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Factors Associated With Family Caregivers' Knowledge and Attitudes Toward Home-Based Geriatric Care in Primary Healthcare: A Cross-Sectional Study

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ABSTRACT

Family caregivers play a central role in home-based geriatric care, especially in settings where institutional long-term care remains limited. However, caregiver capacity may vary according to socio-demographic, relational, and service-related factors. This study aimed to identify factors associated with family caregivers' knowledge and attitudes toward home-based geriatric care in a primary healthcare context. A quantitative analytic study with a cross-sectional design was conducted from September to December 2025 in two Puskesmas working areas in Batam City, Indonesia. A total of 326 family caregivers were recruited using proportional sampling. Data were collected through structured questionnaires and analyzed using univariate analysis, Chi-square tests, and multivariate logistic regression. Most caregivers had low knowledge (86.5%) and negative attitudes (61.0%) despite reporting high communication patterns and positive perceptions of healthcare facility quality. Bivariate analysis showed that economic status, caregiving duration, communication pattern, and perceived quality of healthcare facilities were significantly associated with knowledge, whereas economic status, communication pattern, and perceived quality of healthcare facilities were associated with attitudes. In the multivariate model, only caregiving duration (AOR = 15.790; $p < 0.001$) and communication pattern (AOR = 0.157; $p = 0.013$) remained independently associated with caregiver knowledge. No independent predictors were identified for attitudes. These findings indicate that caregiver knowledge was more strongly associated with experiential and relational factors, particularly caregiving duration and family communication. Structured, family-centered, and nurse-led interventions in primary healthcare may help strengthen caregiver preparedness in home-based geriatric care.

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INTRODUCTION

Population aging is one of the most consequential demographic transitions of the twenty-first century and is reshaping the priorities of health systems, long-term care provision, and community-based support worldwide. The World Health Organization has projected that the global population aged 60 years and older will reach 2.1 billion by 2050, while the number of people aged 80 years and older will more than triple during the same period. This demographic transition is especially salient in low- and middle-income countries, where the pace of aging is accelerating more rapidly than the development of formal long-term care systems. As longevity increases, so does the prevalence of multimorbidity, frailty, disability, cognitive decline, and dependency in activities of daily living, making sustained support in home and community settings increasingly necessary. In this context, home-based geriatric care is no longer a peripheral strategy, but a central component of healthy aging and aging-in-place agendas because it enables older adults to remain in familiar environments, preserve social ties, and maintain dignity and autonomy for as long as possible (World Health Organization [WHO], 2025;

Organisation for Economic Co-operation and Development [OECD], 2023; Jiang et al., 2024).

Within home-based geriatric care, family caregivers constitute the backbone of everyday support. Across OECD countries, about 60% of older adults with long-term care needs report receiving only informal care, and more than one in eight people aged 50 years and older provide informal care, with women accounting for the majority of carers. In Asia and other family-centered societies, this dependence on unpaid family support is often even more pronounced because institutional long-term care remains limited, unevenly accessible, or culturally less preferred than care provided by relatives. Family caregiving in later life therefore operates at the intersection of public health, social protection, gendered labor, and family responsibility. Rather than simply "assisting" older relatives, caregivers frequently become the de facto coordinators of long-term care, filling gaps left by fragmented formal services and adapting care routines in response to the progressive and fluctuating needs of older adults (Jiang et al., 2024; OECD, 2023; Schulz et al., 2020).

The practical realities of home caregiving are complex and demanding. Family caregivers may be expected to assist with bathing, dressing, toileting, feeding, transferring, medication management, symptom monitoring, appointment scheduling, transportation, emotional reassurance, and navigation of health and social services. Recent reviews have shown that informal caregivers of older adults often function not only as hands-on care providers but also as advocates, interpreters of clinical advice, care coordinators, and system navigators. In primary care settings, older adults frequently depend on family members to facilitate access to healthcare and manage daily household tasks related to treatment and recovery. Qualitative evidence further shows that caregivers often struggle with practical decisions around nutrition, mobility, hygiene, safety, behavioral symptoms, and chronic condition monitoring, especially when they have never received structured training. These home-based care demands make caregiving competence highly consequential, because mistakes or uncertainty in routine care can contribute to medication problems, preventable complications, delayed help-seeking, caregiver distress, and poorer outcomes for older adults (Hailu et al., 2024; Kim et al., 2023; Mizumoto et al., 2025).

For this reason, caregiver knowledge and caregiver attitudes should be understood as core proximal capacities rather than secondary background characteristics. Knowledge is essential because family caregivers must recognize symptoms, understand chronic disease management, implement basic preventive measures, and make day-to-day decisions that affect safety, function, comfort, and continuity of care. Attitude is equally important because caregiving is relational and sustained over time; caregivers' beliefs, willingness, motivation, emotional orientation, and perceived meaning of the role can influence whether care is delivered consistently, empathetically, and proactively. Caregivers with insufficient knowledge may provide incomplete or inappropriate care, while caregivers with negative attitudes may experience disengagement, frustration, avoidance, or low confidence in performing caregiving tasks. Evidence from Indonesia reinforces this concern. A recent cross-sectional study on pressure injury prevention among community-dwelling older adults found substantial gaps in family caregivers' knowledge, attitudes, and practices, indicating that even when families are highly involved in care, caregiving quality cannot be assumed in the absence of adequate preparedness and guidance. Similarly, qualitative work on elderly home care has emphasized that family caregivers often need clearer knowledge and stronger practical skills to carry out care effectively in domestic settings (Hailu et al., 2024; Sari et al., 2025).

More explicit theoretical framing helps clarify why knowledge and attitudes are central to home-based geriatric care and why they may be shaped by relational and service-related factors. Orem's Self-Care Deficit Nursing Theory is particularly relevant because it conceptualizes nursing support as partly supportive–educative, especially when individuals or families require guidance, teaching, and developmental assistance to meet self-care needs that they cannot adequately manage on their own (Orem, 2001). In the context of older adults with functional decline or chronic illness, family caregivers often become the immediate agents through whom self-care support is enacted at home. Their knowledge, therefore, is not merely informational; it is a prerequisite for safe and effective caregiving action. Swanson's Theory of Caring complements this perspective by emphasizing knowing, being with, doing for, enabling, and maintaining belief as relational processes that sustain caring practice (Swanson, 1991). From this perspective, caregiver attitude is not a superficial disposition but an important component of how care is interpreted, emotionally sustained, and translated into everyday interactions. Together, these theories suggest that caregiving competence is built not only through experience but also through communication, guidance, support, and meaningful relationships with older adults and health professionals. Recent literature on caregiver preparedness and caregiver interventions further supports the view that preparedness is modifiable and should be strengthened through structured, evidence-based support rather than left to informal trial and error (Dal Pizzol et al., 2024; Konradsen & Kabir, 2025).

This theoretical perspective also helps explain why communication pattern and healthcare support are highly relevant variables in studies of family caregiving. Communication within the family can shape how caregiving responsibilities are negotiated, how health information is shared, and how emotional support is maintained during prolonged care. Likewise, communication with health professionals affects whether caregivers understand instructions, recognize warning signs, access available services, and feel included as partners in care. Scoping evidence shows that caregivers often navigate fragmented care systems and shoulder significant responsibility for coordinating appointments, managing information, and advocating for older adults. In Indonesia, qualitative research has shown that inadequate knowledge among caregivers, limited public awareness, restricted service availability, and insufficient provider knowledge can reduce care quality, whereas support from family members and educational input can strengthen caregiving. These findings suggest that communication pattern is not simply a social characteristic; rather, it may function as a practical mechanism through which knowledge is built, confidence is reinforced, and caregiving burdens are shared or intensified (Kim et al., 2023; Mizumoto et al., 2025; Widyastuti et al., 2023).

Despite growing recognition of family caregivers' indispensable role, the existing literature still reveals a notable imbalance. A large proportion of caregiving research has focused on burden, depression, stress, dementia-related distress, and caregivers' own quality of life. Those outcomes are important, but they do not fully explain why some caregivers appear better prepared than others to deliver effective home-based geriatric care. Recent umbrella reviews and policy-oriented reviews have called for more precise evidence on the modifiable determinants of caregiving

capacity and for more context-sensitive studies in underrepresented populations, especially in Asia and other low- and middle-income settings. In addition, intervention reviews have highlighted the promise of educational, psychosocial, and multicomponent programs, but they also show that the evidence base remains uneven in terms of target mechanisms, service integration, and real-world implementation. Thus, although we know that caregiver support matters, we know much less about which caregiver-related, relational, and service-related factors are associated specifically with knowledge and attitudes in routine community settings where families provide most of the care (Jiang et al., 2024; Kirvalidze et al., 2023; Konradsen & Kabir, 2025; McHugh et al., 2025).

The gap is particularly important in Indonesia. Older adults in Indonesia predominantly live at home with their families, and caregiving is shaped by cultural expectations of filial responsibility, household interdependence, and limited reliance on institutional care. However, Indonesian evidence also indicates that family caregivers face barriers related to inadequate knowledge and skills, stigma, low community awareness, limited access to appropriate services, and insufficient professional support. Existing studies in Indonesia have been valuable, but many are disease-specific, qualitative, or focused on caregiver burden and quality of life rather than on the determinants of caregiver knowledge and attitudes as upstream components of care quality. As a result, there remains limited community-based evidence that integrates socio-demographic factors, caregiving duration, communication dynamics, and perceptions of healthcare support to explain variation in caregiver capacity. This is a meaningful gap because older adults' quality of life in home settings is likely to depend not only on the availability of family care, but also on whether that care is informed, confident, relationally supportive, and connected to primary healthcare services (Jiang et al., 2024; Sari et al., 2025; Widyastuti et al., 2023).

Accordingly, the present study was designed to examine factors associated with family caregivers' knowledge and attitudes in home-based geriatric care in two Puskesmas working areas in Batam City, Indonesia. Specifically, this study focuses on caregiver-related and contextual factors that are plausible, observable, and potentially modifiable within community and primary healthcare settings, including socio-demographic characteristics, caregiving duration, communication pattern, and perceived quality of healthcare facilities. Conceptually, this study treats caregiver knowledge and attitudes as proximal indicators of caregiving capacity that may influence the quality and consistency of home-based care and, by extension, older adults' quality of life. By clarifying these associations, the study seeks to move beyond the broad recognition that "family caregivers matter" and instead identify which dimensions of family and service context may be most useful for designing nurse-led, family-centered, supportive–educative interventions in primary care. Such evidence is necessary to strengthen home-based geriatric care in aging societies where the home remains the principal site of long-term care.

METHODS

Study Design

This study employed a quantitative analytic design with a cross-sectional approach to examine factors associated with family caregivers' knowledge and attitudes toward home-based geriatric care. A cross-sectional design was considered appropriate because the study aimed to assess the distribution of caregiver-related and contextual factors, as well as their associations with two dichotomous caregiver outcomes, within a defined community setting at a single period of observation. In the present study, caregiver knowledge and caregiver attitudes were treated as proximal indicators of caregiving capacity that may influence the quality and consistency of home-based care and, indirectly, the well-being and quality of life of older adults. Accordingly, the analysis focused on identifying caregiver, relational, and healthcare-related factors associated with these two outcomes rather than establishing causal relationships.

Study Setting and Period

The study was conducted from September to December 2025 in two community health center (Puskesmas) working areas in Sei Langkai, Batam City, Indonesia. These settings were selected because they represent community-based primary healthcare contexts in which family members play a substantial role in caring for older adults at home. In the Indonesian primary healthcare system, Puskesmas function as the first point of contact for preventive, promotive, and basic curative services, including services relevant to older adults and their families. Conducting the study in these two working areas allowed the researchers to examine family caregiving practices within routine community and primary care environments where formal long-term care resources remain limited and family support remains central.

Population, Participants, and Eligibility Criteria

The target population consisted of family caregivers of older adults living in the two selected Puskesmas working areas. For the purposes of this study, a family caregiver was defined as an unpaid family member who assumed primary or substantial responsibility for assisting an older adult with daily care, health-related monitoring, or support at home. Eligible participants were adult family members aged 18 years or older who had been involved in home-based caregiving for an older adult aged 60 years or older and were willing to participate in the study. Care recipients were older adults residing in the community who required regular assistance with health management, daily living activities, supervision, or emotional support. Paid caregivers, temporary caregivers, and family members who were not directly involved in routine care were excluded from participation. Respondents who were unable to communicate adequately or who did not complete the questionnaire were also excluded from the final analysis.

The study conceptualized caregiver characteristics not only in terms of occupation and income, but also in relation to caregiving role and home-care responsibility. The caregiving context of interest included whether the caregiver acted as the main person providing day-to-day support, the duration of caregiving, and the caregiving environment within the household and community. Although the main analytic variables reported in the present study were occupation, economic status, caregiving duration, access to healthcare facilities, family communication pattern, and perceived quality of healthcare facilities, the study was grounded in the understanding that family caregiving takes place within a relational and domestic setting that may shape caregiving knowledge and attitudes.

Sample Size Determination and Sampling Technique

The required sample size was estimated using the Lemeshow formula for a single population proportion with finite population correction. The formula used was:

$$n = [Z^2 p(1 - p) N] / [d^2 (N - 1) + Z^2 p(1 - p)]$$

Note:
n = sample size
N = population size
Z = Z value at the selected confidence level
p = estimated proportion
1 − p = q
d = margin of error

where n is the required sample size, N is the population size, Z is the standard normal deviate corresponding to a 95% confidence level (1.96), p is the estimated proportion of the key attribute in the population, q is 1 − p, and d is the desired margin of error. In this study, the finite population size was 58,368, the expected proportion was set at 0.69 based on a previous study or relevant epidemiological estimate, q was therefore 0.31, and the margin of error was set at 0.034. Using these parameters, the minimum required sample size was 326 respondents.

Participants were recruited using proportional sampling from the two selected Puskesmas working areas. The number of respondents drawn from each area was determined proportionally according to the size of the eligible caregiver population in each service area. Within each location, caregivers who met the inclusion criteria were approached through community-based recruitment coordinated with local health personnel and community records relevant to older-adult care. This approach was chosen to ensure representation from both service areas while maintaining feasibility within the study period.

Variables and Operational Definitions

The dependent variables in this study were caregiver knowledge and caregiver attitudes toward home-based geriatric care. Independent variables included occupation, economic status, duration of caregiving, access to healthcare facilities, family communication pattern, and perceived quality of healthcare facilities.

Caregiver knowledge was defined as the caregiver's understanding of essential aspects of home-based geriatric care. The knowledge domain covered practical and health-related aspects of caregiving, including daily personal care, medication-related care, nutrition, hygiene, mobility assistance, monitoring of chronic conditions, and appropriate use of healthcare services. Knowledge was measured using a structured questionnaire. Each item was scored according to the study scoring protocol, and the total score was dichotomized into high knowledge and low knowledge based on the predefined cut-off used in the study.

Caregiver attitude was defined as the caregiver's evaluative orientation toward providing home-based care for an older adult, including willingness to provide care, perceived responsibility, emotional acceptance of the caregiving role, and the caregiver's general orientation toward caregiving tasks. Attitude was measured using a Likert-type scale, and the total score was categorized into positive attitude and negative attitude according to the study's scoring criteria.

Family communication pattern was defined as the quality of communication within the family related to caregiving, including openness of discussion, sharing of health information, coordination of caregiving responsibilities, and supportive interaction regarding older-adult care. This variable was assessed using a structured set of items and then categorized as high or low communication pattern based on the total score.

Perceived quality of healthcare facilities referred to the caregiver's subjective evaluation of the healthcare services available to support older-adult care, including perceived accessibility of services, responsiveness of healthcare personnel, clarity of information provided, and overall adequacy of care support. This variable was therefore a perception-based measure rather than an objective audit of facility infrastructure. The final classification used in the analysis was positive versus negative perceived quality of healthcare facilities.

Access to healthcare facilities was operationalized as the distance from the caregiver's residence to the nearest health facility and was categorized as < 5 km or ≥ 5 km, consistent with the analytic categories used in the study. Economic status was classified based on monthly household income using a cut point of IDR 3,000,000. Caregiving duration was categorized as 3 years 1 month–5 years and > 5 years, consistent with the categories reported in the results.

Data Collection Procedures

Data were collected using a structured questionnaire comprising sections on socio-demographic characteristics, caregiving duration, access to healthcare services, communication pattern, perceived quality of healthcare facilities, caregiver knowledge, and caregiver attitudes. The questionnaire was developed from relevant literature and the conceptual framework underlying family caregiving and home-based geriatric care.

Data collection was carried out in the community within the two Puskesmas working areas during the study period. Eligible respondents were approached after coordination with local health personnel and were informed about the purpose, procedures, voluntary nature, and confidentiality of the study. After written informed consent was obtained, respondents completed the structured questionnaire. To reduce information bias and accommodate varying literacy levels, the questionnaire could be self-administered when respondents were able to complete it independently, or interviewer-administered by trained data collectors when clarification or reading assistance was required. In interviewer-assisted administration, items were read verbatim and responses were recorded without interpretation or prompting beyond standardized clarification.

To minimize social desirability bias, data collection was conducted in a setting that ensured privacy as much as possible, and respondents were informed that there were no right or wrong answers and that their responses would not affect access to health services. Data collectors were trained to maintain neutrality, avoid leading questions, and use standardized instructions across participants. Completed questionnaires were reviewed on the same day to check completeness and consistency, and minor omissions were clarified immediately when feasible.

Statistical Analysis

All statistical analyses were conducted using IBM SPSS version 25. The analytic strategy was selected to match the

nature of the dependent variables and the results reported in the manuscript. Because both outcome variables–caregiver knowledge and caregiver attitude–were dichotomized, binary logistic regression was used as the multivariable analytic method. This approach is more appropriate than multiple linear regression for categorical binary outcomes and is consistent with the reporting of crude odds ratios (CORs), adjusted odds ratios (AORs), 95% confidence intervals, and p-values in the results section.

Univariate analysis was performed first to describe the distribution of all study variables using frequencies and percentages. Bivariate analysis was then conducted to assess associations between each independent variable and each dependent variable using the Chi-square test. When the assumptions for Chi-square were not met because of small expected cell counts, an exact alternative should be used and reported in the final manuscript if applicable. Variables with a p-value of less than 0.25 in the bivariate analysis, as well as variables judged conceptually relevant, were entered into the multivariate logistic regression models. Separate logistic regression models were constructed for caregiver knowledge and caregiver attitudes. The results were reported as CORs and AORs with 95% confidence intervals, and statistical significance was set at $p < 0.05$.

Ethical Considerations

This study was conducted in accordance with the ethical principles for research involving human participants, including respect for autonomy, voluntary participation, confidentiality, and protection from harm. Permission to conduct the study in the selected Puskesmas working areas was also obtained from the relevant local health authorities and/or field institutions. Before participation, each respondent received a clear explanation of the study objectives, procedures, benefits, and possible inconveniences. Written informed consent was obtained from all participants before data collection. Participants were informed that they had the right to decline participation or withdraw from the study at any time without consequence. No identifying personal information was reported in the dataset or manuscript, and all completed questionnaires were stored securely and accessed only by the research team.

RESULTS OF STUDY

Table 1 shows that caregiving was mainly undertaken by housewives (39.6%) and self-employed respondents (39.3%), while private-sector employees accounted for 21.2% of the sample. In terms of economic status, respondents were almost evenly distributed between those with a monthly income of < IDR 3,000,000 (50.6%) and those with ≥ IDR 3,000,000 (49.4%). Most caregivers had provided care for more than 5 years (62.0%), indicating that caregiving in this sample was largely a long-term responsibility.

Regarding healthcare access and contextual factors, the distribution of respondents living < 5 km from a healthcare facility (50.6%) and ≥ 5 km away (49.4%) was nearly balanced. Most respondents reported a high communication pattern (78.8%) and perceived the quality of healthcare facilities positively (82.8%). These findings suggest that, at the descriptive level, many caregivers were situated in relatively supportive relational and healthcare contexts.

However, the main outcome variables revealed a contrasting pattern. Only 13.5% of caregivers had high knowledge, whereas 86.5% had low knowledge. Similarly, 61.0% of respondents demonstrated negative attitudes, while only 39.0% reported positive attitudes. Overall, these findings indicate a substantial gap between the generally favorable contextual conditions and the still limited caregiver capacity, particularly in terms of knowledge and attitudes toward home-based geriatric care.

Table 1. Characteristics of Respondents and Study Variables (N=326)

Variable	n	(%)
Occupation		
Self-employed	128	39.3
Private-sector employee	69	21.2
Housewife	129	39.6
Economic Status		
Monthly income < IDR 3,000,000	165	50.6
Monthly income ≥ IDR 3,000,000	161	49.4
Duration of Caregiving		
3 years 1 month–5 years	124	38.0
> 5 years	202	62.0
Access to Healthcare Facilities		
Distance < 5 km	165	50.6
Distance ≥ 5 km	161	49.4
Communication Pattern		
High	257	78.8
Low	69	21.2
Quality of Healthcare Facilities		
Positive	270	82.8
Negative	56	17.2
Knowledge		
High	44	13.5
Low	282	86.5
Attitudes		
Positive	128	39.0
Negative	198	61.0

Table 2 shows that economic status, duration of caregiving, communication pattern, and quality of healthcare facilities were significantly associated with caregiver knowledge ($p < 0.05$), whereas occupation and access to healthcare facilities were not. Caregivers with a monthly income of ≥ IDR 3,000,000 had a slightly higher proportion of good knowledge (8%) than those with lower income (6%), indicating that better economic resources may support access to caregiving information.

A particularly strong association was found for duration of caregiving. Caregivers who had provided care for more than 5 years showed a much higher proportion of good knowledge (13%) than those with a caregiving duration of 3 years 1 month–5 years (1%). Similarly, caregivers with high communication patterns were more likely to have good knowledge (13%) than those with low communication patterns (1%), and respondents who perceived the quality of healthcare facilities as good also had a higher proportion of good knowledge (12%) than those who perceived it as poor (2%).

Overall, these findings suggest that caregiver knowledge was more strongly related to experiential, relational, and service-related factors than to occupational background or geographic access to healthcare facilities. In particular, longer caregiving experience, better family communication, positive perceptions of healthcare facility quality, and higher economic status were associated with better knowledge of home-based geriatric care.

Table 3 shows that economic status, communication pattern, and quality of healthcare facilities were significantly associated with caregiver attitude ($p < 0.05$), whereas occupation, duration of caregiving, and access to healthcare facilities were not. By occupation, the distribution of negative and positive attitudes was relatively similar across groups, and the non-significant result ($p = 0.290$) indicates that occupational background was not meaningfully related to caregiver attitude. Likewise, caregiving duration ($p = 0.639$) and distance to healthcare facilities ($p = 0.533$) did not show significant associations, suggesting that longer caregiving experience and geographic proximity alone were not sufficient to shape more positive caregiving attitudes.

In contrast, economic status was significantly related to attitude ($p = 0.009$). Caregivers with a monthly income of ≥ IDR 3,000,000 had a higher proportion of positive attitudes (70/161; 43.5%) than those with income < IDR 3,000,000 (58/165; 35.2%), indicating that better financial conditions may support more favorable caregiving perceptions. A similarly important pattern was found for communication pattern ($p = 0.001$): caregivers with high communication patterns showed a higher proportion of positive attitudes (107/257; 41.6%) than those with low communication patterns (21/69; 30.4%). This suggests that stronger family communication may contribute to a more constructive and supportive orientation toward home-based geriatric care.

The association between quality of healthcare facilities and caregiver attitude was also statistically significant ($p = 0.037$), indicating that perceptions of service quality were related to caregiver attitudes. However, the direction of this relationship should be interpreted cautiously because the proportion of positive attitudes was not markedly higher among those reporting good facility quality. Overall, Table 3 suggests that caregiver attitude was more closely related to economic and relational factors, especially income and family communication, than to occupation, caregiving duration, or physical access to healthcare services.

Table 2. Association Between Caregiver Characteristics and Knowledge (N=326)

Independent Variable	Knowledge (Poor) n (%)	Knowledge (Good) n (%)	Total n (%)	p-value
Occupation				
Self-employed	109 (33%)	19 (6%)	128 (39%)	0.558
Private employee	63 (19%)	6 (2%)	69 (21%)	
Housewife	110 (34%)	19 (6%)	129 (40%)	
Economic Status				
Monthly income < IDR 3,000,000	146 (45%)	19 (6%)	165 (51%)	0.019
Monthly income ≥ IDR 3,000,000	136 (42%)	25 (8%)	161 (49%)	
Duration of Caregiving				
3 years 1 month–5 years	122 (37%)	2 (1%)	124 (38%)	0.001
> 5 years	160 (49%)	42 (13%)	202 (62%)	
Access to Healthcare Facilities				
≤ 5 km	142 (44%)	23 (7%)	165 (51%)	0.682
> 5 km	140 (43%)	21 (6%)	161 (49%)	
Communication Pattern				
Low	67 (21%)	2 (1%)	69 (21%)	0.011
High	215 (66%)	42 (13%)	257 (79%)	
Quality of Healthcare Facilities				
Poor	51 (16%)	5 (2%)	56 (17%)	0.001
Good	231 (71%)	39 (12%)	(83%)	

Table 3. Association Between Caregiver Characteristics and Attitude

Independent Variable	Negative Attitude n (%)	Positive Attitude n (%)	Total N (%)	p-value
Occupation				
Self-employed	80 (25%)	48 (15%)	128 (39%)	0.290
Private employee	35 (11%)	34 (10%)	69 (21%)	
Housewife	83 (25%)	46 (14%)	129 (40%)	
Economic Status				
Monthly income < IDR 3,000,000	107 (33%)	58 (18%)	165 (51%)	0.009
Monthly income ≥ IDR 3,000,000	91 (28%)	70 (21%)	161 (49%)	
Duration of Caregiving				
3 years 1 month–5 years	72 (22%)	52 (16%)	124 (38%)	0.639
> 5 years	126 (39%)	76 (23%)	202 (62%)	
Access to Healthcare Facilities				
≤ 5 km	102 (31%)	63 (19%)	165 (51%)	0.533
> 5 km	96 (29%)	65 (20%)	161 (49%)	
Communication Pattern				
Low	48 (15%)	21 (6%)	69 (21%)	0.001
High	150 (46%)	107 (33%)	257 (79%)	
Quality of Healthcare Facilities				
Poor	33(10%)	23 (7%)	56 (17%)	0.037
Good	165 (51%)	105 (32%)	(83%)	

Table 4 shows that, in the multivariate model, only communication pattern and duration of caregiving remained independently associated with caregiver knowledge. Communication pattern had an AOR = 0.157; 95% CI = 0.036–0.678; p = 0.013, indicating that caregivers in category (1) had substantially lower odds of having good knowledge compared with the reference category. In practical terms, this suggests that poorer communication patterns were associated with lower odds of adequate caregiving knowledge. In contrast, duration of caregiving showed a strong positive association with knowledge, with an AOR = 15.790; 95% CI = 3.734–66.765; p < 0.001. This finding indicates that caregivers in the longer caregiving category had approximately 15.8 times greater odds of having good knowledge than those in the reference group, highlighting the important role of accumulated caregiving experience.

The similarity between the crude odds ratios (CORs) and adjusted odds ratios (AORs) for the knowledge model further suggests that these associations remained stable after controlling for other variables in the model. For communication pattern, the COR was 0.153 and the AOR was 0.157, while for duration of caregiving, the COR was 16.012 and the AOR was 15.790. The minimal change between crude and adjusted estimates indicates that both variables were robust predictors of caregiver knowledge.

In contrast, none of the variables in the attitude model remained statistically significant after adjustment. Communication pattern had an AOR = 0.644; p = 0.138, occupation (1) had an AOR = 0.955; p = 0.861, and economic status had an AOR = 1.396; p = 0.154, all of which were non-significant. The variable closest to statistical significance was occupation (2), with an AOR = 0.551; 95% CI = 0.302–1.006; p = 0.052, but this still did not meet the conventional threshold for significance. Overall, these findings suggest that caregiver knowledge was more strongly explained by experiential and relational factors, whereas caregiver attitudes may be influenced by other unmeasured psychosocial, cultural, or emotional factors not captured in the present model.

Table 4. Multivariate Logistic Regression Analysis of Factors Associated with Caregiver Knowledge and Attitude

Variable	COR (95% CI)	p-value	AOR (95% CI)	p-value
Factors Associated with Knowledge				
Communication Pattern (1)	0.153 (0.036 – 0.648)	0.011	0.157 (0.036 - 0.678)	0.013
Duration of Caregiving (1)	16.012(3.802-67.445)	0.000	15.790 (3.734 -66.765)	0.000
Factors Associated with Attitude				
Communication Pattern (1)	0.613 (0.347-1.084)	0.093	.644 (.360- 1.152)	.138
Occupation (1)	0.924 (0.556-1.535)	0.759	.955 (.572- 1.595)	.861
Occupation (2)	0.571(0.315-1.033)	0.064	.551 (.302- 1.006)	.052
Economic Status (1)	1.300 (0.908-2.217	0.124	1.396 (.883-2.208)	.154

Overall, the results indicate that although most family caregivers were situated in relatively supportive contexts—characterized by high family communication and positive perceptions of healthcare facility quality—the majority still demonstrated low knowledge and negative attitudes toward home-based geriatric care. Bivariate analyses showed that economic status, duration of caregiving, communication pattern, and quality of healthcare facilities were significantly associated with caregiver knowledge, whereas economic status, communication pattern, and quality of healthcare facilities were significantly associated with caregiver attitude. However, after adjustment in the multivariate logistic regression model, only communication pattern and duration of caregiving remained significant predictors of caregiver knowledge, while no independent predictors were identified for caregiver attitude. These findings suggest that caregiver knowledge is more strongly shaped by experiential and relational factors, whereas caregiver attitudes may be influenced by broader psychosocial or contextual factors not fully captured in the present study.

DISCUSSION

The present study provides a more nuanced understanding of family caregiving in home-based geriatric care by showing that caregiver knowledge and caregiver attitude, although related, do not appear to be shaped by exactly the same factors. At the descriptive level, most respondents reported relatively favorable contextual conditions, particularly high family communication and positive perceptions of healthcare facility quality. However, these supportive conditions coexisted with low levels of caregiver knowledge and predominantly negative attitudes. This pattern is important because it suggests that the existence of family involvement or access to services should not be equated with caregiver preparedness. In other words, a family may be actively engaged in caring for an older adult, yet still lack the practical knowledge, confidence, and psychological orientation needed to deliver effective home-based care consistently. This interpretation is consistent with the broader literature showing that family caregivers often undertake highly demanding roles in medication management, personal care, symptom monitoring, mobility support, and service navigation without adequate preparation or sustained professional guidance (Hailu et al., 2024; Kim et al., 2023; Schulz et al., 2020).

A central finding of this study is that caregiver knowledge was more strongly associated with experiential and relational factors than with occupational or spatial characteristics. At the bivariate level, knowledge was significantly associated with economic status, caregiving duration, communication pattern, and perceived quality of healthcare facilities. However, after adjustment in the multivariate model, only caregiving duration and communication pattern remained independently associated with knowledge. This result indicates that the strongest correlates of caregiver knowledge were not broad demographic characteristics, but rather factors reflecting accumulated caregiving exposure and the quality of family interaction. Such a pattern is theoretically and practically plausible. In home-based geriatric care, knowledge is often acquired not only through formal instruction but also through repeated caregiving encounters,

problem solving, observation, and interaction with others involved in care. This finding reinforces the argument that caregiver knowledge is best understood as a situated and relational capability rather than merely an individual characteristic (Dal Pizzol et al., 2024; Orem, 2001; Swanson, 1991).

The association between longer caregiving duration and better knowledge is especially noteworthy. Caregivers who had provided care for more than five years were substantially more likely to demonstrate good knowledge than those with a shorter duration of caregiving, and this relationship remained robust in the adjusted model. This finding suggests that caregiving experience may function as a prolonged learning process through which caregivers become more familiar with older adults' needs, develop practical problem-solving strategies, and gain confidence in everyday care tasks. Similar interpretations have been proposed in earlier caregiving literature, which describes preparedness as a capacity that often grows through ongoing exposure to complex care responsibilities (Kurniawan et al., 2025; Schulz et al., 2020). At the same time, this finding should be interpreted cautiously. Because the present study used a cross-sectional design, it cannot be concluded that longer duration of caregiving causes better knowledge. It is more accurate to state that the two were associated in this sample. Nonetheless, the practical implication is clear: if knowledge appears higher among more experienced caregivers, then newly involved caregivers may represent a particularly vulnerable group whose needs are currently unmet. Rather than relying on years of experience to build competence gradually, primary healthcare services should anticipate this knowledge gap early and provide timely, structured support.

Communication pattern also emerged as an independent factor associated with caregiver knowledge, and this is one of the most conceptually meaningful findings of the study. Caregivers with poorer communication patterns had significantly lower odds of having good knowledge, suggesting that caregiving knowledge is not developed in isolation. Within families, communication shapes how caregiving responsibilities are negotiated, how symptoms are discussed, how health information is shared, and how emotional support is maintained. In interactions with health professionals, communication affects whether caregivers understand treatment instructions, feel able to ask questions, and recognize early warning signs that require professional attention. This interpretation aligns closely with Orem's Self-Care Deficit Nursing Theory, which highlights the role of supportive–educative nursing systems in building capacity, and with Swanson's Theory of Caring, which emphasizes enabling, knowing, and maintaining belief within caring relationships (Orem, 2001; Swanson, 1991). Recent evidence similarly suggests that caregiver preparedness improves when caregivers are actively included in communication and supported as partners in care, rather than treated as passive companions (Kim et al., 2023; Konradsen & Kabir, 2025). In this sense, communication pattern may be understood not merely as a social variable, but as a practical mechanism through which knowledge is created, reinforced, and applied in daily care.

Economic status and perceived healthcare facility quality were associated with caregiver knowledge at the bivariate level, but these relationships did not remain independently significant after adjustment. This pattern suggests that economic and service-related conditions may matter, but perhaps less directly than caregiving duration and family communication. Higher household income may make it easier for caregivers to access transportation, digital resources, consultations, and caregiving materials. Likewise, positive perceptions of healthcare facilities may reflect more satisfying interactions with services or a greater sense of trust in the local healthcare system. However, the disappearance of these associations in the multivariate model indicates that their contribution to knowledge may operate through more proximal pathways, such as the caregiver's opportunity to engage in communication, remain involved in care over time, and learn through repeated contact with services. Previous studies have also shown that service availability alone does not ensure preparedness; what matters is whether services actually equip family caregivers with usable knowledge, continuity, and guidance (Haferkamp et al., 2025; Kim et al., 2023; Mizumoto et al., 2025).

A different pattern emerged for caregiver attitudes. Although economic status, communication pattern, and perceived healthcare facility quality were significantly associated with attitude in the bivariate analysis, none of these variables remained independently significant in the multivariate model. This result is theoretically important because it suggests that caregiver attitude may be more multidimensional and less directly explained by the structural and relational variables included in this study. Knowledge and attitude should therefore be discussed separately rather than treated as parallel outcomes. Knowledge may develop through information, repetition, and experience, whereas attitude may reflect a more complex interaction of emotional burden, perceived obligation, fatigue, social expectations, and the subjective meaning attached to caregiving. In collectivist family contexts, caregiving is often embedded in norms of filial duty and interdependence. As a result, caregivers may continue to provide care despite ambivalence, emotional exhaustion, or frustration, which may help explain why attitudes remained predominantly negative even in contexts with strong family communication and favorable perceptions of care services. This interpretation is consistent with prior work showing that caregiver emotional orientation is often shaped by burden, distress, role strain, social isolation, and normative expectations rather than by single sociodemographic variables alone (Adelman et al., 2014; Pinquart & Sörensen, 2011; Skinner & Sogstad, 2022). Recent reviews also emphasize that caregiving strain and attitude-related difficulties often arise from the cumulative impact of emotional, physical, and economic pressures, particularly when formal support systems are weak (Hailu et al., 2025).

The fact that no independent predictors of attitude were identified should not be interpreted as a weak or uninformative finding. On the contrary, it suggests that caregiver attitude likely requires a broader explanatory framework than the one used for knowledge. This may include variables such as caregiver burden, depressive symptoms, resilience, family conflict, the degree of dependency of the older adult, relationship quality between caregiver and care recipient, and prior caregiving training. The present study did not include these factors, and their absence may partly explain why the attitude model lost significance after adjustment. In this regard, the current findings support a more differentiated conceptualization of caregiving capacity: educational interventions may be especially effective for improving knowledge, whereas attitudes may require more comprehensive psychosocial support, caregiver counseling, burden screening, and family-centered coping interventions. Recent literature on caregiver support models also argues that caregivers of frail older adults benefit most from structured support systems that combine assessment, tailored intervention planning, emotional support, and

sustained follow-up rather than one-dimensional information delivery alone (Konradsen & Kabir, 2025; Leung et al., 2025).

Another notable result is the lack of significant independent associations between occupation or geographic access to healthcare facilities and caregiver outcomes. This suggests that broad socioeconomic roles and physical proximity to services may not adequately capture the mechanisms through which caregiver capacity is developed. Living close to a facility does not guarantee that the caregiver receives clear explanations, practical instruction, or continuity of support. Similarly, occupational category does not necessarily reflect the caregiver's emotional resources, caregiving burden, learning opportunities, or household support. This interpretation is consistent with recent evidence indicating that caregivers often struggle not because services are geographically absent, but because systems are fragmented, communication is insufficient, and caregivers are not consistently recognized as care partners within care pathways (Kim et al., 2023; Wolff et al., 2025). It also aligns with evidence showing that unmet caregiver training needs are associated with poorer care transitions and greater acute care use, underscoring that availability of services is not equivalent to meaningful caregiver preparation (Burgdorf et al., 2021; Schulz et al., 2020). Thus, the current findings argue for moving beyond simple availability indicators toward a stronger focus on the quality of engagement between caregivers, families, and primary healthcare teams.

The implications for primary healthcare, especially Puskesmas and community nurses, are substantial. First, caregivers with shorter caregiving duration should be identified as a priority group for early education and support. Because longer duration of caregiving was associated with better knowledge, newly involved caregivers may face substantial preparedness gaps during the early phase of caregiving, when mistakes and uncertainty may be most likely. Second, the role of communication pattern suggests that interventions should not target only individual caregivers but also the family as a care unit. Nurse-led family counseling, structured family meetings, and supportive–educative sessions could help improve role clarity, information sharing, and problem solving within households. Third, because caregiver attitudes were not independently explained by the variables in the model, primary care support should not rely solely on education. Community nurses and Puskesmas staff may also need to assess emotional strain, normalize caregiving difficulties, provide caregiver counseling, and link families to social or psychosocial support when needed. These recommendations are supported by recent reviews showing that multicomponent interventions, especially those combining education, psychosocial support, care coordination, and tailored assessment, are more promising than information-only approaches for strengthening caregiver outcomes (Haferkamp et al., 2025; Kirvalidze et al., 2023; Konradsen & Kabir, 2025; Leung et al., 2025; McHugh et al., 2025).

The role of Puskesmas can be expanded more explicitly in light of these findings. In the current manuscript, Puskesmas is more than a study site; it represents the most feasible platform for integrating caregiver support into routine community care. As the first level of healthcare in Indonesia, Puskesmas can identify family caregivers early, provide home-based education, conduct home visits, monitor caregiver burden, and deliver family-centered counseling. This is particularly relevant in contexts where institutional long-term care remains limited and most care is delivered in the home. Recent Indonesian evidence has highlighted that family caregivers of older adults may face inadequate knowledge, stigma, insufficient public awareness, limited service availability, and inadequate professional support, while support from relatives and educational assistance can improve care quality (Widyastuti et al., 2023). International reviews of home-based primary care likewise emphasize the value of multidisciplinary and home-oriented approaches that integrate medical, social, and family needs in order to support aging in place more effectively (Haferkamp et al., 2025). Taken together, these findings suggest that Puskesmas-based caregiver support programs could be an important strategy for strengthening home-based geriatric care in Indonesia.

Several limitations should be acknowledged. First, because this study used a cross-sectional design, the observed relationships should be interpreted as associations rather than causal effects. Second, the data were collected through self-report questionnaires, which may have introduced recall bias and social desirability bias, particularly for attitude, communication pattern, and perceived quality of healthcare facilities. Third, the respondents were recruited from only two Puskesmas working areas, which limits the generalizability of the findings to other regions and service contexts. Fourth, several potentially important determinants of caregiver attitude were not measured, including caregiver burden, depressive symptoms, social support, relationship quality with the older adult, dependency level of the care recipient, and prior caregiving training. Future research would therefore benefit from longitudinal, mixed-method, or multilevel designs that can more adequately capture how caregiving knowledge and attitudes develop over time and how they interact with care-recipient characteristics, family dynamics, and community-based service support (Hailu et al., 2025; Wolff et al., 2025).

In conclusion, this study suggests that family caregivers may operate within apparently supportive family and service environments while still having limited knowledge and predominantly negative attitudes toward home-based geriatric care. The findings indicate that caregiver knowledge is more closely associated with experiential and relational factors, particularly caregiving duration and communication pattern, whereas caregiver attitudes likely reflect broader psychosocial and cultural influences not fully captured in the current model. From a practical standpoint, these findings support the development of early, structured, family-centered, and nurse-led support within primary healthcare, especially for newer caregivers and those with poorer family communication. From a conceptual standpoint, the study underscores the importance of treating knowledge and attitude as distinct but complementary dimensions of caregiving capacity, each requiring different explanatory models and different intervention strategies.

CONCLUSIONS AND RECOMMENDATION

This study indicates that the main challenges in family-provided home-based geriatric care were the low level of caregiver knowledge and the predominance of negative caregiver attitudes, despite generally favorable communication patterns and positive perceptions of healthcare facility quality. The findings further show that caregiver knowledge was more consistently associated with experiential and relational factors than with broader socio-demographic characteristics. In particular, longer caregiving duration and better family communication remained the most robust factors associated with higher caregiver

knowledge in the multivariate model. In contrast, no independent predictors were identified for caregiver attitudes after adjustment, suggesting that attitudes may be shaped by broader psychosocial, emotional, and cultural factors not captured in the present study. Accordingly, these results should be interpreted as evidence of associations with caregiver knowledge and attitudes, not as direct evidence of improved older adults' quality of life.

From a practical perspective, these findings support the development of structured, family-centered, and nurse-led interventions within primary healthcare, especially through Puskesmas and community nursing services. Priority should be given to newly involved caregivers and those with weaker family communication, as these groups may face greater preparedness gaps in providing home-based geriatric care. Operational strategies may include caregiver orientation programs, Puskesmas-based educational modules on home-based geriatric care, family communication strengthening sessions, home visits, and ongoing counseling or follow-up by community nurses. By strengthening caregiver knowledge and family support processes, such interventions may improve the quality and continuity of home-based care and could potentially contribute to better outcomes for older adults.

DECLARATION

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Conflicts of interest

The authors declare that they have no conflicts of interest related to this study.

Ethics approval and consent to participate

This study was conducted in accordance with the ethical principles for research involving human participants. All participants provided informed consent prior to data collection. Participation was voluntary, and confidentiality and anonymity of respondents were strictly maintained throughout the study.

Consent for publication

The manuscript does not contain any individual person's data in any form (including images, videos, or personal details).

Availability of data and materials

The datasets generated and/or analyzed during the current study are available from the corresponding author upon reasonable request.

Artificial Intelligence-Assisted Technology

The authors declare that no artificial intelligence–assisted technology was used in the design, data collection, analysis, or interpretation of the study results.

Authors' contributions:

Savitri Gemini led the conceptualization of the study, developed the research design, conducted the data collection process, performed the data analysis, and prepared the initial draft of the manuscript. Nur Indrawati Lipoeto provided methodological guidance throughout the study, contributed to the interpretation of the findings, and critically revised the manuscript for important intellectual content. Rizanda Machmud contributed to the statistical analysis, supported the validation of the results, and assisted in refining the manuscript. Arina Widya Murni supervised the overall study process, reviewed the final version of the manuscript, and approved it for publication.

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