Original Article

Caregiver Knowledge and Functional Status in Preventing Pressure Ulcers among Stroke Patients: A Cross-Sectional Study

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ABSTRACT

Background: Stroke is a leading cause of death and disability, often reducing patients' quality of life and increasing caregiver burden. Immobility after stroke raises the risk of pressure ulcers, worsening outcomes, and prolonging hospital stays. Caregivers are crucial in prevention, as their knowledge and functional ability affect care effectiveness. However, few studies have explored the direct link between caregiver knowledge and functional status in pressure ulcer prevention, particularly in home or community settings. This study aims to examine that relationship.

Methods: This cross-sectional study (June–July 2025) in Indonesia involved 38 primary caregivers of stroke patients, selected via consecutive sampling. Eligible caregivers were ≥18 years old, had ≥1 month of caregiving experience, and consented; professional caregivers and those caring for acute-phase patients were excluded. Data were collected using bilingual questionnaires on caregiver knowledge (15 items, $\alpha = 0.739$) and functional status (18 items, $\alpha = 0.878$). Descriptive statistics summarized participant characteristics, and Pearson's correlation analyzed the relationship between knowledge and functional status.

Results: Most caregivers were aged 46–55 (42.1%), female (76.3%), educated to junior/high school level (71.1%), and predominantly housewives (47.4%). A majority (76.3%) had no prior caregiving experience. The mean knowledge and functional status scores were 10.58 ± 1.605 and 61.95 ± 4.550, respectively. Pearson's correlation revealed a strong, significant positive relationship between caregiver knowledge and functional status ($r = 0.634$; $p < 0.001$), suggesting that greater understanding of pressure ulcer prevention is associated with improved caregiving performance in stroke care.

Conclusion: Caregivers' knowledge and functional status directly affect their effectiveness in stroke care. Better-informed caregivers more successfully prevent pressure ulcers, emphasizing the need for structured training programs that build skills and confidence, improve patient outcomes, and reduce complications.

Keywords: Stroke; Pressure Ulcer; Caregivers; Functional Status; Nursing Care.

Implications for Practice:

- Structured training programs should be implemented to enhance caregivers' knowledge and functional skills in pressure ulcer prevention.
- Emphasis on caregiver education can improve patient outcomes and reduce complications in stroke rehabilitation.
- Simple, community-based interventions can effectively support caregivers in providing quality post-stroke

Implications for Practice:

care in low- and middle-income countries.

Introduction

Stroke is a significant public health issue with profound implications for individual and societal healthcare systems. It occurs when there is a disruption in cerebral blood flow, leading to neurological deficits and brain dysfunction. Rather than being a single disease, stroke represents a range of cerebrovascular disorders that are influenced by various risk factors and mechanisms affecting the central nervous system (Murphy & Werring, 2023).

According to Lauritano et al. (2022), stroke is a rapidly progressing clinical syndrome characterized by focal or global disturbances in brain function that last for more than 24 hours or lead to death, with no identifiable cause other than a vascular origin. It is globally recognized as the third leading cause of death, following ischemic heart disease and COVID-19 (World Health Organization, 2021). The World Stroke Organization reports around 13.7 million new stroke cases each year, resulting in 5.5 million deaths, particularly in low- and middle-income countries, including Indonesia (Feigin et al., 2021)

The trend of stroke prevalence in Indonesia has declined over the past five years. According to the 2023 Indonesian Health Survey (IHS), the national stroke prevalence decreased from 10.9 per thousand in 2018 to 8.3 per thousand in 2023. Despite this overall reduction, East Kalimantan Province recorded a relatively high stroke prevalence in 2023, reaching 10 per thousand among individuals aged over 15 years—although this figure was lower than the 14.7 per thousand reported in 2018 (Kebijakan Pembangunan et al., 2024). East Kalimantan remains the fifth-highest province in Indonesia in terms of stroke patient numbers.

Stroke patients often experience mobility impairments such as hemiparesis, spasticity, and coordination deficits (Murphy & Werring, 2023). Platz, (2021) emphasizes the importance of structured rehabilitation pathways involving multidisciplinary interventions to address motor deficits and promote early mobilization. Prolonged immobility post-stroke increases the risk of complications, notably pressure ulcers (Yang et al., 2020).

Pressure ulcers develop from prolonged pressure on specific body areas, resulting in capillary occlusion, tissue ischemia, and damage to both the skin and underlying structures (Zaidi SRH, 2025). According to uneven local pressure in patients with limited mobility, it can lead to progressive tissue damage, which may range from redness (erythema) to deep open wounds. This risk is especially high in individuals with chronic illnesses and older adults, such as stroke patients, particularly when adequate preventive measures are not in place.

The risk factors for developing pressure injuries are generally divided into two categories: intrinsic factors related to the patient, such as immobility, poor nutritional status, and comorbid conditions, and extrinsic factors related to the care environment, including friction, excessive moisture, and improper use of assistive devices (Bååth et al., 2024). Pressure injuries can cause significant pain, compromise patient comfort, and increase the likelihood of severe infections (Afzali Borojeny et al., 2020). Research by (Amir et al. 2017) showed that 44% of hospitalized patients with pressure ulcers developed them before admission, highlighting the importance of early prevention. These ulcers can lead to serious complications,

such as sepsis, further diminishing the patient's quality of life (Roussou et al., 2023).

Caring for stroke patients requires active involvement from caregivers to address the patient's essential needs, such as maintaining hygiene, regularly monitoring body positioning to prevent pressure injuries, and ensuring adequate nutrition (Jammal et al., 2025). Caregivers' knowledge regarding pressure injury prevention is crucial for enhancing patients' physical recovery and minimizing the risk of complications (Farzan et al., 2023). Farzan et al. (2023) further emphasize that this knowledge is influenced by factors such as educational background, access to relevant information, and the availability of training programs.

A study conducted by Alabdulhadi et al. (2024) in Al Ahsa reveals that while most caregivers have a basic understanding of these issues, there is a significant gap in formal training that could improve pressure injury prevention practices. The research indicates that caregiver knowledge positively correlates with caregiving experience and participation in structured training programs. This highlights the importance of ongoing and well-structured education, which is essential for helping caregivers recognize the early signs of pressure injuries and enhancing their ability to implement preventive measures like scheduled repositioning, skin integrity monitoring, and appropriate nutritional support.

The functional status of caregivers is also a critical indicator of the effectiveness of stroke patient care (J.-H. Lee & Jung, 2023). Functional status refers to the caregiver's physical, psychological, and social capacity to perform caregiving tasks independently or with minimal assistance (Wang, 2004). A study by Cejalvo et al. (2021) revealed that the complex interplay of physical, psychological, and social factors shapes caregiver functional status. High caregiving demands, particularly when caring for individuals with physical disabilities, can lead to musculoskeletal disorders, fatigue, and a decline in overall quality of life. Moreover, emotional stress, anxiety, and depression further impair caregivers' ability to carry out daily activities. Protective factors such as strong social support, high self-esteem, and resilience have been shown to preserve caregivers' functional capacity and overall well-being. Conversely, an imbalance between caregiving demands and personal resources, compounded by insufficient training and lack of social recognition, significantly increases the risk of physical and mental functional decline among caregivers.

Caregiver knowledge and functional status are interrelated and mutually reinforcing. A study by Costa et al. (2022) demonstrated that enhancing caregiver knowledge through education and training positively impacts their functional capacity in caring for stroke patients.

This finding aligns with Swanson's theory of caring, which conceptualizes caring not merely as a technical task but as a relational and transformative process involving five components: knowing, being with, doing for, enabling, and maintaining belief (Swanson, 2018). In the context of this study, caregiver knowledge reflects the 'knowing' and 'enabling' elements, allowing caregivers to understand patient needs and empower care. At the same time, functional status encompasses 'doing for' and 'being with', referring to their physical presence and capacity to perform necessary tasks. Thus, Swanson's theory provides a theoretical bridge connecting these two variables.

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knowledge through education and training positively impacts their functional capacity in caring for stroke patients. This finding aligns with Swanson's theory of caring, which conceptualizes caring as a technical task and relational and transformative process (Swanson, 2018). Caregiver knowledge is not simply informational, it constitutes an enabling process that strengthens their functional ability to prevent decubitus ulcers (Sanjuán et al., 2023). Meanwhile, caregivers' functional status reflects their capacity to effectively ("doing for") the patient, shaped by their understanding ("knowing") and emotional engagement ("being with") (Theng et al., 2023). Preventing pressure injuries requires repetitive actions, meticulous attention to detail, and sustained commitment, each of which represents a tangible expression of caring in practice.

Although numerous studies have explored pressure injury prevention, there remains a lack of empirical research specifically examining the relationship between caregiver knowledge and functional status in the context of stroke patients. Studies by Aulia Refriyani et al. (2025) and Tarihoran (2023) indicate that family knowledge significantly influences their role in pressure injury prevention; however, these studies have not explicitly measured caregivers' functional status. This underscores the need to investigate how knowledge and function interact in real caregiving practice.

This study aimed to examine the relationship between caregiver knowledge and functional status in preventing pressure ulcers among stroke patients in Indonesia, addressing the lack of empirical studies that connect these two dimensions.

Methods

Study Design

This study employed a cross-sectional design to examine the relationship between caregivers' knowledge and their functional status in preventing pressure ulcers among stroke patients. The study followed the Strengthening the Reporting of Observational Studies in Epidemiology (STROBE) guidelines to ensure methodological rigor, transparency, and accuracy in reporting. The cross-sectional design was chosen because it allows data to be collected at a single point in time, enabling the identification of associations between key variables without direct intervention. By adhering to the STROBE checklist, this study systematically addressed essential methodological elements, including participant selection, variable measurement, data analysis, and ethical considerations. This design provides a comprehensive snapshot of caregivers' current conditions and how their knowledge influences their caregiving performance, thereby offering a strong foundation for developing evidence-based educational interventions to enhance caregiver competence in stroke care.

Participants

This study was conducted in East Kalimantan Province, Indonesia, from June to July 2025. The setting included healthcare facilities that provide post-stroke care and rehabilitation services, where family caregivers directly assisted stroke patients during their recovery process. The study population consisted of primary caregivers who met the eligibility criteria and were identified through coordination with healthcare providers in these facilities. Participants were recruited consecutively throughout the data collection period to ensure that all eligible caregivers were included until the target sample size was achieved.

Data collection was performed through face-to-face interviews using structured, bilingual questionnaires (Indonesian and English) administered by trained

enumerators under the supervision of the principal investigator. Each session was conducted in a private and comfortable setting to maintain confidentiality and minimize response bias. Before data collection, enumerators received standardized training to ensure consistency in administering the instruments. No exposure or follow-up procedures were applied, as this was a cross-sectional observational study in which all data were obtained at a single point in time. All data collection activities were performed in compliance with the ethical standards for research involving human participants and received prior approval from the institutional Health Research Ethics Committee.

Instruments

This study was conducted in Indonesia and employed a consecutive sampling technique, a non-probabilistic method in which each eligible participant who met the inclusion criteria was recruited consecutively during the data collection period. The inclusion criteria were as follows: (1) primary caregivers who directly cared for stroke patients at home, (2) aged 18 years or older, (3) had provided care for at least one month, and (4) voluntarily agreed to participate by signing a written informed consent form. The exclusion criteria included: (1) professional or paid caregivers (e.g., nurses or healthcare workers) without a familial relationship to the patient, and (2) caregivers of stroke patients in the acute phase or those currently receiving hospital-based care.

The sample size was determined using a statistical formula for cross-sectional studies with a correlational analysis framework, assuming a 95% confidence level, a 5% margin of error, and an estimated correlation coefficient (r) of 0.40 based on prior studies. The minimum required sample was calculated to be 35 participants; after adjusting for a potential 10% nonresponse rate, the final target sample size was set at 38 caregivers. All participants completed the survey, resulting in no dropouts or missing data during the data collection period.

This sampling procedure ensured that all eligible caregivers from the target population were proportionally represented during the study period. The final sample size provided sufficient statistical power to identify the association between caregiver knowledge and functional status in Indonesia's stroke care context.

This study included two primary variables: caregiver knowledge of pressure ulcer prevention as the exposure variable, and caregiver functional status as the outcome variable. Caregiver knowledge was defined as the level of understanding possessed by caregivers regarding the causes, risk factors, and preventive measures related to pressure ulcer development in stroke patients. This construct reflects the caregivers' cognitive ability to recognize early signs of pressure injury and implement preventive strategies such as patient repositioning, skin monitoring, and maintaining adequate nutrition and hygiene.

Caregiver functional status was defined as the caregiver's capacity to perform daily caregiving tasks effectively, encompassing both physical and psychosocial domains. It represents how caregivers can provide consistent, safe, and supportive care to stroke patients without external assistance. A higher functional status score indicates better performance and self-efficacy in caregiving practices.

In this cross-sectional design, caregiver knowledge served as the predictor variable influencing functional status. No diagnostic or clinical criteria were applied, as both variables were measured using structured, validated self-report questionnaires rather

than clinical evaluation. Potential confounders such as age, gender, educational level, and caregiving experience were recorded but not included in the primary analysis, as they were not the focus of this study. The relationships between the variables were examined under the assumption of normal distribution and linear association.

Data Collection

Data were collected using two structured questionnaires developed to assess the main variables of the study: (1) caregiver knowledge of pressure ulcer prevention, and (2) caregiver functional status. Both instruments were designed in bilingual format (Indonesian and English) to enhance comprehension and cultural appropriateness for the target respondents.

The Caregiver Knowledge Questionnaire was adapted from the instrument developed by Atiqoh M.N. (2017), with minor modifications to align with the context of stroke care in Indonesia. The adaptation process followed rigorous psychometric procedures. Content validity was established through expert review by three medical-surgical nursing faculty members, who evaluated each item's relevance, clarity, and cultural suitability. Construct validity was tested using Pearson's product–moment correlation, yielding item-total correlation coefficients (r-values) ranging from 0.407 to 0.610, all exceeding the critical r-table value of 0.344. Reliability testing using Cronbach's alpha produced a coefficient of 0.739, indicating acceptable internal consistency.

The questionnaire consisted of 15 true–false statements related to the definition, risk factors, and prevention of pressure ulcers. Each correct answer was scored as 1, and each incorrect answer as 0, producing a total possible score ranging from 0 to 15. Higher scores reflected greater caregiver knowledge regarding pressure ulcer prevention.

The Caregiver Functional Status Questionnaire was adapted from Hartati J. (2015), with contextual modifications to better represent the caregiving responsibilities associated with stroke patients. The instrument contained 18 items designed to assess the frequency of caregiving activities related to mobility support, personal hygiene assistance, nutrition, medication adherence, and pressure ulcer prevention. A four-point Likert scale was used to capture the frequency of each activity: Always (4), Often (3), Sometimes (2), and Never (1). Higher total scores indicated better functional status in performing caregiving tasks. Validity analysis revealed item-total correlation coefficients between 0.490 and 0.865, confirming strong item validity. Cronbach's alpha for the functional status questionnaire was 0.878, demonstrating high internal consistency and reliability.

Both instruments underwent a forward–backward translation process to ensure linguistic accuracy and conceptual equivalence. Initially, a bilingual nursing expert translated the original English versions into Indonesian. The translated version was then independently back-translated into English by a professional linguist unfamiliar with the original instruments. The two English versions were compared to identify and resolve any discrepancies through expert consensus, ensuring that the final bilingual tools accurately conveyed the intended meaning of each item.

All instruments were pretested among five caregivers outside the main study population to evaluate readability, clarity, and cultural relevance. The results confirmed that the wording was easily understood and that no further modifications were required before formal data collection (**Table 1** and **Table 2**)

Table 1. Caregiver knowledge assessment tool on pressure ulcer prevention – bilingual version (Indonesian and English versions)

No.	Statement Indonesia Version	Statement English Version
1.	Luka tekan adalah kerusakan pada kulit atau bagian bawahnya yang terjadi karena ada tekanan yang terus menerus dan terlalu lama pada satu bagian tubuh.	A pressure ulcer is damage to the skin or its underlying tissue caused by continuous and prolonged pressure on a specific part of the body.
2.	Nama lain luka tekan adalah luka baring (borok).	Another term for pressure ulcers is bedsores (or sores).
3.	Luka tekan terjadi karena bagian kulit tertentu terlalu lama tertekan, sehingga aliran darah ke area tersebut menjadi terhambat.	Pressure ulcers occur when certain areas of the skin are subjected to prolonged pressure, which impedes blood flow to the affected area.
4.	Luka tekan biasanya terjadi pada bagian tulang yang menonjol seperti pada daerah bagian punggung, bahu, dan pantat.	Pressure ulcers typically occur over bony prominences, such as the back, shoulders, and buttocks.
5.	Daerah dada dan perut merupakan daerah yang paling sering mengalami luka tekan.	The chest and abdominal areas are among the most common sites for pressure ulcers.
6.	Tanda kemerahan pada kulit yang tidak hilang saat ditekan dengan jari bukan termasuk tanda awal terjadi luka tekan.	A redness on the skin that does not disappear when pressed with a finger is not an early indication of a pressure ulcer.
7.	Luka tekan akibat terlalu lama berbaring biasanya terlihat seperti kulit lecet atau melepuh.	Pressure ulcers caused by prolonged lying down typically appear as skin abrasions or blisters.
8.	Gejala luka tekan yang parah tidak sampai merusak otot dan tulang pasien.	Severe symptoms of pressure ulcers do not extend to damaging the patient's muscles or bones.
9.	Pasien yang berbaring terlalu lama tanpa bergerak dan berubah posisi berisiko terkena luka tekan.	Patients who remain in a lying position for extended periods without moving or changing positions are at risk of developing pressure ulcers.
10.	Gesekan pada punggung pasien saat penggantian sprei yang tidak hati-hati dapat menyebabkan terjadinya luka tekan.	Friction on the patient's back during careless bed sheet changes can lead to the development of pressure ulcers.
11.	Kulit pasien yang terlalu lembab tidak akan mengalami luka tekan.	Excessively moist skin does not result in pressure ulcers.
12.	Terjadinya luka tekan pada pasien tidak dipengaruhi oleh usia pasien tersebut.	The patient's age does not influence the occurrence of pressure ulcers in patients.
13.	Perubahan posisi setiap 2 jam sekali dapat mengurangi risiko terjadinya luka tekan.	Regularly repositioning the patient every two hours is an effective strategy to minimize the risk of pressure ulcer formation.
14.	Risiko terjadinya luka tekan dapat dikurangi dengan cara selalu menjaga kulit pasien agar tetap bersih dan kering.	Maintaining the cleanliness and dryness of the patient's skin can help reduce the risk of pressure ulcer development.
15.	Untuk menjaga agar tubuh terhindar dari penekanan saat berbaring dalam waktu lama dapat menggunakan bantal, selimut, gulungan handuk dan busa karet.	To prevent pressure on the body during prolonged lying down, pillows, blankets, rolled towels, and foam pads can be used.

Table 2. Caregiver functional status instrument – bilingual version (Indonesia and English versions)

No.	Statement Indonesia Version	Statement English Version
1.	Saya membantu pasien dalam melakukan aktifitas fisik dengan menggerakan anggota badan dan perubahan posisi di tempat tidur guna mengurangi risiko luka tekan.	I assist the patient in performing physical activities by moving their limbs and changing positions in bed to reduce the risk of pressure ulcers.

No.	Statement Indonesia Version	Statement English Version
2.	Saya membantu mendukung posisi tubuh pasien untuk mencegah luka tekan misalnya dengan memindahkan posisi tubuh pasien menggunakan bantalan atau kasur khusus.	I assist in supporting the patient's body position to prevent pressure ulcers, for example, by repositioning the patient using cushions or specialized mattresses.
3.	Saya membantu pasien stroke dalam merawat kebersihan diri seperti mandi, menyisir rambut dan menyikat gigi setiap hari.	I assist stroke patients with personal hygiene tasks, such as bathing, brushing their hair, and brushing their teeth daily.
4.	Saya membantu dan melatih pasien berpakaian dengan benar.	I assist and train the patient to dress properly.
5.	Saya secara rutin mengganti pakaian dan sprei pasien yang kotor dan basah untuk mencegah adanya infeksi kulit.	I regularly change the patients' soiled and damp clothing and bed linens to prevent skin infections.
6.	Saya melakukan perawatan kulit pasien, seperti memijat, mengelap, memberikan bedak atau pelembab dan menjaga kulit tetap kering.	I provide skin care for the patient, such as massaging, wiping, applying powder or moisturizer, and keeping the skin dry.
7.	Saya mampu membantu pasien untuk buang air besar/ kecil baik di kamar mandi/ toilet maupun ditempat tidur (pispot) untuk menjaga kulit tetap kering.	I am able to assist the patient with bowel and bladder movements, whether in the bathroom/toilet or in bed (using a bedpan), to keep the skin dry.
8.	Saya membantu mengganti celana atau pampers pasien setelah buang air besar/kecil untuk menjaga kebersihan kulit.	I assist in changing the patient's pants or diapers after bowel or bladder movements to maintain skin cleanliness.
9.	Saya memeriksa kondisi buang air pasien (bau, warna, jumlah) untuk mencegah iritasi atau infeksi kulit.	I monitor the patient's elimination (odor, color, quantity) to prevent skin irritation or infection.
10.	Saya mengingatkan pasien untuk makan tepat waktu dan menghindari makanan dengan kolestrol dan garam tinggi.	I remind the patient to eat on time and avoid foods high in cholesterol and salt.
11.	Saya membantu pasien stroke dengan menyiapkan makanan bernutrisi yang dapat mendukung penyembuhan dan mencegah luka tekan.	I assist stroke patients by preparing nutritious meals that support healing and help prevent pressure ulcers.
12.	Saya membantu pasien untuk melakukan kontrol rutin ke rumah sakit atau dokter tepat waktu.	I assist the patient in attending routine check-ups at the hospital or with the doctor on time.
13.	Saya membantu pasien minum obat tepat waktu untuk mencegah komplikasi.	I assist the patient in taking medication on time to prevent complications.
14.	Saya dengan seksama mengikuti anjuran dokter untuk perawatan di rumah, termasuk membeli obat-obatan yang diresepkan, menghindari makanan tertentu, menghentikan kebiasaan buruk seperti merokok, dan melakukan perawatan kulit sesuai petunjuk.	I closely follow the doctor's advice for home care, including purchasing prescribed medications, avoiding certain foods, quitting harmful habits like smoking, and providing skin care as instructed.
15.	Saya memberikan semangat dan dukungan kepada pasien selama masa perawatan baik di rumah sakit maupun di rumah.	I encourage and support the patient during their care, both in the hospital and at home.
16.	Saya membantu menopang tubuh pasien yang lemah saat berjalan agar tidak jatuh atau cedera.	I assist in supporting the patient's weak body while walking to prevent falls or injuries.
17.	Saya memastikan lingkungan sekitar tempat tidur pasien tetap rapi dan bebas dari benda yang dapat membahayakan keselamatan pasien.	I ensure that the area around the patient's bed remains tidy and free from objects that could pose a safety risk to the patient.
18.	Saya mengawasi aktivitas pasien setiap hari agar terhindar dari risiko cedera dan mencegah luka tekan.	I monitor the patient's activities daily to prevent the risk of injury and avoid pressure ulcers.

Bias

Several methodological precautions were implemented throughout the study to minimize potential sources of bias. Selection bias was reduced by applying a consecutive sampling technique in which all eligible caregivers who met the inclusion criteria were enrolled sequentially during the data collection period, ensuring objectivity and consistency in participant recruitment. Information and measurement bias were addressed through the use of standardized, bilingual (Indonesian English) questionnaires that had been previously validated and tested for reliability. The instruments were administered consistently by trained enumerators who followed a standardized protocol to maintain procedural uniformity. Participants were assured of confidentiality and anonymity to mitigate response bias and encourage honest reporting. Recall bias was minimized by asking respondents to base their answers on current caregiving activities rather than past experiences. In addition, data quality was safeguarded through regular supervision during data collection and independent double verification of completed questionnaires to prevent data entry errors and enhance overall data accuracy and reliability.

Study size

The study sample size was determined using a statistical formula for correlation analysis in cross-sectional research, considering the expected correlation coefficient (r), significance level (α), and statistical power (1–β). Based on previous studies reporting moderate correlations between caregiver knowledge and functional capacity ($r \approx 0.40–0.60$), the minimum required sample size was calculated using $\alpha = 0.05$ and 80% power, resulting in a minimum of 35 participants. To anticipate potential non-responses or incomplete questionnaires, an additional 10% was included, bringing the final total to 38 participants.

Beyond statistical considerations, the sample size was also determined by feasibility and representativeness. The study was conducted within a single provincial healthcare context in Indonesia, focusing on a defined population of primary stroke caregivers available during the study period. Therefore, 38 respondents represented an adequate and realistic sample for ensuring data completeness and internal validity, while remaining consistent with the study's cross-sectional and exploratory nature. This approach aligns with recommendations for small-to-medium-scale nursing studies that prioritize methodological rigor within practical field constraints.

Quantitative Variables

All quantitative variables in this study were treated as continuous and analyzed using parametric statistical methods, as both the caregiver knowledge and functional status scores met the assumption of normality. Descriptive statistics, including the mean, standard deviation, and range, were used to summarize the central tendency and variability of the data. No categorical grouping or cutoff points were applied, allowing the variables to remain continuous and ensuring greater precision in detecting relationships. The Pearson product–moment correlation coefficient was employed to assess the linear association between caregiver knowledge and functional status. This analytical approach was selected to maintain statistical rigor and capture the full dataset variability, consistent with best practices in cross-sectional quantitative nursing research.

Data Analysis

All statistical analyses were performed using the Statistical Package for the Social

Sciences (SPSS) version 26. Descriptive statistics were first applied to summarize participants' demographic characteristics and the distribution of key variables, including caregiver knowledge and functional status. Measures of central tendency (mean, median) and dispersion (standard deviation, range) were reported to provide a clear overview of data variability. The normality of quantitative variables was assessed using the Shapiro–Wilk test, which is appropriate for small sample sizes (<50). Both variables met the normality assumption ($p > 0.05$), allowing the use of parametric statistical methods. The Pearson product–moment correlation coefficient was then used to examine the linear association between caregiver knowledge and functional status. Statistical significance was set at $\alpha = 0.05$, and all analyses were two-tailed.

No subgroup or interaction analyses were conducted, as the study focused exclusively on the overall relationship between the two continuous variables. Potential confounding was minimized through consistent inclusion and exclusion criteria, standardized data collection procedures, and validated instruments. Missing data were minimal (<5%) and were addressed using listwise deletion to maintain analytical consistency without materially affecting statistical power. The cross-sectional sampling strategy was considered by performing complete-case analysis and ensuring that all participants met the predefined eligibility criteria. Sensitivity analyses were deemed unnecessary, as the dataset was complete, and no imputation or weighting procedures were required.

Ethical Considerations

This study underwent a comprehensive ethical review and was approved as ethically acceptable under Ethical Clearance Letter No. 50/KEPK-AWS/VI/2025, issued by the Health Research Ethics Committee (HREC) of Abdoel Wahab Sjahranie General Hospital, Samarinda, Indonesia. The ethical evaluation was conducted in accordance with the seven fundamental research ethics principles established by the World Health Organization (WHO, 2011), including social value, scientific validity, fair distribution of burdens and benefits, risk assessment, protection against exploitation, confidentiality and privacy, and informed consent.

Furthermore, the study adhered to the international ethical guidelines set forth by the Council for International Organizations of Medical Sciences (CIOMS, 2016), ensuring alignment with globally recognized ethical standards for research involving human participants. Prior to data collection, institutional authorization and coordination were obtained from the hospital administration, ward management, and nursing staff at the Stroke Unit to facilitate participant recruitment. All participants were informed about the study objectives, procedures, and their rights, and written informed consent was obtained before participation to ensure voluntary involvement in accordance with approved ethical procedures.

Results

The respondents involved in this study were 38 stroke patient caregivers. The characteristics of the respondents included age, gender, education, occupation, experience, and their relationship with the patient (**Table 3**).

Table 3. Demographic Data and Characteristics of Respondents

No.	Variable	Category	n (%)
1.	Age	17-25 years	2 (5.3)
		26-35 years	11(28.9)
		36-45 years	9 (23.7)
		46-55 years	16 (42.1)
2.	Sex	Male	9 (23.7)
		Female	29 (76.3)

No.	Variable	Category	n (%)
3.	Education Level	Primary School	3 (7.9)
		Junior/Senior High	27 (71.1)
		Higher Education	8 (21.0)
4.	Occupation	Entrepreneur	8 (21.0)
		Farmer	3 (7.9)
		Employee	3 (7.9)
		Housewife	18 (47.4)
		Unemployed	2 (5.3)
5.	Relationship with Patient	Parent	0 (0)
		Husband	4 (10.5)
		Wife	16 (42.1)
		Child	15 (39.5)
		Grandchild	3 (7.9)
6.	Caregiving Experience	Yes	9 (23.7)
		No	29 (76.3)

The demographic data and characteristics of the respondents are presented in Table 3. Most caregivers fall within the productive age group, with the largest segment being those aged 46–55 years, comprising 16 individuals (42.1%). This indicates that caregiving roles are largely undertaken by individuals in the mature adult phase, who generally have greater family responsibilities. The majority of respondents were female, with 29 out of 38 individuals (76.3%), reflecting the common trend of caregiving predominantly being performed by women within the family context. The most common education level among respondents was junior to senior high school, with 27 respondents (71.1%), which could influence their access to and understanding of health information and their ability to follow medical instructions. In terms of occupation, the largest group of caregivers were housewives, with 18 individuals (47.4%), indicating full involvement in the care of stroke patients at home and potentially greater time flexibility. The relationship with the patient was predominantly with spouses and children, with 16 respondents (42.1%) being wives and 15 (39.5%) being children. This suggests a strong emotional attachment in the caregiving role, which may influence motivation and commitment to care. Interestingly, most of the respondents did not have prior caregiving experience, with 29 individuals (76.3%), which could be an important factor in assessing their preparedness and effectiveness in caregiving, as well as the need for additional training or education.

To evaluate the relationship between knowledge and the functional status of caregivers in preventing pressure ulcers in stroke patients, bivariate analysis was conducted using the Pearson Product-Moment Correlation method. This technique was chosen based on the continuous nature of both variables and the normal distribution assumption, which had been verified beforehand. The normality assumption was tested using the Shapiro–Wilk test, which is recommended for small samples (<50 respondents). The test results showed that the knowledge variable had a p-value of 0.275, while the caregiver's functional status variable had a p-value of 0.205. Both values exceeded the significance threshold of $\alpha = 0.05$, indicating that the data distribution for both variables did not deviate significantly from a normal distribution ($p > 0.05$).

Table 4. Knowledge and Caregiver Functional Status

Variables	Score Min-Max	Mean ± SD	Correlation Coefficient (r)	p-value	Interpretation
Knowledge	7-14 (0-15)	10.58 ± 1.605	0.634	<0.001	Strong Positive Correlation
Functional Status	54-70 (18-72)	61.95 ± 4.550			

Note: p-value < 0.01 denotes statistical significance

The average caregiver knowledge score regarding pressure ulcer prevention is 10.58, with a standard deviation (SD) of ±1.605. This score suggests that caregivers demonstrate moderate knowledge levels, with relatively consistent scores across respondents. Meanwhile, the average functional status score of caregivers is 61.95, with an SD of ±4.550. This reflects that most caregivers can perform their caregiving roles and responsibilities effectively in caring for stroke patients, although there is a slight variation in the functional capacity across individuals.

The Pearson correlation analysis results reveal a significant association between the caregivers' knowledge level and their functional status in providing care for stroke patients. The correlation coefficient (r = 0.634) indicates a strong positive correlation, meaning that the higher the caregivers' knowledge level, the better their functional status in performing caregiving duties. Caregiver knowledge goes beyond information; it enables effective functional performance by providing a foundation for informed decisions and consistent preventive actions. This correlation is linear and direct, suggesting that an increase in caregivers' understanding of pressure ulcer prevention is closely related to their improved ability to carry out consistent and effective caregiving actions. The p-value of < 0.001 signifies that the relationship is statistically significant at the 99% confidence level ($p < 0.001$), implying an extremely low probability that this result is due to chance. These findings emphasize the importance of educational interventions in enhancing caregivers' knowledge as a key determinant of caregiving effectiveness, particularly in the context of pressure ulcer prevention in stroke patients (**Table 4**).

Discussion

This study highlights a strong and statistically significant association between caregivers' knowledge of pressure ulcer prevention and their functional status in caring for stroke patients ($r = 0.634$; $p < 0.001$). These findings underscore the importance of knowledge, not only as a cognitive foundation but also as an active factor that shapes caregivers' preparedness and enhances the effectiveness of their care, especially in preventing pressure ulcers. Pressure ulcers are a preventable complication but continue to be a major concern, especially in stroke patients with limited mobility. Preventing these ulcers requires caregivers to take proactive, structured steps, such as regular repositioning, skin care, and ensuring proper nutrition. In this context, caregivers are responsible for physical assistance and play a central role in delivering basic nursing interventions at home. As such, their functional capacity is a critical factor in determining the quality of life for stroke patients (Mervis & Phillips, 2019).

This study reinforces the view that knowledge is a fundamental foundation in shaping functional actions. Caregivers who understand the mechanisms behind pressure ulcers, the risk factors, and effective preventive measures are more likely to perform caregiving practices in a

consistent, focused, and accurate manner. This is reflected in the high functional status scores of caregivers with good knowledge. These findings align with the caring theory (Swanson, 2018), which positions the dimensions of "knowing" and "doing for" as integral elements of relational-based nursing actions. The knowledge that caregivers possess is not just information; it becomes a driving force in decision-making and meaningful preventive actions. Knowledge (knowing) is the first and foundational element that allows caregivers to understand the patient's condition, the risks of pressure ulcers, and the prevention strategies that need to be implemented consistently. This process is subsequently translated into preventive measures, including actions such as repositioning the patient every two hours, maintaining skin cleanliness and moisture, and ensuring that the patient's nutritional and hydration requirements are adequately addressed.

These findings are also consistent with several studies, including one by Lee & Lee, (2022) in South Korea, which confirmed a significant correlation between knowledge of pressure ulcers and caregiving performance, with a correlation coefficient of $r = 0.692$; $p < 0.001$. This study demonstrated that caregivers with a strong understanding could consistently and effectively apply pressure ulcer prevention strategies in long-term care settings, a role that structurally mirrors that of family caregivers in home care environments. A study by Tuncer et al. (2024) further demonstrated that direct, face-to-face training provided to caregivers significantly improved their skills in preventing pressure ulcers, compared to interventions based on printed media or written instructions. Such interventions enhance knowledge and strengthen caregivers' confidence and self-efficacy, ultimately improving their functional capacity.

However, not all caregivers have an adequate educational background or access to health information. A study by Sen & Kilic, (2024) found that the average score of most caregivers in Turkey was low, with an average of only 22.25 out of 40 points, and the majority had never received prior training. Similarly, research by Sari et al. (2025) revealed that 61% of family caregivers in Indonesia had inadequate knowledge about pressure ulcer prevention. Although they had positive attitudes towards prevention, actual practices were still very limited. The barriers identified included low levels of education, limited health literacy, and lack of access to training. This highlights the need for knowledge enhancement to be accompanied by accessible, sustainable, and contextually relevant educational interventions tailored to local socio-cultural conditions. Globally, social and psychological factors also influence caregiver performance. A qualitative study by Chen et al., (2025) in China found that caregivers without adequate knowledge often experience high emotional burdens, uncertainty in caregiving, and anxiety about complications, which ultimately lowers their functional status. This situation illustrates that structured education is not only crucial for improving technical skills but also plays a significant role in reducing emotional stress, which can weaken caregiving performance.

Thus, this study makes an important empirical contribution by reinforcing the association between caregiver knowledge and functional performance in stroke care, rather than establishing causality. Practically, these findings emphasize that caregiver education programs should no longer be considered an optional intervention, but rather a core component of family-based stroke patient care management. Caregivers equipped with adequate knowledge can act as agents of

change in preventing complications, improving patients' quality of life, and reducing secondary healthcare burdens caused by pressure ulcers.

This study also presents new opportunities for the advancement of community-based nursing intervention models. Education should not be limited to providing leaflets or verbal instructions but should be delivered through interactive methods such as simulation training, role-playing, or direct mentoring. These approaches are more effective in transferring knowledge while simultaneously shaping positive attitudes and habits in caregiving practices. Furthermore, from a research perspective, the results suggest the importance of exploring other mediating and moderating variables in the relationship between knowledge and functional status, such as self-efficacy, caregiver stress levels, and social support. Longitudinal and experimental studies, such as randomized controlled trials (RCTs), could be designed to evaluate the effectiveness of different home-based caregiver training models in reducing the incidence of pressure ulcers among stroke patients.

Implications and limitations

This study highlights the crucial role of caregiver knowledge in preventing pressure ulcers and enhancing functional performance in stroke care, showing that well-informed caregivers provide more effective and compassionate care, improving patient outcomes and quality of life. Practical implications include strengthening knowledge to improve preventive practices, incorporating psychological support in training to reduce caregiver stress, and integrating structured, evidence-based education into post-stroke care policies to ensure sustainable, family-centered practices. Despite its insights, the study is limited by its small, localized sample, cross-sectional design, and unexamined factors such as caregiver stress or patient severity, suggesting the need for broader, longitudinal, and qualitative research to better understand influences on caregiver performance.

Relevance to for Practice

The findings of this study hold direct practical relevance for nursing practice, particularly in strengthening caregiver competence through structured, nurse-led education. Nurses can implement community-based training initiatives, such as simulation exercises, practical demonstrations, and guided mentoring, to enhance caregivers' practical skills in preventing pressure ulcers. Integrating these educational interventions into post-stroke care across hospitals and community health services ensures that caregivers are equipped with the necessary knowledge, confidence, and consistency to deliver safe and effective home-based care. Moreover, tailoring these programs to the local social and cultural context can significantly improve their applicability, sustainability, and overall impact on patient outcomes.

Conclusion

This study shows a significant relationship between caregivers' knowledge of pressure ulcer prevention and their functional status in caring for stroke patients. Caregivers with good knowledge are more effective in implementing preventive care, such as regular repositioning and skin care, which enhances patients' quality of life. These findings emphasize the importance of caregiver education as an essential component of post-stroke care, which can reduce the risk of pressure ulcers and optimize patient care at home.

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CrediT Authorship Contributions Statement

Chrisyen Damanik: Conceptualization, Methodology, Data Curation, Writing - Original Draft, Supervision

Salwa Setya Anggun Pratama: Investigation, Formal Analysis, Writing - Review & Editing, Visualization, Project Administration

Conflicts of Interest

The authors declare no conflicts of interest, financial or otherwise, related to this manuscript. The research was carried out independently, with no external influence on the study's design, data collection, analysis, interpretation, or manuscript preparation.

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Supplementary Materials

Supplementary File S1: Questionnaire contains the full questionnaire used for data collection.

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