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Factors associated with caregiver ability to support medication adherence among people with mental disorders: a multivariate cross-sectional study

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ABSTRACT

Introduction: Family caregivers play a significant role in ensuring that people with mental disorders adhere to their medication. However, these abilities are shaped by several factors. This study aimed to identify family, caregiver, patient, nurse, and healthcare service factors associated with caregivers' ability to support medication adherence among relatives with mental disorders.

Methods: This cross-sectional study was conducted between February and June 2024 at seven community health centers *(*Puskesmas*)* in Makassar, Indonesia. Purposive sampling was used to recruit 155 caregivers. Questionnaires were validated prior to data collection. Bivariate associations were examined using the chi-square test, and factors associated with caregivers' ability to support medication adherence were analyzed using multivariate logistic regression.

Results: The multivariate model was statistically significant (model $\chi^2 = 42.87$, $p < 0.001$; Nagelkerke $R^2 = 0.32$). In bivariate analyses, the caregiver's ability to support patients' medication adherence was associated with family functioning, caregiver factors (gender, stress, motivation, knowledge), patient factors (relapse frequency, severity level), and nurse psychological factors. In the multivariate analysis, family economic status (AOR = 0.22, 95% CI = 0.07–0.69, p = 0.010), family functioning (AOR = 2.58, 95% CI = 1.19–5.58, p = 0.016), caregiver motivation (AOR = 0.29, 95% CI = 0.12–0.73, p = 0.008), and caregiver knowledge (AOR = 0.40, 95% CI = 0.16–0.96, p = 0.041) remained significantly associated with caregiver ability to support medication adherence.

Conclusions: Significant associations were observed between family (economic status, functioning) and caregiver (motivation, knowledge) factors and caregiver ability to support medication adherence. These results suggest that family factors and caregiver psychosocial preparedness play critical roles in facilitating adherence-related caregiving practices. Strengthening family functioning and caregiver motivation and knowledge may improve support for medication adherence.

Keywords: caregiver, family, healthcare service, medication adherence, mental disorders, nurse, patient

Introduction

Mental disorders are characterized by deficits in cognitive, psychomotor, and affective functioning, which influence how individuals perform daily activities and experience quality of life (QOL). The World Health Organization estimates that by 2024, approximately 970

million individuals are living with mental disorders worldwide (World Health Organization, 2024). According to data released by the Indonesian Health Survey, the Ministry of Health of Indonesia reported that approximately 54 million people, or approximately 20% of the population, were affected by mental disorders (Indonesian Ministry of Health, 2023). With an increasing number of individuals living with mental disorders, families are becoming more involved in caregiving roles, which often entail long-term care, monitoring medication use, and providing psychosocial support.

Social stigma, emotional crises, financial pressure, lack of knowledge, insufficient support resources, disruption of regular activities, interpersonal conflict, and the possibility of physical and mental health problems represent major challenges in providing adequate family care (Akbari *et al.*, 2018; Aldiabat *et al.*, 2024). Several programs have been developed to support family caregivers of individuals with mental disorders by strengthening caregiving skills, offering emotional support, and improving cognitive understanding of mental illness. Such interventions include cognitive behavioral therapy, psychodynamic therapy, and group psychoeducational therapy, which primarily aim to enhance caregivers' preparedness and capacity to provide care (Cheng *et al.*, 2019; Kuhney *et al.*, 2023). Although these programs mainly target caregiver-related outcomes, improvements in patient outcomes such as reduced relapse rates, better medication adherence, and increased self-controlare often expected to be indirect benefits of enhanced caregiving. Nevertheless, despite these efforts, key indicators of positive mental healthcare outcomes in Indonesia have not yet been consistently achieved (Indonesian Ministry of Health, 2023).

Pharmacological therapy is commonly used in the management of mental disorders, particularly in moderate-to-severe conditions, and is often combined with psychosocial interventions. Medication adherence plays an important role in optimizing treatment effectiveness, reducing relapse risk, lowering hospitalization rates, and improving the quality of life and cognitive functioning (Velligan *et al.*, 2017). Conversely, nonadherence to prescribed treatment increases the likelihood of relapse, reduces treatment responsiveness, and may lead to severe outcomes, including suicide and mortality (Chinarev and Malinina, 2025; Religioni *et al.*, 2025). Previous studies have shown that individuals with mental disorders who fail to adhere to their medication regimens often experience poorer clinical outcomes, such as persistent symptoms and impaired daily functioning. Medication non-adherence is influenced by multiple factors, including patients' knowledge, awareness, attitudes, social support, clinical condition, health system factors, and substance use (Semahegn *et al.*, 2020). Social support has been identified as a protective factor, with evidence from a meta-analysis indicating that lack of social support increases the risk of non-adherence (Guo *et al.*, 2023). These findings highlight the ongoing challenges of medication adherence among people with mental disorders, and underscore the important role of family members as primary caregivers.

Family members represent the closest and most stable support systems for individuals with mental disorders. Family related influences, including family functioning, emotional support, caregiving resources, and caregiving environment, play an important role in facilitating medication adherence (Rindayati, Nasir and Rizal, 2021). Previous studies have identified several factors associated with adherence, including psychological distress, medication side effects, social stigma, neighborhood support, and family resources (Dehbozorgi *et al.*, 2022). Caregivers' perceptions of medication usefulness and treatment effectiveness also influence therapeutic outcomes. Caregivers who hold positive perceptions of medication tend to provide more consistent support, which is associated with higher treatment adherence, whereas negative perceptions may reduce support and lead to poorer adherence (Kretchy *et al.*, 2021). Furthermore, caregiver self-efficacy, illness-related factors, and stress have been reported to negatively affect treatment compliance (El-Saifi, Moyle and Jones, 2019). Collectively, these findings suggest that the capacity of families to support treatment adherence among individuals with mental disorders reflects a complex interaction of psychosocial and environmental factors.

Despite a growing body of evidence highlighting the importance of these factors, previous studies have primarily examined medication adherence by focusing on patient-level outcomes or isolated determinants. Limited attention has been given to the integrated influence of family, caregiver, patient, nurse, and healthcare service factors on caregivers' ability to support medication adherence. Evidence from our previous study, which developed and tested a health coaching framework grounded in the Friedman Family Assessment Model (FFAM), a family nursing assessment framework, and the Theory of Planned Behavior (TPB), demonstrated that planned behavior and health coaching played a mediating role in caregiving abilities (e.g., assistance with daily living activities, socialization, symptom management, and medication adherence) and factors related to the patient, family, caregiver, nurse, and healthcare service (Andriani *et al.*, 2025). However, the study did not specifically examine the direct interdependence of these multilevel factors on caregivers' ability to support medication adherence as a distinct domain. Accordingly, caregivers' ability to support medication adherence should be viewed as an outcome shaped by interactions across multiple levels including

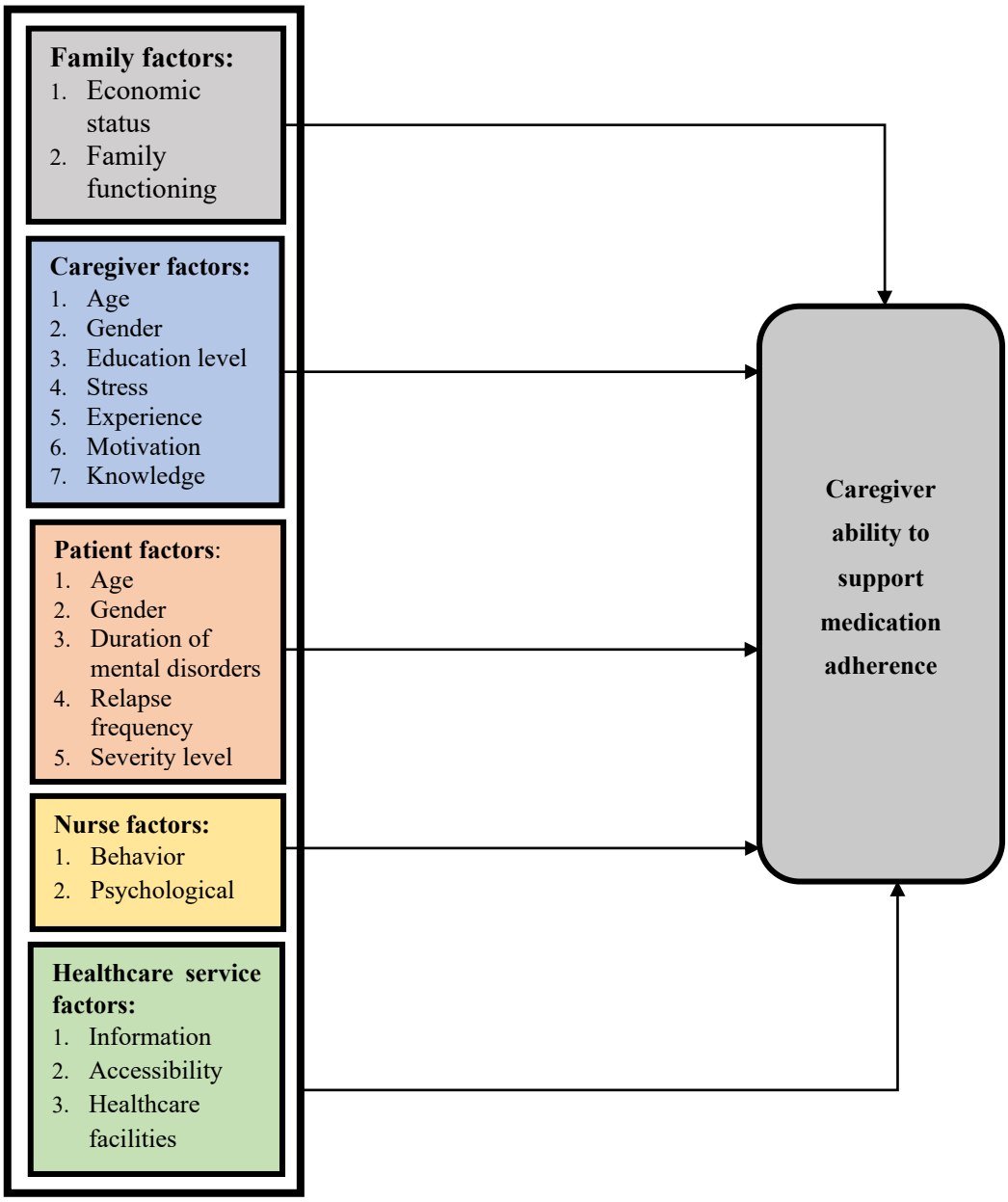

Figure 1. Conceptual Framework Based on Integration of the Friedman Family Assessment Model, the Theory of Planned Behavior, and the Health Coaching
(Ajzen, 1991; Friedman, Bowden and Jones, 2010; Greif et al., 2022).
Conceptual Notes:
The framework illustrates the multilevel determinants of caregivers' ability to support medication adherence. Family, caregiver, patient, nurse, and healthcare service factors were examined as the associated determinants. The FFAM was used to contextualize family level determinants, the TPB-informed motivational and cognitive determinants at the caregiver level, and coaching-related components informed relational support mechanisms from nurses. Healthcare service components were positioned as contextual background factors within TPB. Integrated model-guided variable selection and interpretation.

family dynamics, caregiver attributes, patient clinical status, nursing support, and healthcare service readiness.

To address this gap, the present study applies a multivariate approach to examine determinants across multiple levels (family, caregiver, patient, nurse, and healthcare service) while focusing specifically on caregivers' ability to support medication adherence as a key caregiving process. The novelty of this study lies in its integration of family systems and behavioral perspectives, the use of a multivariate analytical model to assess combined effects, and its contextual contribution from a low- and middle-income setting, where families serve as the primary providers of mental health care.

This study was guided by established family and behavioral theories to inform variable selection and analytical strategies. Specifically, family determinants were informed by FFAM, which conceptualizes families as interdependent systems influencing health and caregiving contexts, while caregiver-related behavioral factors were aligned with TPB (Ajzen, 1991; Friedman, Bowden and Jones, 2010). Thus, this study aimed to identify the factors associated with caregivers' ability to

support medication adherence among people with mental disorders. Accordingly, FFAM and TPB were employed to guide the selection and specification of the family, caregiver, patient, nurse, and healthcare service variables included in the empirical model (see Figure 1).

Materials and Methods

Study Design and Samples

This cross-sectional study examined predictor and outcome variables. This cross-sectional study was based on the Strengthening the Reporting of Observational Studies in Epidemiology (STROBE) Declaration (Field *et al.*, 2014). The final version of the STROBE checklist is provided in Supplementary File 1. This study was conducted at seven community health centers (Puskesmas) in Makassar, Indonesia. Puskesmas is a primary healthcare clinic run by the government to provide mental health services.

This study presents a secondary analysis of a dataset previously published by the authors (Andriani *et al.*, 2025). In a previous study, a health coaching model was developed using partial least squares structural equation modeling (PLS-SEM). The current analysis aimed to identify factors associated with caregivers' ability to support medication adherence using multivariate logistic regression, reflecting differences in research objectives, outcome variables, and analytical approaches. No overlapping results were reported between the two studies.

Seven Puskesmas were purposively selected based on the prevalence of people with mental disorders in their catchment areas during 2023–2024, as reported by local health authorities. A total of 155 family caregivers were recruited from these seven Puskesmas. The number of caregivers recruited from each center varied according to the availability of eligible participants during the data collection period. Purposive sampling was conducted at the health center level to ensure the inclusion of caregiving contexts with higher demands for mental health services. The procedures for participant recruitment and eligibility criteria are described in the subsequent section.

The study population comprised family members who provided care to community-dwelling patients with mental disorders in Makassar, Indonesia. Participant identification and recruitment were conducted in collaboration with the mental health program supervisors at the selected Puskesmas through outreach records and home visits. Of the 350 caregivers initially identified from the Puskesmas records, 200 were screened for eligibility, and 155 met the inclusion criteria and consented to participate. Data were collected between February and June 2024. The sample adequacy for multivariate logistic regression was evaluated using statistical considerations, with the events-per-variable (EPV) ratio exceeding the commonly cited threshold of 10, indicating an adequate sample size to estimate regression parameters with a reduced risk of overfitting (Peduzzi *et al.*, 1996; Vittinghoff and McCulloch, 2007; Riley *et al.*, 2020).

The inclusion criteria of the participants were defined as follows: (a) being a primary family caregiver of a person diagnosed with a mental disorder, defined as an individual who provided primary and ongoing support for daily care and medication management; (b) being aged 18 years or older; (c) having complete and valid contact information; and (d) being accessible for home visits during the data collection period. Potential participants were identified with the assistance of mental health program supervisors at Puskesmas to facilitate initial contact, while final eligibility screening and recruitment were conducted by the research team. Individuals with formal education in health-related fields, such as medicine, nursing, midwifery, or psychology, were excluded from the study. Because patients were not the direct focus of the study, no specific inclusion or exclusion criteria were applied.

The sampling method used in this study was a two-phase approach. In the first phase, Puskesmas were purposively selected based on predefined operational criteria, including higher-documented mental health caseloads, active implementation of community mental health programs, availability of updated caregiver records for outreach, and coordination with mental health program supervisors to facilitate access to the study population. In the second phase, purposive sampling was used to recruit eligible family caregivers from the selected Puskesmas as described in the preceding sections.

Variables and Instruments

Some of the predictor variables of this study were: (a) family factors, which comprise family economic status and family functioning; (b) caregiver factors, such as age, gender, education, stress, experience, motivation, and knowledge; (c) patient factors, including age, gender, duration of mental disorders, relapse frequency, and level of severity; (d) nurse factors, including behavioral and psychological factors; and (e) healthcare service factors, including information, accessibility, and healthcare facilities. Caregivers' ability to support medication adherence was the outcome variable.

The researchers developed structured, closed-ended questionnaires that were adapted from a previous study (Andriani *et al.*, 2025). Each questionnaire is described in Supplementary File 2, including items, scoring procedures, and classification methods.

Caregivers' ability to support medication adherence was the main outcome variable and was determined by a nine-item structured questionnaire designed to assess caregiver behavioral support in maintaining treatment continuity among relatives with mental disorders. This instrument measures the level of caregiver support

behavior rather than the patients' actual medication-taking behavior. The questionnaire consisted of a single dimension with two behavioral aspects: follow-up care support (two items) and medication adherence support (seven items). Each item was rated using a three-point Likert scale ("not done" = 0; "sometimes done" = 1; "always done" = 2), resulting in total scores ranging from 0 to 18, with higher scores indicating greater caregiver ability to support medication adherence. Scores were classified into two categories: 0–13 were categorized as low ability and 14–18 were categorized as high ability, based on the cut-off values established in the previous validation study (see Supplementary File 2). Example items include "I accompany the patient to scheduled health service follow-up visits" and "I assist the patient in taking medication according to the prescribed dose and frequency" (see Supplementary File 3).

Facial validity, expert panel review, and psychometric testing were conducted through pilot testing, content validity assessment, and reliability analysis (Sahir, 2021). The outcome measure remained unchanged from that in a previous study. Construct validity was examined using Pearson product–moment correlation, and reliability was assessed using Cronbach's alpha. The correlation coefficients ranged from 0.305 to 0.964, and the Cronbach's alpha values ranged from 0.636 to 0.974, indicating adequate validity and reliability (see Supplementary File 4). To minimize self-report and social desirability bias, the questionnaire was completed anonymously without identifying information in a non-observed setting, and data collectors were trained and not involved in the clinical care team.

Data Collection and Analysis

Data were gathered through home visits using questionnaires administered to the selected Puskesmas catchment areas. Mental health program supervisors collaborated with the research team to facilitate contact with caregivers. The questionnaires were administered face-to-face by trained data collectors to ensure that all items were read and clearly understood. Interviewers explained each item using standardized procedures to ensure consistent understanding across participants with different educational backgrounds. This interviewer-administered approach helped to minimize uncertainty during data collection and reduce interviewer-related bias, thereby maintaining response consistency (Hariati *et al.*, 2020).

Univariate analysis was conducted using frequency and percentage distributions to describe family, caregiver, patient, nurse, healthcare service variables, and caregiver abilities. A Chi-square test was used in the bivariate stage to examine the associations between predictor variables and outcome variables. A significant association between the variables was defined as $p < 0.05$. variables with $p < 0.25$ in the bivariate analysis were eligible for inclusion in the multivariate logistic regression model. A $p < 0.25$ threshold is commonly recommended in logistic regression modeling to avoid excluding potentially important independent variables and confounders (Hosmer, Lemeshow and Sturdivant, 2013). This approach also supports the model parsimony and stability, particularly in observational studies with multiple predictors (Zhang, 2016).

Multivariate logistic regression was then performed to identify the predictive factors associated with caregivers' ability to support medication adherence. Adjusted odds ratios (AORs) and 95% confidence intervals (CIs) were reported using a significance threshold of $P < 0.05$. Model fit was assessed using the Hosmer–Lemeshow goodness-of-fit test, and multicollinearity among independent variables was evaluated using Variance Inflation Factor (VIF) values, with VIF < 5 indicating acceptable levels. Categorical predictor variables were dummy-coded with predefined reference categories, including family economic status (≤minimum city minimum wage [MCMW]), family functioning (poor), caregiver gender (male), caregiver stress (mild), caregiver motivation (low), caregiver knowledge (inadequate), patient relapse frequency (1–3 times per year), patient severity level (mild), nurse behavior factor (incapable), nurse psychological factor (incapable), and healthcare facilities (not supportive). All analyses were performed using IBM SPSS Statistics version 25.0.

Ethical Considerations

Ethical approval was obtained from the Health Research Ethics Committee, Faculty of Nursing, Universitas Airlangga (Approval No. 3100-KEPK) on February 26, 2024. All participants provided written informed consent before participation.

Results

One hundred and fifty-five family caregivers met the eligibility criteria, provided informed consent, and were included in the final analysis. Table 1 presents the demographic characteristics of the caregivers and patients. The majority of caregivers were adults (47.7%), females (63.9%), and senior high school graduates (56.8%). The patients were predominantly adult (62.6%) and male (61.3%).

Table 2 presents the distribution of the study variables. Most families (82.6%) had an economic status below the MCMW and the majority demonstrated good family functioning (65.2%). Among caregiver-related variables, 29.7% reported moderate stress levels and 54.2% had extensive caregiving experience. Most caregivers were highly motivated (60.6%) and possessed adequate knowledge (65.8%). Regarding patient-related clinical characteristics, 54.2% had been ill for more than 10 years, 80.6% experienced one–three relapses per year, and 60.6% presented with mild disorder severity.

Table 1: Demographic characteristics of caregivers and patients (n = 155)

Variables	Indicators	Category	n	%
Caregiver	Age	Adult	74	47.7
		Middle-aged adult	48	31.0
		Elderly	33	21.3
	Gender	Male	56	36.1
		Female	99	63.9
	Education level	No formal education	5	3.2
		Elementary school	11	7.1
		Junior high school	27	17.4
		Senior high school	88	56.8
		Tertiary education	24	15.5
Patient	Age	Adult	97	62.6
		Middle-aged adult	45	29.0
		Elderly	13	8.4
	Gender	Male	95	61.3
		Female	60	38.7

Table 2: Frequency and percentage distribution of variables (n=155)

Variables	Indicators	Category	n	%
Family factors	Economic status	≤MCMW	128	82.6
		>MCMW	27	17.4
	Family functioning	Poor	11	7.1
		Moderate	43	27.7
		Good	101	65.2
Caregiver factors	Stress	Mild	5	3.2
		Moderate	46	29.7
		Severe	104	67.1
	Experience	Limited	71	45.8
		Extensive	84	54.2
	Motivation	Low	61	39.4
		High	94	60.6
	Knowledge	Inadequate	53	34.2
		Adequate	102	65.8
Patient factors	Duration of mental disorders	1-3 years	18	11.6
		4-6 years	20	12.9
		7-10 years	33	21.3
		>10 years	84	54.2
	Relapse frequency	1-3 per year	125	80.6
		4-5 per year	15	9.7
		>5 per year	15	9.7
	Severity level	Mild	94	60.6
		Moderate	38	24.5
		Severe	23	14.8
Nurse factors	Behavior	Incapable	53	34.2
		Capable	102	65.8
	Psychological	Incapable	59	38.1
		Capable	96	61.9
Healthcare service factors	Information	Not supportive	22	14.2
		Supportive	133	85.8
	Accessibility	Not supportive	38	24.5
		Supportive	117	75.5
	Healthcare facilities	Not supportive	49	31.6
		Supportive	106	68.4
Caregiver ability to support mental disorder patients	Medication adherence	Low	76	49.0
		High	79	51.0

Note: MCMW= Minimum City Minimum Wage as defined by local government regulations

Regarding nurse-related variables, 65.8% of respondents perceived nurses as behaviourally capable and 61.9% as psychologically capable. With respect to healthcare services, most caregivers perceived information availability (85.8%), accessibility (75.5%), and facilities (68.4%) as supportive. Overall, 51.0% of the caregivers demonstrated a high ability to support medication adherence.

Table 3 shows the bivariate associations between the predictors and outcome variables. Factors significantly associated with caregiver ability to support medication adherence were family functioning ($p < 0.001$), caregiver gender ($p = 0.029$), caregiver stress ($p = 0.044$), caregiver motivation ($p < 0.001$), caregiver knowledge ($p < 0.001$), relapse frequency ($p = 0.009$), severity level ($p = 0.026$), and nurse psychological factors ($p = 0.019$). No significant associations were observed for family economic status, caregiver factors (age, education level, caregiving experience), patient factors (age, gender, illness duration), nurse behavior, and healthcare service

Table 3: Bivariate analysis of factors associated with caregiver ability to support medication adherence among people with mental disorders (n=155)

Variables	Dimensions	Category	Caregiver Ability to Support Medication Adherence				χ^2 (p-value)*
			Low		High		
			n	%	n	%	
Family factors	Economic status	≤MCMW	66	42.6	62	40	1.882 (0.170)
		>MCMW	10	6.5	17	17	
	Family functioning	Poor	10	6.5	1	1	19.763 (<0.001)
		Moderate	29	18.7	14	14	
		Good	37	23.9	64	64	
Caregiver factors	Age	Adult	35	22.6	39	25.2	0.764 (0.682)
		Middle-aged adult	26	16.8	22	14.2	
		Elderly	15	9.7	18	11.6	
	Gender	Male	34	21.9	22	14.2	4.788 (0.029)
		Female	42	27.1	57	36.8	
	Education level	No formal education	2	1.3	3	1.9	1.870 (0.760)
		Elementary school	7	4.5	4	2.6	
		Junior high school	15	9.7	12	7.7	
		Senior high school	41	26.5	47	30.3	
		Tertiary education	11	7.1	13	8.4	
	Stress	Mild	1	0.6	4	2.6	6.259 (0.044)
		Moderate	17	11	29	18.7	
		Severe	58	37.4	46	29.7	
	Experience	Limited	36	23.2	35	22.6	0.147 (0.702)
		Extensive	40	25.8	44	28.4	
	Motivation	Low	44	28.4	17	11	21.475 (<0.001)
		High	32	20.6	62	40	
	Knowledge	Inadequate	37	23.9	16	10.3	13.915 (<0.001)
		Adequate	39	25.2	63	40.6	
Patient factors	Age	Adult	47	30.3	50	32.3	0.134 (0.935)
		Middle-aged adult	22	14.2	23	14.8	
		Elderly	7	4.5	6	3.9	
	Gender	Male	45	29	50	32.3	0.272 (0.602)
		Female	31	20	29	18.7	
	Duration of mental disorders	1–3 years	12	7.7	6	3.9	2.602 (0.457)
		4–6 years	9	5.8	11	7.1	
		7–10 years	16	10.3	17	11	
		>10 years	39	25.2	45	29	
	Relapse frequency	1–3 per year	54	34.8	71	45.8	9.324 (0.009)
		4–5 per year	12	7.7	3	1.9	
		>5 per year	10	6.5	5	3.2	
	Severity level	Mild	40	25.8	54	34.8	7.291 (0.026)
		Moderate	19	12.3	19	12.3	
		Severe	17	11	6	3.9	
Nurse factors	Behavior	Incapable	31	20	22	14.2	2.883 (0.090)
		Capable	45	29	57	36.8	
	Psychological	Incapable	36	23.2	23	14.8	5.475 (0.019)
		Capable	40	25.8	56	36.1	
Healthcare service factors	Information	Not supportive	12	7.7	10	6.5	0.312 (0.577)
		Supportive	64	41.3	69	44.5	
	Accessibility	Not supportive	20	12.9	18	11.6	0.261 (0.609)
		Supportive	56	36.1	61	39.4	
	Healthcare facilities	Not supportive	29	18.7	20	12.9	2.955 (0.086)
		Supportive	47	30.3	59	38.1	

Note: *χ^2 = chi-square test; p <0.05.
MCMW= Minimum City Minimum Wage as defined by local government regulations

factors (information, accessibility, and healthcare facilities).

Table 4 summarizes the multicollinearity diagnostics. Variance Inflation Factor (VIF) values ranged from 1.148 to 1.880, indicating the absence of significant multicollinearity among the predictor variables. The overall model demonstrated good statistical significance (Model $\chi^2 = 42.87$, $p < 0.001$), with moderate explanatory power (Nagelkerke $R^2 = 0.32$). The Hosmer–Lemeshow goodness-of-fit test further indicated an adequate model fit ($p = 0.450$).

Table 5 displays the adjusted associations between the predictors and caregivers' ability to support medication adherence. Four variables remained significant in the adjusted model: family economic status, family functioning, caregiver motivation, and caregiver knowledge. Caregivers from households with a low economic status (below the MCMW) had lower odds of supporting medication adherence (AOR = 0.22, 95% CI = 0.07–0.69, p = 0.010). Caregivers from families with good functioning were more likely to support medication adherence than those from families with poor or

Tabel 4: Variance Inflation Factor (VIF) of predictor variables in the multivariate logistic regression model

Variables	Dimensions	VIF
Family factors	Economic status	1.185
	Family functioning	1.565
Caregiver factors	Age	1.346
	Gender	1.196
	Education level	1.420
	Stress	1.808
	Experience	1.148
	Motivation	1.472
	Knowledge	1.286
Patient factors	Age	1.221
	Gender	1.174
	Duration of mental disorders	1.213
	Relapse frequency	1.347
	Severity level	1.880
Nurse factors	Behavior	1.452
	Psychological	1.329
Healthcare service factors	Information	1.175
	Accessibility	1.196
	Healthcare facilities	1.776

Note:
VIF < 5 indicates no significant multicollinearity among predictor variables
Model $\chi^2 = 42.87$, $p < 0.001$; Nagelkerke $R^2 = 0.32$

Tabel 5: Binary logistic regression analysis of factors associated with caregivers' ability to support medication adherence among people with mental disorders

Variables	B	SE	Adjusted OR	p-value
Family economic status (≤MCMW)	-1.54	0.59	0.22 (0.07–0.69)	0.010
Family functioning (poor)	0.95	0.39	2.58 (1.19–5.58)	0.016
Caregiver gender (male)	0.43	0.45	1.53 (0.64–3.68)	0.338
Caregiver stress (mild)	-0.82	1.25	0.44 (0.04–5.13)	0.512
Caregiver motivation (low)	-1.23	0.47	0.29 (0.12–0.73)	0.008
Caregiver knowledge (inadequate)	-0.92	0.45	0.40 (0.16–0.96)	0.041
Patient relapse frequency (1-3 times per year)	0.59	0.84	1.80 (0.35–9.27)	0.485
Patient severity level (mild)	0.20	0.77	1.23 (0.27–5.57)	0.792
Nurse behavior factor (incapable)	0.84	0.50	2.32 (0.88–6.12)	0.089
Nurse psychological factor (incapable)	0.61	0.48	1.84 (0.72–4.74)	0.206
Healthcare facilities (not supportive)	0.33	0.52	1.40 (0.50–3.89)	0.523

Notes:
Statistical significance: $p < 0.05$
B: regression coefficient; SE: Standard Error; OR: Odds Ratio; CI: Confidence Interval; MCMW: Makassar City Minimum Wage

moderate functioning (AOR = 2.58, 95% CI = 1.19–5.58, p = 0.016). Higher caregiver motivation (AOR = 0.29, 95% CI = 0.12–0.73, p = 0.008) and adequate caregiver knowledge (AOR = 0.40, 95% CI = 0.16–0.96, p = 0.041) were also significantly associated with the caregiver ability to support medication adherence.

Discussions

This study examined factors associated with caregivers' ability to support medication adherence among people with mental disorders using an integrated framework based on FFAM and TPB alongside health coaching principles. Bivariate analyses identified significant associations across family, caregiver, patient, and nurse-related variables, whereas multivariate analysis highlighted key determinants at the family and caregiver levels.

In line with the FFAM approach, a substantial association was observed between family functioning and adherence to support. Caregivers from well-functioning families reported higher levels of adherence support than did those from moderately or poorly functioning families. FFAM conceptualizes the family as an interdependent system in which communication, roles, and affective processes shape adaptive functioning (Friedman, Bowden and Jones, 2010). Similarly, previous literature indicates that cohesive and supportively organized families tend to be more actively involved in caregiving and treatment participation (Rotheram-Borus *et al.*, 2017; Oltean *et al.*, 2020; Cameron *et al.*, 2024). In contrast, limited family support, constrained resources, and negative perceptions of treatment have been identified as barriers to adherence to medication (Tan *et al.*, 2022; Amini, Jalali and Jalali, 2023). In contrast, limited family support, constrained resources, and negative perceptions of treatment have been identified as barriers to adherence to medication (Chai *et al.*, 2021).

Caregiver factors associated with adherence support included gender, stress, motivation, and knowledge. Adherence support was more pronounced among female caregivers, which is consistent with evidence of stronger emotional engagement and greater participation in caregiving roles among women (Rexhaj *et al.*, 2023). Adherence support was negatively associated with higher levels of caregiver stress, indicating that stress may

impair motivation, emotional regulation, and coping capacity within caregiving roles (Cornelius *et al.*, 2017; Rady, Mouloukheya and Gamal, 2021). Conversely, greater caregiver motivation and knowledge were positively associated with adherence support, which is consistent with findings that informed and motivated caregivers tend to be more actively engaged in treatment processes (Siddiqui and Khalid, 2019; Kızılırmak, Ertem and Kılıçaslan, 2023; Tahghighi *et al.*, 2023). These findings are consistent with the Theory, which emphasizes the role of attitudes, motivation, and perceived control in shaping behavioral intentions (Ajzen, 2020).

The frequency of relapse and severity of the disorder were significant patient-related factors associated with adherence support. Caregivers who managed patients with milder symptoms and fewer relapses had higher levels of adherence support. Previous research has indicated that recurrent relapses and severe symptoms increase caregiver burden and reduce consistent engagement in care (Litzelman *et al.*, 2023; Ramani *et al.*, 2024). Structured behavioral and coaching-based interventions have been reported to help address these challenges by enhancing caregiver engagement(Harris, Bourke-Taylor and Leo, 2022).

Psychological support, rather than behavioral competence, was associated with adherence support. Caregivers' confidence and self-efficacy may be reinforced through empathic communication, emotional support, and informational guidance (Imanigoghary *et al.*, 2017; Purba, Suttharangsee and Chaowalit, 2017; Seyedrasooli *et al.*, 2020). These findings are consistent with health coaching concepts that focus on motivational, informational, and emotional elements in supporting behavior change (Bozer and Jones, 2018; Zhang and Zhang, 2020).

Adherence support was not significantly associated with healthcare service factors such as information availability, accessibility, and facility adequacy. This implies that structural resources may not exert sufficient influence on caregiver engagement unless they are supported by relational and motivational factors (Barr and Tsai, 2021; Rahayu, Mubin and Suerni, 2023). Previous literature also suggests that long-term adherence may not be achieved through access alone without sustained relational support (Chai *et al.*, 2021; Deng *et al.*, 2022). Recent findings from guided digital interventions further emphasize the importance of coaching relationships for maintaining engagement (Bernstein *et al.*, 2024).

In multivariate analysis, family economic status, family functioning, caregiver motivation, and caregiver knowledge were found to be significantly associated with adherence support. These results indicate the interaction between family level factors (FFAM) and motivational and cognitive elements (TPB). Although these associations are consistent with the theoretical framework, they should be interpreted as being associational rather than causal.

The implications of these findings are related to community mental health nursing practices. Long-term medication adherence may be supported by interventions that reinforce family functioning and increase caregivers' motivation and illness-related knowledge. Psychological support and structured communication processes may also help nurses foster caregiver motivation and self-efficacy, consistent with health coaching principles. These implications remain exploratory and require further confirmation using prospective or experimental research designs.

This study has several limitations. The cross-sectional design did not allow causal inference, and the observed associations should be interpreted with caution. Self-reported information may be prone to recall and social desirability bias. The selection of Puskesmas with higher mental health caseloads may limit the generalizability to other settings with different service coverage and sociodemographic characteristics. Unexplained variance may also be attributable to unmeasured psychosocial factors such as stigma or broader social support. Finally, although the conceptual framework was grounded in family and behavioral perspectives, it did not assess a formal health coaching intervention; therefore, the findings reflect associational patterns rather than intervention effects.

Conclusion

A significant association was found between family economic status, family functioning, caregiver motivation, and caregiver knowledge in supporting medication adherence. These results indicate that family dynamics and psychosocial preparedness may play a more prominent role in adherence-related caregiving behaviors than demographic or structural factors do. Integrating the perspectives of FFAM, TPB, and health coaching may help contextualize how structural, motivational, and informational factors shape caregiver engagement in medication support. Strengthening family functioning and caregivers' psychosocial resources may be beneficial for future programs aimed at enhancing adherence to support. Further research, including longitudinal or interventional designs, is needed to clarify potential causal pathways and implications for patient-level adherence outcomes.

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Availability of data and materials

Upon reasonable request, the corresponding author will provide the datasets generated and/or analyzed during the present study.

Authors' contributions

Research design, study conception, and preliminary manuscript: AA, AY, RF, EE, SH, and NM. Collection, analysis, and interpretation of data: AA, AY, RF, MJB, DSA, and SH. Manuscript revision: AA, AY, RF, EE, SH, NM, and KSK. Final editing: AA, AY, RF, MJB, DSA, NM, and KSK. All authors approved the submission of the final version of the manuscript.

Declaration of Interest

The authors declare no conflicts of interest

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