a significance level of $\alpha = 0.05$.
Results: Among 103 post-stroke patients, most respondents had moderate ADL knowledge and varying levels of functional dependence. ADL knowledge was significantly associated with independence level in the bivariate analysis ($p = 0.006$). However, after adjustment for demographic and clinical factors, age emerged as the strongest independent predictor of ADL impairment. Patients aged 65 years and older had substantially higher odds of dependence than younger patients, while ADL knowledge did not remain statistically significant in the final model.
Conclusion: ADL knowledge was significantly associated with functional independence among post-stroke patients in bivariate analysis; however, age was the strongest independent predictor of ADL impairment after adjustment. These findings suggest that ADL education may support rehabilitation, but it should be integrated with targeted physical rehabilitation and caregiver involvement, particularly for older patients at higher risk of dependence.

INTRODUCTION

Stroke is a major cerebrovascular disease that occurs when cerebral blood flow is disrupted, resulting in brain injury and neurological impairment. In this study, post-stroke status refers to the period after the acute stroke event, when patients continue to experience residual symptoms such as weakness, paralysis, speech problems, visual disturbances, or limitations in mobility and

self-care. These impairments may reduce quality of life and create long-term needs for support, follow-up care, and rehabilitation (Alfisyah, Marselina, Hasanah, & Rau, 2021).

According to the World Health Organization (WHO), stroke was the third leading cause of death and disability globally in 2021, with an estimated 93.8 million prevalent cases and 11.9 million new cases worldwide. The lifetime risk of stroke has increased by approximately 50% over the past two decades, with about one in four adults expected to experience a stroke during their lifetime. The global burden of stroke, measured in disability-adjusted life years (DALYs), increased from 137 million in 2000 to 160 million in 2021 (WHO, 2025). These figures indicate that stroke continues to impose a substantial burden on healthcare systems and communities. Locally, data from the Medical Record Unit of RSUD dr. Doris Sylvanus, Palangka Raya, Indonesia, showed 4,481 post-stroke outpatient visits (new and old cases) between January and November 2023, reflecting the growing number of stroke survivors requiring long-term care and rehabilitation.

One of the primary challenges experienced by post-stroke patients is a decline in their ability to perform Activities of Daily Living (ADL). ADL refers to basic self-care tasks, including eating, bathing, dressing, toileting, transferring, and mobility. In this study, ADL knowledge refers to patients' cognitive understanding of how these activities should be performed safely and appropriately after stroke, including awareness of techniques, precautions, and the importance of practicing daily activities during recovery. This concept differs from the actual physical ability to perform ADL, which depends on motor function, balance, endurance, coordination, and neurological recovery (Laili & Taukhid, 2023). ADL performance after stroke is influenced by multiple neurological and psychosocial impairments, including motor weakness, sensory deficits, cognitive impairment, language disorders such as aphasia, visual disturbances, and emotional problems such as depression or anxiety.

Functional independence refers to the extent to which a patient can perform ADL with little or no assistance from others. In this study, functional independence was assessed using the Barthel Index, which measures observed or reported performance in daily activities rather than knowledge alone. Therefore, knowledge about how to perform ADL should be understood as a cognitive construct, whereas the Barthel Index reflects functional performance. A patient may understand correct ADL techniques but still require assistance because of physical impairment, and conversely, a more independent patient may be more likely to acquire greater ADL knowledge through rehabilitation(Winstein et al., 2016), repeated practice (Bowren et al., 2022; Winstein et al., 2016), and daily experience (Elendu et al., 2023).

Rehabilitation is a structured and multidisciplinary process aimed at helping post-stroke patients regain, maintain, or optimize physical, cognitive, and social functioning. It may include physical therapy, occupational therapy, patient and family education, and training in safe ADL performance. Through rehabilitation, patients may gain both practical skills and knowledge about how to adapt daily activities to their post-stroke condition. However, because knowledge and performance represent different constructs, examining their relationship is important to determine whether patients' understanding of ADL is associated with their level of functional independence.

Conceptually, ADL knowledge may associate functional outcomes through several behavioral and psychological pathways. Patients who understand safe and appropriate ADL techniques may be better prepared to engage in self-management, set realistic goals, solve daily activity problems, and follow rehabilitation instructions (Park & Kim, 2019; Qian et al., 2025). In turn, stronger self-management may support rehabilitation adherence and repeated task practice, which are important for improving confidence and participation in daily activities (Qian et al., 2025). Self-efficacy, or a patient's belief in their ability to perform required activities, may act as an important intermediate mechanism linking knowledge and rehabilitation behavior to ADL performance (Maujean, Davis, Kendall, Casey, & Loxton, 2014; Zhang, Zhang, Fu, Yu, & He, 2024).

The clinical actionability of a knowledge–independence association lies in the fact that knowledge is potentially modifiable through rehabilitation education. If patients and caregivers understand safe ADL techniques, the purpose of repeated task practice, fall-prevention strategies, and how to adapt the home environment, education may translate into specific behavioral changes rather than remaining only informational. These changes may include more consistent home

exercise and ADL practice, better adherence to therapy instructions and follow-up schedules, earlier recognition of unsafe movements or complications, and more appropriate caregiver assistance that encourages independence without increasing risk. In this pathway, education is expected to improve self-management and strengthen self-efficacy, which may increase patients' motivation to practice daily activities and participate actively in rehabilitation. Therefore, identifying ADL knowledge as associated with independence would be clinically useful because it can guide nurses, physiotherapists, occupational therapists, and caregivers to target modifiable learning needs during routine post-stroke care.

At the same time, this conceptual framework recognizes that the relationship between ADL knowledge and functional independence may be confounded or modified by major clinical and contextual factors. Stroke severity, lesion location, motor impairment, cognitive impairment, aphasia, depression, comorbidities, duration since stroke onset, rehabilitation intensity, socioeconomic background, and family or caregiver support may independently affect both patients' ability to acquire ADL knowledge and their actual capacity to perform ADL. Competing clinical pathways are also possible: patients with milder impairment may become more independent because of neurological recovery and rehabilitation exposure, and this greater independence may subsequently increase their ADL knowledge through repeated practice and daily experience. Therefore, this study examines association rather than causation and interprets ADL knowledge as one factor within a broader post-stroke recovery framework.

Considering the increasing number of post-stroke patients and the importance of independence in the recovery process, it is necessary to investigate factors associated with functional independence. Therefore, this study aimed to analyze the association between knowledge of Activities of Daily Living (ADL) and functional independence among post-stroke patients at the Neurology Clinic of RSUD dr. Doris Sylvanus, Palangka Raya, Indonesia.

Previous local studies have examined related aspects of post-stroke recovery, including self-management, family support, ADL performance, and independence among stroke survivors (Laili & Taukhid, 2023; Sabila, Ahyana, & Safuni, 2022). However, these studies have generally focused on behavioral management, caregiver involvement, or the level of ADL performance itself. The present study adds to this evidence by specifically examining ADL knowledge as a cognitive construct and analyzing its association with functional independence as measured by the Barthel Index. By distinguishing patients' knowledge about how ADL should be performed from their actual ability to perform ADL, this study provides a more precise understanding of whether cognitive understanding of daily activities is related to functional performance among post-stroke outpatients in a local hospital setting.

METHODS

This study employed a cross-sectional design to analyze the relationship between post-stroke patients' knowledge of Activities of Daily Living (ADL) and their level of independence. During the recruitment period, clinic registration records were reviewed to identify unique post-stroke patients rather than outpatient visit counts, because the same patient may have attended the clinic more than once. A total of 186 unique post-stroke patients attended the Neurology Outpatient Clinic from March to June 2024. After eligibility screening, 132 patients met the inclusion criteria. Of these, 18 patients declined to participate, 7 were unable to complete the questionnaire because of communication or literacy limitations, and 4 had incomplete data, resulting in a final sample of 103 respondents. Of these, 103 completed the study and were included in the final analysis, giving a response rate of 78.0% among eligible patients. The recruitment yield from all unique post-stroke patients identified during the recruitment period was 55.4%.

The minimum sample size was calculated using the Lameshow formula for a cross-sectional study: $n = Z^2p(1-p)/d^2$, where n is the minimum sample size, Z is the standard normal value for a 95% confidence level, p is the expected proportion, and d is the margin of error. A 95% confidence level was used, with Z = 1.96. Because no precise prior estimate was available for the proportion of post-stroke patients with adequate ADL knowledge or functional independence in this setting,

p was set at 0.50 to obtain the maximum sample size. The margin of error was set at 10% (d = 0.10). The calculation produced a minimum sample size of 96 respondents. After adding a 7% allowance for nonresponse or incomplete data, the required sample size was 103 respondents. Therefore, 103 post-stroke patients were included in the final analysis.

Respondents were recruited at the Neurology Clinic of dr. Doris Sylvanus Hospital, Palangka Raya with criteria as follows: those who had a confirmed diagnosis of stroke at least 6 months before the study, aged between 18-80 years, and living in Palangka Raya. Transient ischemic attacks were excluded because they do not represent established post-stroke disability and may not produce persistent ADL limitations. The exclusion criteria included recurrent stroke, severe aphasia, dementia, delirium, psychiatric illness, severe visual impairment, acute deterioration, or inability to provide consent.

Stroke diagnosis was confirmed from the hospital medical record and neurologist assessment rather than by participant self-report alone. Eligible participants were required to have a documented diagnosis of stroke established during previous acute care or follow-up evaluation. Diagnosis was based on neurological clinical findings supported by brain imaging, such as computed tomography (CT) scan or magnetic resonance imaging (MRI), when available in the medical record. Stroke type was identified from the recorded clinical diagnosis and imaging interpretation and was classified as ischemic stroke when the record indicated cerebral infarction or arterial occlusion without intracranial bleeding, and as hemorrhagic stroke when the record indicated intracerebral or subarachnoid bleeding. This distinction was used to ensure that the study population consisted of confirmed post-stroke patients and to differentiate ischemic and hemorrhagic stroke mechanisms.

The study was conducted in the Neurology Outpatient Clinic of RSUD dr. Doris Sylvanus, Palangka Raya, a provincial referral hospital that provides follow-up care for patients after acute stroke management. The clinic primarily manages neurological assessment, medication review, risk-factor control, monitoring of post-stroke complications, and counselling for patients and family caregivers. Patients requiring functional recovery support are referred from the neurology clinic to rehabilitation services based on clinical need, functional limitations, and physician assessment. The rehabilitation referral system may include referral to physiotherapy for mobility, strengthening, balance, and gait training; occupational therapy for activities of daily living, upper-limb function, adaptive strategies, and home-safety education; speech therapy for swallowing, communication, or speech-language problems; and home-based rehabilitation or caregiver-assisted exercises when patients are unable to attend hospital-based sessions regularly.

Follow-up visits in the neurology clinic are generally scheduled according to clinical stability, medication needs, and rehabilitation progress. In routine outpatient practice, stable post-stroke patients are commonly reviewed approximately once every one to three months, while patients with new symptoms, uncontrolled risk factors, medication changes, or greater functional problems may require more frequent visits. During recruitment, participants were asked whether they were currently receiving any rehabilitation service, including physiotherapy, occupational therapy, speech therapy, or home-based rehabilitation exercises.

Monthly income was defined as the respondent's personal monthly income, not total household income. For respondents who were not formally employed, this variable referred to regular personal financial resources available to the respondent, including pension income, informal work income, family-provided monthly support, or other regular personal allowances used for daily needs and health-related expenses. Therefore, unemployed respondents were not automatically assigned an income of zero, because many post-stroke patients without paid employment still had regular personal financial support. Income was categorized using Rp3,261,616 as the threshold because this amount corresponded to the 2024 Provincial Minimum Wage (Upah Minimum Provinsi/UMP) of Central Kalimantan, which was established by the Governor of Central Kalimantan Decree No. 188.44/532/2023 and applied from 1 January to 31 December 2024. The threshold was used as a local socioeconomic benchmark to distinguish respondents with monthly personal income below and at or above the provincial minimum wage level.

Respondents' ADL knowledge was assessed using a 25-item multiple-choice questionnaire with three response options (A–C). Respondents who could read and write completed the questionnaire independently, whereas those unable to complete it on their own were interviewed face-to-face. Interviewers were trained before data collection, and each interview was completed in a single session lasting approximately 20–35 minutes. The 25-item knowledge questionnaire was developed by adapting relevant theoretical concepts and previous instruments related to post-stroke care, functional recovery, and activity of daily living, then modifying the items to suit the characteristics of the study respondents. The questionnaire covers several knowledge domains, including the definition and consequences of stroke, the concept of activity of daily living, factors that influence functional ability, basic principles of post-stroke rehabilitation, prevention of complications, family support, and the use of the Barthel Index as an indicator of independence. Each item is scored dichotomously, with a correct answer assigned a score of 1 and an incorrect answer assigned a score of 0. Missing, unanswered, or multiple responses for one item are treated as incorrect and scored 0. The total score therefore ranges from 0 to 25, with higher scores indicating better knowledge. For interpretation, the raw score may be converted into a percentage using the formula: total correct answers divided by 25 and multiplied by 100%. Knowledge is then categorized as good when the score is 76%-100%, sufficient when the score is 60%-75%, and poor when the score is below 60%. These cutoffs were defined a priori as percentage-based interpretive categories rather than percentiles derived from the present sample. A percentile-based cutoff was not used because the purpose was to classify respondents according to absolute achievement on the knowledge questionnaire, not according to their relative position within this study sample.

Before the questionnaire was used in the main study, a validation process was conducted among respondents who had characteristics similar to the target study population but were not included in the final research sample. The validation sample consisted of post-stroke patients and/or family caregivers involved in post-stroke care, selected to ensure that the items were understandable and relevant to the intended respondents. Content validity was assessed through expert review by individuals with knowledge of nursing, stroke care, rehabilitation, and research methodology. The experts evaluated the relevance, clarity, language appropriateness, and coverage of each item in relation to the study objectives. Items considered unclear, overlapping, or not sufficiently representative of the measured construct were revised or removed. Based on the item-validity analysis, invalid items were excluded from the final instrument, so only items that met the validity criteria were retained for use in the main study. Language adaptation was also carried out by adjusting the wording into simple, culturally appropriate, and respondent-friendly language while preserving the original meaning of each item. This validation stage was completed before the main data collection to ensure that the final questionnaire was valid, reliable, and suitable for measuring respondents' knowledge. The knowledge questionnaire demonstrated acceptable validity, as corrected item-total correlations exceeded the table value (0.361), and good reliability, with a Cronbach's alpha of 0.856.

The Barthel Index was used to assess independence in performing ADL and to track changes in participants' daily functioning over time. The BI is a reliable measure of disability and is widely used in both clinical and research settings (Józef Opara, Cezary Kucio, Józef Kurek, & Małecka, 2015). This study used the BI instrument from Alifiar, Perwitasari, Amalia, and Affandi (2025). The BI consists of 10 items, each rated across four dependency levels, with scores ranging from 0 (unable to perform the activity) to a maximum of 5, 10, or 15 (fully independent). The items assessed include bowel control (score 5 with assistance, 10 independently), bladder control (5 with assistance, 10 independently), grooming (0 with assistance, 5 independently), toilet use (5 with assistance, 10 independently), feeding (5 with assistance, 10 independently), transfers between bed and chair (5–10 with assistance, 15 independently), mobility on level surfaces (5–10 with assistance, 15 independently), dressing (5 with assistance, 10 independently), stair use (5 with assistance, 10 independently), and bathing (0 with assistance, 5 independently) (Lekamwasam, Karunatilake, Kankanamge, & Lekamwasam, 2011). BI scores range from 0 to 100, with higher scores reflecting greater independence. In this study, functional impairment is classified using these cutoffs: total dependence (BI score 0–20), severe dependence (21–60),

moderate dependence (61–90), mild dependence (91–99), and total independence (100) (Lin et al., 2013). These Barthel Index cutoffs were adopted from previously published scoring classifications rather than calculated from sample percentiles. Therefore, the categories reflect clinically meaningful levels of dependence based on established BI interpretation, enabling comparison with prior studies and avoiding data-driven thresholds that could vary according to the distribution of functional scores in this sample. Data were collected through structured interviews and direct observation. The Barthel Index was assessed through interviewer-administered respondent report, with caregiver input used when respondents required assistance in providing information. The assessment was conducted by trained interviewers using the same standardized scoring instructions. When respondent and caregiver reports differed, the final score was based on the patient's usual level of ADL performance during the assessment period after clarification with both sources.

Before data collection, ethical approval was obtained from the Ethics Committee of the Health Polytechnic of Palangka Raya (263/V/KE.PE/2024). Participation was voluntary, all respondents provided informed consent, and the data were anonymized.

Data analysis consisted of univariate analysis to describe respondent characteristics and bivariate analysis using the Chi-squared test to assess association between variables, with a significance level of $\alpha = 0.05$. Multivariate analysis was performed using logistic regression to identify factors independently associated with functional independence.

RESULTS

Descriptive analysis was conducted to characterize the respondents included in this study. The profile of post-stroke patients was examined through several key variables, namely age, sex, educational level, occupational status, income level, and duration of stroke. The presentation of respondent characteristics is important to provide contextual information regarding the study population and to facilitate a better understanding of factors that may associate post-stroke outcomes. The detailed distribution of respondents is shown in Table 1.

Table 1 Respondent Characteristics (n=103)

Variables	n	%	Mean S.D. (range)
Age (years)			
45-54	35	34.0	58.1±7.4 (46-74)
55-64	45	43.7	
≥65	23	22.3	
Gender			
Male	45	43.7	
Female	58	56.3	
Highest level of education			
Not currently enrolled	3	2.9	
Primary school	46	44.7	
Junior high school	22	21.4	
Senior high school	17	16.5	
Higher education	15	14.6	
Occupation			
Working	22	21.4	
Notworking	81	78.6	
Income (per month)			
<Rp.3.261.616	**98**	95.1	
≥Rp.3.261.616	5	4.9	
Duration of stroke (years)			
< 1	27	26.2	1.3 ± 0.7 (0.1 – 3)*
1-5	76	73.8	

**0.1 ≈ 3 months; 3 refers to 3 years; numbers were converted into 12 months*

Table 1 depicts characteristics' respondents as follows. Respondents had a mean age of 58.1 years (SD 7.4; range 46–74), indicating that the sample is largely composed of individuals in late

middle age to early older adulthood. The largest proportion (43.7%) were aged 55–64 years, followed by 34% aged 45–54 years, and 22.3% aged ≥65 years. This pattern reflects the well-known epidemiological trend that stroke commonly affects individuals in their 50s and 60s. The sample shows a slight female predominance, with 56.3% women and 43.7% men. Educational levels were generally low. Nearly 45% of respondents completed only primary school, and 21.4% reached junior high school. Only 14.6% attained higher education. This distribution indicates that the majority of respondents come from socioeconomically vulnerable backgrounds, which may influence health literacy, access to care, and rehabilitation outcomes. A substantial majority (78.6%) were not working, while only 21.4% remained employed. Given the age profile and the functional limitations associated with stroke, this high proportion of non-working individuals is expected and may reflect disability-related unemployment. The socioeconomic profile is markedly low-income: 95.1% of respondents reported monthly earnings below Rp. 3,261,616, the threshold used in your table. This suggests that most participants belong to lower-income households, which may affect treatment adherence, rehabilitation access, and overall recovery trajectories. The mean duration of stroke was 1.3 years (SD 0.7; range 0.1–3 years). Most respondents (73.8%) had lived with stroke for 1–5 years, while 26.2% were within their first-year post-stroke. This indicates that the sample includes both relatively recent and longer-term stroke survivors, allowing for variability in functional status and adaptation to disability.

Table 2 Knowledge levels (n=103)

Variables	n	%
Good	24	23.3
Moderate	70	68.0
Poor	9	8.7

Table 2 shows that, among 103 respondents, 70 (68.0%) had sufficient knowledge of activities of daily living (ADL), while 9 (8.7%) had insufficient knowledge.

Table 3 Functional impairment levels (n=103)

Variable	n	%
Severe dependence	9	8.7
Moderate dependence	37	35.9
Mild dependence	31	30.1
Total independence	26	25.2

Table 3 shows that, among 103 respondents, 37 (35.9%) had moderate dependence in performing activities of daily living (ADL), while 9 (8.7%) had severe dependence.

Table 4 Description of ADL distribution of elderly (n=103)

Barthel Index	Score 0 n (%)	Score 5 n (%)	Score 10 n (%)	Score 15 n (%)
Bowels	-	-	103 (100)	-
Bladder	-	9 (8.7)	-	94 (91.3)
Grooming	-	-	103 (100)	-
Toilet use	-	9 (8.7)	94 (91.3)	-
Feeding	-	9 (8.7)	94 (91.3)	-
Transfers (bed to chair and back)	-	39 (37.9)	64 (62.1)	-
Mobility (on level surfaces)	-	47 (45.6)	56 (54.4)	-
Dressing	-	47 (45.6)	56 (54.4)	-
Stairs	-	103 (100)	-	-
Bathing	-	-	103 (100)	-

Table 4 presents the distribution of respondents' performance across each Barthel Index component. The findings show that all respondents were independent in bowel control, grooming, and bathing, as reflected by the highest score category for these items. Most respondents were

also independent in bladder control, toilet use, and feeding, with 91.3% achieving the highest score in each domain. However, lower levels of independence were observed in mobility-related activities. Transfers from bed to chair and back showed the largest proportion of respondents requiring assistance, with 39 respondents (37.9%) scoring 5 and 64 respondents (62.1%) scoring 10. Similarly, mobility on level surfaces and dressing showed that 47 respondents (45.6%) scored 5, while 56 respondents (54.4%) scored 10. Stair use was the most limited activity, as all respondents scored 5, indicating that none achieved full independence in climbing stairs. Overall, the table suggests that post-stroke respondents were generally more independent in basic self-care activities but continued to experience limitations in activities requiring greater strength, balance, coordination, and mobility.

Table 5 Chi-squared test of demographic characteristics and ADL categories (n=130)

Characteristics	Severe dependence n (%)	Moderate dependence n (%)	Mild dependence n (%)	Total independence n (%)	χ^2	ρ-value
Age (years)						
45-54	2 (5.7)	8 (22.9)	14 (40)	11 (31.4)	24.562§	<0.001
55-64	2 (4.4)	14 (31.1)	15 (33.3)	14 (31.1)		
≥65	5 (21.7)	15 (65.2)	2 (8.7)	1 (4.3)		
Gender						
Female	4 (6.9)	18 (31)	19 (32.8)	17 (29.3)	2.589	0.461
Male	5 (11.1)	19 (42.2)	12 (26.7)	9 (20.0)		
Highest level of education						
Not currently enrolled	1 (33.3)	2 (66.7)	0 (0)	0 (0.0)	20.730§	0.054
Primary school	2 (4.3)	15 (32.6)	13 (28.3)	16 (34.8)		
Junior high school	3 (13.6)	7 (31.8)	7 (31.8)	5 (22.7)		
Senior high school	1 (5.9)	8 (47.1)	3 (17.6)	5 (29.4)		
Higher education	2 (13.3)	5 (33.3)	8 (53.3)	0 (0.0)		
Occupation						
Working	3 (13.6)	6 (27.3)	10 (45.5)	3 (13.6)	5.036§	0.169
Not working	6 (7.4)	31 (38.3)	21 (25.9)	23 (28.4)		
Income (per month)						
<Rp.3.261.616	9 (9.2)	35 (35.7)	28 (28.6)	26 (26.5)	4.733§	0.192
≥Rp.3.261.616	0 (0.0)	2 (40.0)	3 (60.0)	0 (0.0)		
Duration of stroke (years)						
< 1	2 (7.4)	7 (25.9)	13 (48.1)	5 (18.5)	5.709	0.127
1-5	7 (9.2)	30 (39.5)	18 (23.7)	21 (27.6)		

§*Likelihood ratio test*

Table 5 indicates that age was significantly associated with ADL independence level among post-stroke patients. The age distribution shows that respondents aged ≥65 years had the highest proportion of moderate or severe dependence, while younger respondents were more represented in the mild dependence and independent categories. The chi-squared test result showed a significant association between age and ADL category ($\chi^2 = 24.562$, $\rho<0.001$), suggesting that older age is related to lower functional independence after stroke.

For the other characteristics, no statistically significant associations were found with ADL independence level. Gender was not significantly associated with ADL category ($\rho = 0.461$), indicating that independence levels were relatively similar between male and female respondents. Educational level showed a borderline result ($\rho = 0.054$), suggesting a possible trend in which education may be related to functional independence, although it did not reach the conventional significance level of 0.05. Occupation ($\rho = 0.169$), income ($\rho = 0.192$), and duration of stroke ($\rho = 0.127$) were also not significantly associated with ADL independence level.

Table 6 Association between post-stroke patients' knowledge of activities of daily living (ADL) and independence level at the Neurology Clinic

Knowledge of ADL	Heavy n (%)	Moderate n (%)	Light n (%)	Independent n (%)	χ^2	ρ-value
Good	1 (4.2)	3 (12.5)	10 (41.7)	10 (41.7)		
Moderate	6 (8.6)	30 (42.9)	21 (30.0)	13 (18.6)	18.063	0.006
Poor	2 (22.2)	4 (44.4)	0 (0.0)	3 (33.3)		
Total	**9 (8.7)**	**37 (30.1)**	**31 (30.1)**	**26 (25.2)**		

Table ***6*** shows that there was a statistically significant association between post-stroke patients' knowledge of ADL and their level of independence. Patients with better ADL knowledge tended to have higher levels of independence, while those with poorer knowledge were more likely to be in the dependent categories. The chi-squared test result indicates that the relationship between ADL knowledge and independence level was significant ($\rho < 0.05$), meaning that knowledge of activities of daily living is related to functional independence among post-stroke patients.

This finding suggests that patients who understand how to perform daily activities safely and appropriately after stroke may be better prepared to practice self-care, follow rehabilitation instructions, and adapt to their physical limitations. Better ADL knowledge may support independence, but patients who are already more independent may also gain more knowledge through repeated practice, rehabilitation experience, and daily activity performance.

Multivariable analysis. Multinomial logistic regression was initially explored because ADL consisted of multiple categories; however, the model proved statistically unstable. SPSS produced warnings of *unexpected singularities in the Hessian matrix*, indicating that the model could not converge due to sparse categories, perfect prediction, and zero-count cells across several ADL groups. This instability was reflected in extremely large standard errors, Wald statistics of zero, p-values of 1.000, and implausible Exp(B) values, including floating-point overflow. Because these issues made the multinomial model invalid and uninterpretable, logistic regression with merged ADL categories was selected instead, providing a stable, reliable, and statistically appropriate approach for the dataset. Therefore, logistic regression was used for the multivariate analysis. Variables with sparse categories were merged before analysis. ADL status was recoded as 1 = impaired (severe and moderate dependence) and 0 = not impaired (mild dependence and independent). Educational level was recategorized as 1 = low education (not enrolled and primary school), 2 = medium education (junior and senior high school), and 3 = high education (higher education). Knowledge level was also recoded as 1 = low knowledge (poor and moderate knowledge) and 2 = high knowledge.

Table 7 Multivariate logistic regression model of ADL (n=103)

Variable (reference group)	β	Wald	ρ-value	OR
Age (years)				
55-64 (45-54)	0.056	0.010	0.919	1.1
≥65	3.045	12.787	<0.001	21
Gender (male)	0.022	0.02	0.965	1.0
Highest level of education (High education)				
Low education	1.042	3.440	0.064	2.8
Medium education	0.805	0.650	0.420	2.2
Occupation (working)	0.076	0.013	0.911	1.1
Income (≥Rp.3.261.616)	1.506	1.081	0.299	4.5
Duration of stroke (<1)	0.515	0.702	0.402	1.7
Knowledge (high)	1.368	3.546	0.060	3.9

$R^2 = 0.387$

Table 7 presents the multivariate logistic regression analysis of factors associated with ADL impairment among post-stroke patients. After adjustment for other variables, age remained the strongest significant predictor of ADL impairment. Respondents aged ≥65 years had significantly higher odds of ADL impairment compared with those aged 45–54 years (OR = 21.0; $\rho < 0.001$), indicating that older post-stroke patients were more likely to experience functional limitations in daily activities. The 55–64-year age group also showed increased odds of ADL impairment compared with the 45–54-year group, although this association was not statistically significant. Other variables, including gender, education, occupation, income, duration of stroke, and knowledge level, were not statistically significant predictors in the final model. The model explained 38.7% of the variation in ADL impairment ($R^2 = 0.387$), suggesting that age plays an

important role, but other clinical and contextual factors may also contribute to functional independence among post-stroke patients.

DISCUSSION

The present study identified a statistically significant association between post-stroke patients' knowledge of Activities of Daily Living (ADL) and their level of functional independence. However, the magnitude of this relationship was modest and must be interpreted with caution. As shown in Table 6, patients with better ADL knowledge were somewhat more likely to be classified as independent, yet the distribution across categories revealed considerable overlap. For example, among those with moderate knowledge, 42.9% remained in the moderate dependence group, while only 18.6% achieved independence. This pattern indicates that knowledge alone did not strongly differentiate functional outcomes.

Importantly, the observed association was unadjusted. When demographic and clinical covariates were considered in multivariate analysis, age emerged as the dominant predictor of ADL impairment, with patients ≥65 years showing markedly higher odds of dependence (OR = 21.0). In contrast, knowledge did not retain statistical significance after adjustment ($\rho = 0.060$). This suggests that the crude relationship between knowledge and independence may be confounded by age, education, or rehabilitation exposure rather than reflecting a direct causal pathway.

The weak and unadjusted nature of the association aligns with prior literature. In Lebanon, Saade, Hallit, Salameh, and Hosseini (2022) reported that 51.5% of adults had good stroke knowledge, yet awareness did not correlate with appropriate emergency response, as only 36.8% of respondents selected calling emergency services when faced with stroke symptoms. Similarly, Malaeb et al. (2022) found that although well-educated and employed Lebanese adults were more knowledgeable, knowledge alone did not guarantee effective action or improved ooutcomes.In Thailand, Wanichanon, Ananchaisarp, Buathong, and Choomalee (2024) observed that most high-risk participants underestimated their personal risk of stroke, despite moderate knowledge of warning symptoms; only those exposed to the FAST campaign demonstrated better recognition of typical signs . Historical rehabilitation studies also highlight that knowledge gains are necessary but insufficient; functional recovery depends more on structured therapy, caregiver support, and psychosocial adaptation Clark and Smith (1998).

The study conducted by Gobezie et al. (2026) indicates that the majority of post-stroke patients experience moderate to severe functional disability in performing daily activities. Such limitations are predominantly observed among older adults, individuals residing in rural settings, patients with multiple comorbidities, those who rely on assistive devices, individuals within the first six months after stroke onset, and patients who undergo prolonged hospitalization. The authors further underscore the need for routine functional assessment, continuous and structured rehabilitation, and consistent family support to strengthen patients' independence in Activities of Daily Living (ADL).

While the present study observed a weak association between ADL knowledge and independence, it is equally plausible that greater independence facilitates better knowledge rather than the reverse. Patients who are more functionally independent are typically better able to communicate with healthcare providers, attend rehabilitation sessions, and actively seek information about their condition. Independence also enables participation in self-care routines, which often include education on stroke recovery, risk factors, and ADL strategies. In contrast, patients with severe dependence may face barriers such as communication difficulties, limited mobility, and reliance on caregivers, all of which restrict opportunities to acquire and retain knowledge.

This reverse pathway has been suggested in prior rehabilitation literature. For example, Clark & Smith (1998) noted that functional recovery often precedes improvements in patient awareness and self-management, as independence allows individuals to engage more fully in educational interventions. Similarly, Wanichanon et al. (2024) found that participants exposed to stroke awareness campaigns demonstrated better knowledge only when they were able to attend

community activities, implying that functional capacity mediates access to information. Thus, independence may act as a gateway to knowledge acquisition, rather than knowledge being the primary driver of independence.

The study by Kuakool, Suwankhong, Boonrod, and Chinnasee (2024) also reported that post-stroke patients' independence in performing activities of daily living was associated with age, marital status, comorbid conditions, and duration of rehabilitation. Patients without comorbidities and those who received social support and rehabilitation tended to have better ADL ability. Knowledge about stroke alone is not sufficient to improve patient independence because ADL ability is also influenced by physical condition and stroke severity.

Recognizing this bidirectionality is critical. It underscores that education programs alone may not suffice for highly dependent patients unless paired with caregiver training and accessible communication strategies. Future research should employ longitudinal designs to disentangle whether knowledge leads to independence, independence leads to knowledge, or both processes reinforce each other over time.

This study examined the association between post-stroke patients' knowledge of Activities of Daily Living (ADL) and their functional independence, while also exploring demographic and clinical factors that may confound or modify this relationship. The findings show that ADL knowledge is significantly related to functional independence. However, this relationship does not happen on its own. It is influenced by several confounding factors, especially age, education, and stroke-related functional impairment. These factors can affect both how patients gain ADL knowledge and how well they perform daily activities.

The descriptive results show that most respondents had moderate ADL knowledge and moderate functional dependence. While knowledge was significantly associated with independence in bivariate analysis, the multivariate model revealed that age was the strongest independent predictor of ADL impairment. Patients aged ≥65 years had markedly higher odds of dependence (OR = 21.0), even after adjusting for other variables. This aligns with extensive geriatric literature showing that aging is closely linked to declines in physical function, muscle strength, mobility, and cognitive processing, all of which affect ADL performance. For example, Kupske et al. (2025) found that physical function—particularly gait speed and handgrip strength—was a dominant predictor of ADL independence among nonagenarians, surpassing cognitive status. Their findings suggest that physiological decline may overshadow cognitive knowledge in determining functional outcomes, a pattern consistent with the present study's results.Education also emerged as a potential confounder. Although not statistically significant in the final model, low educational attainment showed a trend toward higher ADL impairment. Education is known to influence health literacy, comprehension of rehabilitation instructions, and the ability to internalize ADL-related knowledge. Studies on sensory impairment (Parminder Raina, Micheline Wong, & Massfeller, 2004) and osteoarthritis (Adnani, Hikmawati, Sihapark, Suharyanta, & Widiyaningsih, 2022) similarly report that lower education is associated with greater functional limitations and reduced independence. In the context of stroke, limited education may hinder patients' ability to understand rehabilitation principles, thereby weakening the pathway between ADL knowledge and functional performance.

Functional independence after stroke should therefore be interpreted as a multidimensional outcome influenced by clinical and contextual factors, including lesion severity, spontaneous neurological recovery, rehabilitation exposure, neuroplasticity, comorbidities, motivation, environmental barriers, and caregiver practices. Accordingly, ADL knowledge may contribute to recovery-related behavior, but it should not be interpreted as the sole or direct determinant of independence.

The role of functional impairment itself, which is captured through the Barthel Index, represents another critical confounding factor. Stroke severity, motor deficits, balance problems, and endurance limitations directly affect ADL performance regardless of knowledge. The literature consistently shows that physical function is a primary determinant of independence. For instance, Kupske et al. (2025) demonstrated that handgrip strength and Timed Up and Go (TUG) performance were strong predictors of ADL independence, while cognitive scores did not remain significant in adjusted models. Similarly, Aiello et al. (2024) found that behavioral and

cognitive features influenced ADL performance in ALS patients only after accounting for motor confounders, emphasizing that physical disability often masks or moderates cognitive contributions. These findings reinforce the notion that ADL knowledge alone cannot compensate for substantial physical limitations, explaining why knowledge did not remain significant in the multivariate model of this study.

The study by Wu et al. (2024) reported that the Barthel Index (BI) score is significantly associated with the occurrence of pneumonia among older adults with stroke. Their findings further indicate that patients with lower BI scores have a substantially higher risk of developing stroke-related pneumonia compared with those who demonstrate higher functional independence. Similarly, Wouda, Geerars, Pisters, Visser-Meily, and Punt (2025) noted that post-stroke daily activities can be influenced by motion-sensor technology, which may support gait stability, improve movement patterns, and enhance patients' functional independence.

Other demographic variables such as gender, occupation, income, and duration of stroke did not show significant associations with ADL independence. However, their potential confounding influence should not be dismissed. Income and occupation may shape access to rehabilitation services, assistive devices, and caregiver support. Duration of stroke may influence the extent of neurological recovery or chronic adaptation to disability. Although these variables were not statistically significant, they may still exert subtle effects on both knowledge acquisition and functional performance, consistent with findings from Thailand Tubklay, Siramaneerat, and Bhumkittipich (2025), where socioeconomic factors influenced ADL outcomes among older adults.

The study by Bi et al. (2024) further explains that low Activities of Daily Living (ADL) performance among stroke patients may be influenced by serum albumin levels. Reduced albumin concentrations are associated with a higher risk of severe functional impairment, as reflected by a Barthel Index score below 40. This condition indicates that patients experience high dependency and require substantial assistance to perform basic daily activities.

The clinic context and rehabilitation pathway are important for interpreting the findings. Participants were recruited from an outpatient neurology clinic where follow-up care, medication monitoring, education, and referral to rehabilitation services are routinely provided. Because some patients may have been receiving physiotherapy, occupational therapy, speech therapy, or home-based rehabilitation, their ADL knowledge and Barthel Index scores may partly reflect prior or ongoing rehabilitation exposure. Patients who attend therapy more consistently may receive repeated education, practice ADL techniques more frequently, and have greater opportunities to develop confidence in daily activities. Conversely, patients with more severe impairment may be referred more often but remain dependent because of physical limitations. Therefore, rehabilitation exposure should be considered a contextual factor that may confound or modify the observed association between ADL knowledge and functional independence.

The significant association between ADL knowledge and independence observed in bivariate analysis suggests that knowledge plays an important role in shaping self-management behaviors, rehabilitation adherence, and confidence in performing daily tasks. This aligns with behavioral models of post-stroke recovery, where knowledge enhances self-efficacy, problem-solving, and engagement in therapeutic activities. However, the attenuation of this association in multivariate analysis indicates that knowledge operates within a broader ecological framework. Physical function, age-related decline, and educational background may either facilitate or constrain the translation of knowledge into functional performance.

From a clinical perspective, this means that ADL knowledge should be treated as an intervention target, not merely as a descriptive patient characteristic. A practical pathway can be specified as follows: structured ADL education improves understanding of safe performance and adaptation strategies; improved understanding supports self-efficacy, goal setting, and problem solving; stronger self-efficacy and clearer goals promote adherence to rehabilitation exercises and repeated ADL practice; caregiver education reinforces safe assistance, environmental modification, and encouragement of patient participation; and these behavioral changes may contribute to greater functional independence when physical capacity allows. Thus, the knowledge–independence association is clinically actionable because it suggests concrete points

for intervention, including patient-centered ADL teaching, teach-back assessment, caregiver training, home-practice plans, and reinforcement during outpatient follow-up. However, because this study was cross-sectional and knowledge was not independently significant after adjustment, the proposed pathway should be interpreted as a plausible clinical mechanism to be tested in longitudinal or interventional studies rather than as evidence of causality.

Limitations of the study. This study has several limitations that should be considered when interpreting the findings. First, because the study used a cross-sectional design, temporality cannot be established; therefore, it is not possible to determine whether better ADL knowledge led to greater functional independence or whether more independent patients acquired greater ADL knowledge through rehabilitation exposure and daily practice. Second, the use of purposive sampling may have introduced selection bias, as respondents were recruited based on eligibility and accessibility rather than through random sampling. Consequently, the sample may not fully represent all post-stroke patients in the wider community.

Third, the exclusion of patients with severe communication, cognitive, visual, or literacy limitations may have limited the inclusion of patients with more severe post-stroke disability. This literacy-based and communication-related exclusion may have resulted in a sample with relatively better cognitive and communicative ability than the broader post-stroke population. In addition, some questionnaires were completed with interviewer assistance, which may have helped participants understand the items but could also have influenced responses through social desirability, respondent acquiescence, or interviewer-related variation.

Fourth, information bias may have occurred because data on knowledge and functional independence were collected using questionnaire responses, respondent reports, caregiver input, and interviewer-administered assessment. Respondents or caregivers may have overestimated or underestimated usual ADL performance, and recall or reporting differences may have affected the accuracy of the information. Fifth, although the knowledge questionnaire underwent validity and reliability testing, uncertainty remains regarding the extent to which the instrument fully captures the multidimensional construct of ADL knowledge among post-stroke patients, particularly across different educational and cultural backgrounds.

Sixth, the Barthel Index categories used in this study may have some overlap in clinical interpretation, especially around adjacent categories such as moderate dependence, mild dependence, and independence. This may reduce the precision of categorizing functional status and may partly explain the instability observed when multinomial logistic regression was attempted. Seventh, the study did not include standardized measures of stroke severity, lesion characteristics, motor impairment, aphasia severity, cognitive function, depression, or rehabilitation intensity. The absence of these stroke-severity and cognitive measures limits the ability to determine how much of the observed association was explained by underlying neurological impairment or cognitive capacity.

In particular, the absence of a standardized neurological severity measure, such as the National Institutes of Health Stroke Scale (NIHSS), modified Rankin Scale, or documented motor impairment assessment, represents a major limitation. Without information on stroke severity and level of disability, the relationship between ADL knowledge and functional independence cannot be interpreted fully, because patients with more severe neurological impairment may have lower independence regardless of their knowledge level.

Eighth, although multivariate logistic regression was performed, the adjusted analysis was constrained by sample size, sparse response categories, and the need to merge outcome and predictor categories. As a result, residual confounding may remain, and the adjusted model may not fully account for important clinical, psychosocial, and rehabilitation-related factors. Finally, this was a single-center study conducted at the Neurology Clinic of RSUD dr. Doris Sylvanus, Palangka Raya. The findings may therefore have limited generalizability to post-stroke patients treated in other hospitals, rural settings, community-based rehabilitation programs, or regions with different healthcare access, rehabilitation resources, and sociodemographic characteristics.

Therefore, the findings should be generalized primarily to communicative post-stroke outpatients who are clinically stable enough to attend routine follow-up at a neurology clinic,

rather than to all stroke survivors, including those with severe communication impairment, severe cognitive impairment, acute deterioration, institutional care needs, or limited access to outpatient follow-up.

CONCLUSION

The conclusion of this study underscores that knowledge of Activities of Daily Living (ADL) is significantly associated with functional independence among post-stroke patients, even after accounting for demographic and clinical factors. While age emerged as the strongest independent predictor of ADL impairment which inconsistent with extensive geriatric and neurological literature, the findings also demonstrate that higher ADL knowledge contributes meaningfully to better functional outcomes, suggesting that cognitive understanding of daily activities plays a complementary role alongside physical recovery. This aligns with evidence from prior studies showing that knowledge enhances self-management, rehabilitation adherence, and self-efficacy, all of which support functional gains. The implications of these findings are substantial for clinical practice: structured education on ADL principles should be integrated into post-stroke rehabilitation programs, particularly for older adults who are at heightened risk of dependence. Rehabilitation teams, including nurses, physiotherapists, and occupational therapists that should prioritize patient-centered educational interventions that strengthen understanding of safe techniques, adaptive strategies, and the importance of daily practice. Furthermore, given that knowledge alone cannot overcome severe physical limitations, educational programs should be paired with targeted physical rehabilitation to maximize functional independence. Based on these insights, we recommend that hospitals and community health centers adopt standardized ADL education modules, ensure caregiver involvement in knowledge transfer, and incorporate ADL knowledge assessments into routine follow-up. Future research should explore longitudinal effects of ADL knowledge on functional trajectories, examine interactions between cognitive status and ADL learning capacity, and evaluate tailored educational interventions for diverse post-stroke populations. Collectively, these steps can strengthen rehabilitation outcomes, reduce long-term dependence, and enhance quality of life for stroke survivors.

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