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The Effect of Medical Personnel Communication, Family Support, and Education on Treatment Adherence among Patients with Type 2 Diabetes Mellitus (DM) through Self-Efficacy as an Intervening Variable at the Internal Medicine Polyclinic of RSUD Dr. Harjono S. Ponorogo, East Java

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Abstract

Medication non-adherence among patients with Type 2 Diabetes Mellitus (T2DM) remains a significant issue in chronic disease care. A preliminary study at the Internal Medicine Outpatient Clinic of Dr. Harjono S. Regional General Hospital in Ponorogo Regency revealed that 64% of patients took medication only when symptoms appeared, 70% had not received structured education, 58% did not understand the function of their medication, and 52% lacked family support. This study aimed to analyze the influence of of medical personnel communication, family support, and education on medication adherence, both directly and through self-efficacy as an intervening variable. The study employed a quantitative design using a cross-sectional approach and an explanatory research method. The sample consisted of 130 respondents selected via purposive sampling from a population of 178 active patients; the sample size was determined using the SEM-PLS rule of thumb. Data were collected using a fou point Likert scale questionnaire and analyzed using Structural Equation Modeling–Partial Least Squares (SEM-PLS). All research instruments were validated and proven reliable.The results indicate that medical personnel communication, family support, and education significantly influence medication adherence, both directly and through self-efficacy as an intervening variable. Self-efficacy was proven to be a significant mediator in enhancing medication adherence among T2DM patients. This study contributes to the development of hospital policies based on patient-centered care for the multidimensional management of chronic diseases.

Keywords: *Medical Personnel Communication, Family Support, Education, Self-Efficacy, Treatment Adherence, Type 2 Diabetes Mellitus, SEM-PLS*

1. Background

Health is an important factor affecting an individual's quality of life and productivity. In modern healthcare services, treatment success depends not only on the quality of medical care but also on patients' adherence to prescribed therapies. Non-adherence, such as discontinuing medication or failing to attend regular follow-up visits, remains common among patients with chronic diseases, including Type 2 Diabetes Mellitus (DM), and may lead to complications and increased hospitalization rates.

Type 2 Diabetes Mellitus is a global health problem with a continuously increasing prevalence and is characterized by insulin resistance and impaired pancreatic function. If not properly managed, Type 2 DM can lead to serious complications, including cardiovascular disease, kidney failure, neuropathy, and visual impairment. Effective management of Type 2 DM requires long-term adherence to medication, healthy lifestyle modifications, and regular monitoring. Therefore, Treatment Adherence plays a crucial role in controlling blood glucose levels and preventing complications among patients with Type 2 DM.

Several factors influence Treatment Adherence, including Medical Personnel Communication, Family Support, Education, and Self-Efficacy. Effective and empathetic communication can improve patients' understanding of their condition and increase trust in healthcare providers. Family support, such as emotional encouragement and assistance in following treatment regimens, also contributes to better adherence. Furthermore, structured Education can enhance patients' knowledge and confidence in managing their condition independently

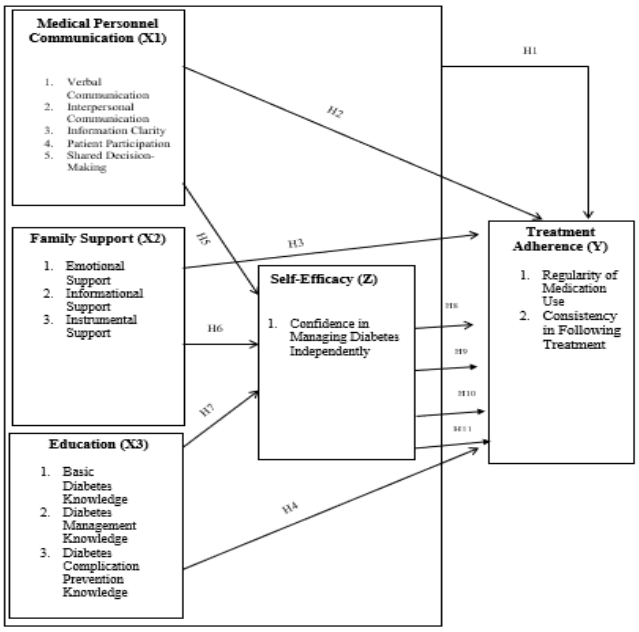
According to Bandura's Social Cognitive Theory [1], health behavior is influenced by environmental factors and self-efficacy, which refers to an individual's belief in their ability to perform specific behaviors. Self-

Efficacy reflects patients' confidence in their ability to adhere to treatment, overcome barriers, and maintain healthy behaviors. Patients with higher Self-Efficacy are more likely to adhere to treatment regimens than those with lower levels of confidence.

Treatment non-adherence remains a significant issue among patients with Type 2 DM at the Internal Medicine Polyclinic of RSUD Dr. Harjono S. Ponorogo, East Java, Indonesia. A preliminary study involving 50 patients revealed that 58% did not understand the purpose of their prescribed medications, 64% only followed treatment recommendations when symptoms occurred, 52% lacked adequate Family Support, and 70% had never received comprehensive and structured Education. These findings indicate that low Treatment Adherence is influenced not only by clinical factors but also by Medical Personnel Communication, Family Support, Education, and patients' Self-Efficacy.

Although numerous studies have examined factors influencing Treatment Adherence, research investigating Self-Efficacy as an intervening variable remains limited, particularly in outpatient settings at regional hospitals in Indonesia. Therefore, this study aims to analyze the effects of Medical Personnel Communication, Family Support, and Education on Treatment Adherence among patients with Type 2 Diabetes Mellitus through Self-Efficacy as an intervening variable at the Internal Medicine Polyclinic of RSUD Dr. Harjono S. Ponorogo, East Java.

Figure 1. Research Conceptual Framework



1.1. Treatment Adherence

Treatment adherence refers to the extent to which patients follow recommendations related to medication use, dietary management, lifestyle modifications, and routine follow-up visits [2]. In Type 2 DM, adherence is essential for glycemic control and prevention of complications. Adherence is measured through the regularity of taking medication and consistency of undergoing treatment.

1.2. Communication of Medical Personnel

Medical personnel communication refers to the interaction between medical personnel, patients, and families in providing information and support related to disease management [3]. Effective communication can improve patient understanding, trust, and adherence to treatment.

1.3. Family Support

Family support includes emotional, instrumental, and informational assistance provided to patients with chronic illnesses [4]. Good family support can improve a patient's motivation, self-efficacy, and medication adherence.

1.4. Education

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Education in this study refers to patient education programs designed to improve knowledge, skills, and self-management abilities related to chronic disease treatment [5]. Education on diabetes management and complication prevention has been proven to improve medication adherence.

1.5. Self-Efficacy

Self-efficacy is an individual's belief in his or her ability to manage certain behaviors [1]. Patients with high self-efficacy tend to be more confident and consistent in undergoing treatment and are able to overcome therapy barriers.

2. Research Methods

2.1. Research Design and Location

This study employed a quantitative approach using an explanatory research design with a cross-sectional method to analyze the causal relationships among variables at a specific point in time. The study was conducted at the Internal Medicine Polyclinic of RSUD Dr. Harjono S. Ponorogo, East Java from November 2025 to January 2026.

2.2. Population and Sample

The study population consisted of all patients with Type 2 Diabetes Mellitus (DM) undergoing routine treatment at the Internal Medicine Polyclinic of RSUD Dr. Harjono S. Ponorogo, East Java, in 2025.

The sampling technique used purposive sampling with the following inclusion criteria: patients diagnosed with Type 2 DM, undergoing routine treatment for at least three months, aged 18–70 years, able to communicate in Indonesian, and willing to participate by providing informed consen

The total sample size was 130 respondents. The sample size determination referred to the SEM-PLS rule-of-thumb approach, which recommends a minimum sample size of at least five times the total number of indicators. With a total of 26 indicators, the minimum required sample size was 130 respondents. Therefore, the sample size in this study was considered adequate for Structural Equation Modeling–Partial Least Squares (SEM-PLS) analysis to produce stable and reliable model estimations.

2.3. Operational Variables and Definitions

This study consisted of three independent variables: Medical Personnel Communication (X1), Family Support (X2), and Education (X3); one intervening variable: Self-Efficacy (Z); and one dependent variable: Treatment Adherence (Y). Data were collected using a structured questionnaire consisting of 26 indicators measured on a five-point Likert scale, ranging from 1 = Strongly Disagree to 5 = Strongly Agree.

Table 1. Operational Definition of Research Variables

Variables / Definitions	Dimensions	Statement Item	Scale
Medical Personnel Communication (X_1) *Perception of type 2 DM patients towards communication of medical personnel*	Verbal Communication	The doctor greeted me politely and kindly	Ordinal
	Interpersonal Communication	The doctor listened to my complaints well	Ordinal
	Clarity of Information	The doctor used language that I could easily understand	Ordinal
	Patient Participation	The doctor gave me the opportunity to ask questions	Ordinal
	Joint Decision-Making	The doctor involved me in making treatment decisions	Ordinal
Family Support (X_2) *Patients' perceptions of family support in treatment*	Emotional Support	1) My family understands how I feel about living with diabetes 2) The family provided emotional support for my condition	Ordinal
	Information Support	Families provide helpful information about diabetes	Ordinal

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	Instrumental Support	1) My family encouraged me to go to the doctor for regular check-ups 2) My family reminds me to take medicine according to the rules 3) My family can accept my condition as a diabetic patient	Ordinal
Education (X_3) *DM patient's level of understanding of diabetes*	Basic Knowledge	1) Excessive sugar consumption can increase the risk of diabetes 2) Diabetes is related to increased blood sugar levels in the body	Ordinal
	Diabetes Management	1) Diabetes can be controlled with proper management 2) Exercise and diet regulation are important in diabetes management	Ordinal
	Prevention of Complications	1) Diabetes can cause complications of blood vessel & nerve disorders 2) Diabetes is related to the disruption of insulin work in the body	Ordinal
Self-Efficacy (Z) *Patient's confidence in managing diabetes independently*	Confidence in Managing Diabetes Independently	1) I am confident that I am able to take medication on schedule 2) I am confident that I can follow the recommendations of health workers 3) I am confident that I can manage my diet according to diabetes recommendations 4) I am confident that I am able to do routine blood sugar control and checks. 5) Overall, I believe I am able to manage diabetes well	Ordinal
Treatment Adherence (Y) *Patient behavior in carrying out diabetes treatment*	Regularity of Drug Consumption	1) I always remember to take medication according to the set schedule 2) I am able to manage my time so as not to miss the schedule of taking medication 3) I take medication every day as recommended	Ordinal
	Consistency of Treatment	1) I continue to take medication even though I feel that my body is in good condition 2) I continued the treatment even though the symptoms were reduced	Ordinal

Source: Processed from various grand theories (2026)

2.4. Research Hypothesis

This study proposes 11 hypotheses as follows:

Table 2. Research Hypothesis

Code	Hypothesis
H1	Medical Personnel Communication (X1) has a positive effect on Treatment Adherence (Y).
H2	Family Support (X2) has a positive effect on Treatment Adherence (Y).
H3	Education (X3) has a positive effect on Treatment Adherence (Y).
H4	Medical Personnel Communication (X1) has a positive effect on Self-Efficacy (Z).
H5	Family Support (X2) has a positive effect on Self-Efficacy (Z).
H6	Education (X3) has a positive effect on Self-Efficacy (Z).
H7	Self-Efficacy (Z) has a positive effect on Treatment Adherence (Y).
H8	Self-Efficacy (Z) mediates the effect of Medical Personnel Communication (X1) on Treatment Adherence (Y).
H9	Self-Efficacy (Z) mediates the effect of Family Support (X2) on Treatment Adherence (Y).

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Code	Hypothesis
H10	Self-Efficacy (Z) mediates the effect of Education (X3) on Treatment Adherence (Y).
H11	Medical Personnel Communication (X1), Family Support (X2), and Education (X3) simultaneously affect Treatment Adherence (Y) through Self-Efficacy (Z).

Source: Primary data, processed 2026

2.5. Validity and Reliability Tests

The validity test was conducted on 30 respondents using *Pearson Correlation* with the criteria of $r > 0.30$ and sig. < 0.05 (SPSS 26). The reliability test used *Cronbach's Alpha* with a minimum limit of 0.70 [6]. In *the PLS-SEM* analysis (SmartPLS 4.0), the convergent validity was assessed via AVE ≥ 0.50 and the composite reliability via *Composite Reliability* ≥ 0.70.

2.6. Data Analysis Techniques

Data analysis was carried out in two stages using *SmartPLS 4.0*: (1) descriptive analysis *of the Three-Box Method* to describe the respondents' perception tendencies; and (2) *PLS-SEM* included outer models (AVE, HTMT, CR) and inner models (VIF, R^2, f^2, Q^2, *path coefficients* with *bootstrapping* 5,000 subsamples, $\alpha = 0.05$).

3. Results and Discussion

3.1. Characteristics of Respondents

The study involved 130 Type 2 DM patients at the Internal Medicine Polyclinic of Dr. Harjono S. Ponorogo Hospital.

Table 3. Characteristics of Respondents (n=130)

Yes	Respondent Characteristics	f	%
1	**Gender**		
	Male	45	34,62
	Women	85	65,38
	Total	130	100
2	**Age**		
	26–40 years old	5	3,85
	41–55 years old	28	21,54
	56–70 years old	97	74,62
	Total	130	100
3	**Education**		
	No school	6	4,62
	Elementary/equivalent	23	17,69
	Junior High School/Equivalent	11	8,46
	High School/equivalent	27	20,77
	Diploma	24	18,46
	Bachelor (S1)	26	20,00
	Postgraduate (S2/S3)	13	10,00
	Total	130	100
4	**Jobs**		
	Private Employees	29	22,31
	Housewives	25	19,23
	PNS	23	17,69
	Retirees	21	16,15
	Labor	16	12,31
	Self-employed	11	8,46
	No/Not Working	5	3,85
	Total	130	100
5	**Long Suffering from DM**		
	3–6 months	28	21,54
	7–12 months	41	31,54
	1–5 years	47	36,15
	> 5 years	14	10,77
	Total	130	100

Source: Primary data, processed 2026

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Based on Table 3, the majority of respondents were female (65.38%), aged 56–70 years old (74.62%), high school education/equivalent (20.77%), worked as private employees (22.31%), and had suffered from DM for 1–5 years (36.15%). The dominance of older age groups and women is an important background in understanding the role of social support and communication in medication adherence.

3.2. Validity and Reliability Tests

The validity test uses outer loading with a criterion of ≥0.70. All indicators on all variables met these criteria (range 0.702–0.896), so they were declared valid.

Table 4. Validity Test Results (Outer Loadings)

Variabel	Indicator	*Outer loading*	Remarks
Medical Personnel Communication (X1)	X1.1 – Verbal Communication	0,786	Valid
	X1.2 – Interpersonal Communication	0,819	Valid
	X1.3 – Clarity of Information	0,809	Valid
	X1.4 – Patient Participation	0,727	Valid
	X1.5 – Joint Decision-Making	0,702	Valid
Family Support (X2)	X2.1 – Emotional support	0,735	Valid
	X2.2 – Informational support	0,848	Valid
	X2.3 – Instrumental support	0,840	Valid
	X2.4 – Appraisal support	0,763	Valid
	X2.5 – Supervision support	0,707	Valid
	X2.6 – Motivational support	0,717	Valid
Education (X3)	X3.1 – DM Knowledge	0,896	Valid
	X3.2 – Diet & Nutrisi	0,844	Valid
	X3.3 – Physical activity	0,841	Valid
	X3.4 – Drug use	0,806	Valid
	X3.5 – Self-monitoring	0,850	Valid
	X3.6 – Prevention of complications	0,863	Valid
Self-Efficacy (Z)	Z1 – Diet management	0,779	Valid
	Z2 – Sports activities	0,794	Valid
	Z3 – Glucose monitoring	0,861	Valid
	Z4 – Medication compliance	0,746	Valid
	Z5 – Stress management	0,749	Valid
Treatment Adherence (Y)	Y1 – Don't forget to take medication	0,772	Valid
	Y2 – Take medication on time	0,706	Valid
	Y3 – Not stopping taking medication	0,776	Valid
	Y4 – Take medication as recommended	0,796	Valid
	Y5 – Consistency of treatment	0,787	Valid

Source: SmartPLS Algorithm output, processed 2026

Table 5. Reliability Test Results

Variabel	*Cronbach's Alpha*	*Composite Reliability*	Remarks
Medical Personnel Communication (X1)	0,827	0,879	Reliabel
Family Support (X2)	0,861	0,897	Reliabel
Education (X3)	0,923	0,940	Reliabel
Self-Efficacy (Z)	0,846	0,890	Reliabel
Treatment Adherence (Y)	0,826	0,878	Reliabel

Source: SmartPLS Algorithm output, processed 2026

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All variables had Cronbach's Alpha >0.70 and Composite Reliability >0.70, making them reliable and suitable for further analysis.

3.3. Descriptive Analysis (Three-Box Method)

The descriptive analysis used the Three-Box Method with a 4-point Likert scale and a range of categories: Low (32.50–65.00), Medium (65.01–97.50), and High (97.51–130.00).

Table 6. Three-Box Method Analysis Results Matrix

Variabel	Average Index	Category	Highest Indicators	Lowest Indicator
Medical Personnel Communication (X1)	109,85	Height	Giving a chance to ask questions (112.50)	Language is easy to understand (107,25)
Family Support (X2)	110,96	Height	Positive family rating (112.75)	Motivation to seek treatment (108.25)
Education (X3)	100,92	Height	Exercise & diet (103,75)	Understanding blood sugar levels (97.00)*
Self-Efficacy (Z)	113,25	Height	Regular light exercise (115.00)	Regulating diet (110.25)
Treatment Adherence (Y)	110,60	Height	Don't forget to take your medicine (114,25)	Consistency of treatment (107.25)

Source: Primary Data processed, 2026

All variables are in the high category. The self-efficacy variable had the highest average index (113.25), while the education variable had the lowest index (100.92). The lowest indicator in the education variable, namely the understanding that diabetes is related to an increase in blood sugar levels (97.00), was in the medium category, indicating that patients' basic understanding of the disease still needs to be improved.

3.4. Evaluation of the Outer Model (PLS-SEM)

The evaluation of the outer model includes testing convergent validity through Average Variance Extracted (AVE) and discriminant validity through Heterotrait-Monotrait Ratio (HTMT).

Table 7. Convergent Validity Testing (AVE)

Variabel	AVE	Ket.
Medical Personnel Communication (X1)	0,593	Valid (>0.50)
Family Support (X2)	0,594	Valid (>0.50)
Education (X3)	0,723	Valid (>0.50)
Self-Efficacy (Z)	0,619	Valid (>0.50)
Treatment Adherence (Y)	0,590	Valid (>0.50)

Source: Primary Data, processed 2026

All variables have an AVE value of >0.50, thus meeting the convergent validity. The results of the cross loading test also showed that each indicator had the highest loading value in the construct it measured, so that the discriminant validity was met.

3.5. Evaluation of the Inner Model

Table 8. Inner VIF Values

Variabel	→ Self-Efficacy (Z)	→ Treatment Adherence (Y)
Medical Personnel Communication (X1)	2,439	2,487
Family Support (X2)	2,215	2,878
Education (X3)	2,292	2,384
Self-Efficacy (Z)	–	2,478

Source: Research Processed Data, 2026

All VIF values are <3.3 (ideal category), so there are no multicollinearity problems in the model.

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Table 9. R-Square and Q-Square values

Variable endogenous	R^2	R^2 Adjusted	Q^2	Category
Self-Efficacy (Z)	0,597	0,587	0,428	Moderate / Big Prediction
Treatment Adherence (Y)	0,736	0,727	0,365	Strong-Moderate / Big Prediction

Source: SmartPLS Algorithm output, processed 2026

The R^2 value of Self-Efficacy of 0.597 indicates that 59.7% of the variation can be explained by communication of medical personnel, family support, and education. A Treatment Adherence R^2 value of 0.736 indicates that 73.6% of the variation can be explained by all four variables in the model. Both Q^2 values >0.35 indicate the model's large predictive capabilities.

Table 10. Effect Size (f^2)

Pathway	f^2	Category
Family Support → Self-Efficacy	0,299	Medium
Family Support → Treatment Adherence	0,228	Medium
Medical Personnel Communication → Treatment Adherence	0,169	Medium
Education → Self-Efficacy	0,040	Small
Medical Personnel Communication → Self-Efficacy	0,020	Small
Education → Treatment Adherence	0,018	Small
Self-Efficacy → Treatment Adherence	0,018	Small

Source: SmartPLS Algorithm output, processed 2026

3.6. Hypothesis Testing

Table 11. Direct Impact Test Results

Path	β	T Statistic	P Value	Conclusion
X1 → Self-Efficacy (Z)	0,139	3,505	0,000	Accepted
X1 → Treatment Adherence (Y)	0,333	3,557	0,000	Accepted
X2 → Self-Efficacy (Z)	0,517	5,076	0,000	Accepted
X2 → Treatment Adherence (Y)	0,417	4,509	0,000	Accepted
X3 → Self-Efficacy (Z)	0,193	3,874	0,000	Accepted
X3 → Treatment Adherence (Y)	0,106	3,127	0,000	Accepted
Z → Treatment Adherence (Y)	0,107	3,041	0,000	Accepted

Source: SmartPLS Bootstrapping output, processed 2026

Table 12. Indirect Influence through Self-Efficacy

Mediation Path	β	T Statistic	P Value	Conclusion
X2 → Z → Y	0,056	3,992	0,000	Accepted
X3 → Z → Y	0,021	3,821	0,000	Accepted
X1 → Z → Y	0,015	3,706	0,000	Accepted

Source: SmartPLS Bootstrapping output, processed 2026

The entire track has a T-statistic of >1.96 and a p-value of <0.05. All eleven research hypotheses were declared accepted.

3.7. Discussion

The simultaneous effect of medical personnel communication, family support, and education on treatment adherence through self-efficacy. Medical personnel communication, family support, and education simultaneously influenced treatment adherence through self-efficacy ($R^2 = 0.736$), indicating that these variables collectively explained 73.6% of the variance in treatment adherence among patients with Type

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2 Diabetes Mellitus. This finding suggests that treatment adherence is influenced not only by external factors but also by patients' confidence in managing their disease. Self-efficacy serves as an important mediating mechanism through which effective communication, family support, and education are translated into better treatment adherence. According to Bandura's Social Cognitive Theory, environmental factors such as communication, family support, and education strengthen self-efficacy, which subsequently promotes adherence to treatment [1]. These findings are consistent with previous studies showing that effective healthcare communication, family involvement, and diabetes education improve adherence by enhancing patients' self-efficacy. Therefore, improving treatment adherence requires an integrated approach that combines effective communication, continuous education, active family participation, and strategies to strengthen patients' self-efficacy.

The Effect of Medical Personnel Communication on Treatment Adherence. Medical personnel communication had a positive and significant effect on treatment adherence ($\beta = 0.333$). This finding indicates that effective communication enables patients to better understand their disease, treatment goals, and the importance of adhering to prescribed therapy. Clear, empathetic, and patient-centered communication also encourages patients to participate actively in decision-making, fostering trust and improving adherence to long-term treatment. According to McCabe and Timmins, effective communication is an essential component of healthcare because it facilitates information exchange, strengthens the therapeutic relationship, and promotes patient engagement. Furthermore, Bandura's Social Cognitive Theory suggests that communication serves as an environmental factor that enhances patients' knowledge and confidence, thereby encouraging positive health behaviors [1]. These findings are consistent with previous studies reporting that effective communication between healthcare professionals and patients significantly improves treatment adherence and diabetes self-management [3]. Therefore, strengthening communication skills among medical personnel should be considered an essential strategy for improving treatment adherence in patients with Type 2 Diabetes Mellitus.

The Effect of Family Support on Treatment Adherence. Family support had a positive and significant effect on treatment adherence ($\beta = 0.417$). This finding indicates that emotional, informational, and instrumental support from family members encourages patients to adhere more consistently to prescribed treatment and long-term diabetes management. Patients who receive continuous encouragement, assistance with medication schedules, and support in maintaining healthy lifestyles are more likely to remain committed to treatment. According to Bandura's Social Cognitive Theory, family support represents an environmental factor that reinforces positive health behaviors by providing motivation and social reinforcement [1]. These findings are consistent with previous studies demonstrating that family involvement improves treatment adherence among patients with chronic diseases by enhancing motivation and reducing barriers to self-management [4]. Therefore, involving family members in diabetes education and treatment planning may strengthen patients' commitment to therapy and improve long-term treatment outcomes.

The Effect of Education on Treatment Adherence. Education had a positive and significant effect on treatment adherence ($\beta = 0.106$). This finding indicates that patient education improves understanding of diabetes, treatment objectives, medication use, healthy lifestyles, and the prevention of complications, thereby encouraging greater adherence to prescribed therapy. Although its direct effect was lower than that of medical personnel communication and family support, education remains an essential component of diabetes management because it equips patients with the knowledge needed to make informed health decisions. According to Bandura's Social Cognitive Theory and Bastable's Patient Education Theory, educational interventions enhance patients' knowledge, skills, and confidence, enabling them to participate actively in managing their condition [1]. These findings are consistent with previous studies reporting that structured diabetes education significantly improves treatment adherence and long-term disease management [5]. Therefore, patient education should be delivered continuously, using simple language and appropriate educational methods tailored to patients' needs.

The Effect of Medical Personnel Communication on Self-Efficacy. Medical personnel communication had a positive and significant effect on self-efficacy ($\beta = 0.139$). This finding suggests that clear, empathetic, and patient-centered communication enhances patients' confidence in their ability to manage Type 2 Diabetes Mellitus. Effective communication allows patients to better understand their condition, express their concerns, and actively participate in treatment decisions, thereby strengthening their confidence in performing self-management behaviors. According to Bandura's Social Cognitive Theory, verbal persuasion provided through effective communication is an important source of self-efficacy because encouragement and constructive feedback increase individuals' confidence in their capabilities [1]. These findings are consistent with previous studies demonstrating that therapeutic communication improves self-

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efficacy and promotes positive self-management behaviors among patients with chronic diseases [7]. Therefore, strengthening communication skills among healthcare professionals may contribute not only to better patient understanding but also to greater confidence in managing diabetes independently.

The Effect of Family Support on Self-Efficacy. Family support demonstrated the strongest positive effect on self-efficacy (β = 0.517). This finding indicates that emotional encouragement, practical assistance, and continuous support from family members substantially strengthen patients' confidence in managing Type 2 Diabetes Mellitus. Family involvement provides motivation, reassurance, and practical guidance that help patients overcome challenges associated with long-term treatment and lifestyle modification. According to Bandura's Social Cognitive Theory, social support represents an important environmental factor that enhances self-efficacy through emotional reinforcement, social persuasion, and positive encouragement [1]. These findings are consistent with previous studies showing that patients who receive strong family support generally report higher self-efficacy and better self-management of chronic diseases [8]. Therefore, family-centered interventions should be integrated into diabetes management programs to strengthen patients' confidence and improve long-term health outcomes.

The Effect of Education on Self-Efficacy. Education had a positive and significant effect on self-efficacy (β = 0.193). This finding indicates that educational interventions improve patients' knowledge, understanding, and confidence in managing Type 2 Diabetes Mellitus independently. Better understanding of diabetes management enables patients to make informed decisions and perform self-care behaviors more confidently. According to Bandura's Social Cognitive Theory, self-efficacy develops through learning experiences that enhance individuals' knowledge and skills. In addition, Bastable's Patient Education Theory emphasizes that effective patient education empowers individuals to participate actively in disease management. These findings are consistent with previous studies demonstrating that structured diabetes education significantly improves patients' self-efficacy and self-management behaviors [9]. Therefore, educational programs should be delivered continuously and adapted to patients' educational needs and individual characteristics.

The Effect of Self-Efficacy on Treatment Adherence. Self-efficacy had a positive and significant effect on treatment adherence (β = 0.107). This finding suggests that patients who have greater confidence in their ability to manage diabetes are more likely to adhere to medication, maintain healthy lifestyles, and attend regular follow-up appointments. According to Bandura's Social Cognitive Theory, self-efficacy is a key determinant of health behavior because individuals with stronger confidence are more persistent in overcoming challenges and maintaining positive behaviors [1]. These findings are consistent with previous studies reporting that higher self-efficacy is associated with better treatment adherence and improved self-management among patients with chronic diseases [1]. Therefore, interventions aimed at strengthening patients' self-efficacy should be incorporated into diabetes management programs to improve long-term adherence and treatment outcomes.

The Indirect Effect of Medical Personnel Communication on Treatment Adherence through Self-Efficacy. Medical personnel communication indirectly influenced treatment adherence through self-efficacy (β = 0.015). This finding indicates that effective communication not only improves adherence directly but also strengthens patients' confidence in managing their condition, which subsequently enhances adherence to treatment recommendations. According to Bandura's Social Cognitive Theory, verbal persuasion and supportive communication increase self-efficacy, leading to more positive health behaviors [1]. These findings are consistent with previous studies demonstrating that patient-centered communication enhances self-efficacy and contributes to better treatment adherence among individuals with chronic diseases [7]. Therefore, effective communication should be considered an important strategy for improving both self-efficacy and long-term treatment adherence.

The Indirect Effect of Family Support on Treatment Adherence through Self-Efficacy. Family support indirectly influenced treatment adherence through self-efficacy (β = 0.056). This finding suggests that family involvement improves treatment adherence by strengthening patients' confidence in their ability to manage diabetes. Emotional encouragement, practical assistance, and continuous motivation provided by family members reinforce self-efficacy, enabling patients to maintain adherence despite the challenges of long-term treatment. These findings support Bandura's Social Cognitive Theory, which identifies social support as an important environmental factor influencing self-efficacy and health behavior [1]. Consistent with previous studies, strong family support enhances self-efficacy and promotes sustained adherence to

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treatment among patients with chronic diseases [4]. Therefore, family participation should be integrated into diabetes care programs to optimize treatment outcomes.

The Indirect Effect of Education on Treatment Adherence through Self-Efficacy. Education indirectly influenced treatment adherence through self-efficacy ($\beta = 0.021$). This finding indicates that educational interventions improve treatment adherence by increasing patients' knowledge, confidence, and ability to manage Type 2 Diabetes Mellitus independently. Better understanding of diabetes and its treatment strengthens self-efficacy, which subsequently promotes adherence to prescribed therapy. These findings are consistent with Bandura's Social Cognitive Theory and previous studies demonstrating that educational programs improve adherence by enhancing patients' self-efficacy and self-management skills [5]. Therefore, continuous and patient-centered educational interventions are essential not only for increasing knowledge but also for strengthening self-efficacy, thereby supporting long-term treatment adherence.

4. Conclusion

This study demonstrated that Medical Personnel Communication, Family Support, and Education significantly influenced Treatment Adherence among patients with Type 2 Diabetes Mellitus, both directly and indirectly through Self-Efficacy. The findings indicate that treatment adherence is not determined by a single factor but results from the interaction between external factors and patients' confidence in managing their disease. Among the independent variables, Family Support showed the strongest influence on Self-Efficacy, highlighting the important role of family involvement in promoting long-term adherence. These findings support Bandura's Social Cognitive Theory, which emphasizes that environmental factors enhance self-efficacy and subsequently encourage positive health behaviors. The study also indicates that improving treatment adherence requires an integrated approach. Healthcare providers should strengthen patient-centered communication by using clear and understandable language, involve family members actively in diabetes management, and provide structured and continuous education to improve patients' knowledge and confidence in self-management. Strengthening self-efficacy should become an essential component of diabetes care because it mediates the effects of communication, family support, and education on treatment adherence. Future studies are recommended to include larger and more diverse samples from multiple healthcare settings to improve the generalizability of the findings. Further research should also examine additional factors, such as health literacy, motivation, socioeconomic status, psychological conditions, and cultural influences, and employ longitudinal or mixed-methods designs to provide a more comprehensive understanding of long-term treatment adherence among patients with Type 2 Diabetes Mellitus.

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