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Factors Determining Blood Glucose Stability in Diabetes Mellitus Patients and Their Impact on Quality of Life in West Lombok

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Abstract

Type 2 diabetes mellitus (T2DM) remains a major public health challenge in primary care, particularly in rural areas where medication adherence, lifestyle practices, family support, diabetes education, and access to healthcare may affect glycemic control and quality of life. This study aimed to identify determinants of blood glucose stability and examine its association with quality of life among patients with T2DM receiving care at Community Health Centers in West Lombok Regency, Indonesia. This quantitative observational analytical study used a cross-sectional design and was conducted from January to April 2026 among 362 patients enrolled in the Chronic Disease Management Program (Prolanis). Data were collected using structured questionnaires, clinical records, and the Diabetes Quality of Life Clinical Trial Questionnaire and analyzed using chi-square tests and multiple logistic regression. Medication adherence (OR = 4.72; 95% CI: 2.91–7.66), family support (OR = 3.58), physical activity (OR = 2.89), diabetes education (OR = 2.41), diet (OR = 2.07), and access to healthcare (OR = 1.62) were significant determinants of blood glucose stability. Stable blood glucose was strongly associated with good quality of life (OR = 7.18; p < 0.001). These findings highlight the importance of integrated primary care interventions that strengthen medication adherence, family involvement, lifestyle management, diabetes education, and healthcare access to improve glycemic stability and quality of life among patients with T2DM in rural settings.

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Introduction

Diabetes Mellitus (DM) is one of the most pressing global health challenges of the contemporary era. The International Diabetes Federation (IDF) reports that in 2023, approximately 537 million adults worldwide were living with DM, a figure projected to increase to 783 million by 2045 (IDF, 2023). The economic and social burden of this condition is enormous, as DM is a leading cause of serious complications including retinopathy, nephropathy, neuropathy, and cardiovascular disease

(Saeedi et al., 2022; Cho et al., 2023). At the national level, the 2023 Basic Health Research (Riskesdas) showed that the prevalence of diabetes mellitus (DM) in Indonesia had reached 11.7% among adults aged 15 years and above, increasing from 10.9% in 2018. West Nusa Tenggara (NTB) Province recorded a DM prevalence of 9.8%, with West Lombok Regency identified as one of the areas with the highest incidence of type 2 DM in NTB, reaching 12.3 per 1,000 population according to data from the West Lombok Regency Health Office in 2023. The number of DM patient visits to primary health facilities in West Lombok continues to increase, with an average annual growth of 8.2% from 2020 to 2023.

Quality of life in DM patients is a multidimensional construct encompassing physical functional status, psychological well-being, treatment satisfaction, and freedom in performing daily activities (Shen et al., 2022). Recent research has shown that the stability of glycemic control directly influences QOL in DM patients. In a cohort study conducted in Taiwan, Huang et al. (2022) found that DM patients with controlled HbA1c (≤7%) consistently reported higher QOL scores than those with poor glycemic control (HbA1c > 9%). A meta-analysis by Trikkalinou et al. (2023), which included 38 studies with a total of 12,641 T2DM subjects, showed a strong correlation between blood glucose stability and functional domains of QOL ($r = 0.48$; 95% CI: 0.41–0.55; $p < 0.001$). In this study, quality of life was assessed using the Diabetes Quality of Life Clinical Trial Questionnaire (DQLCTQ), an instrument specifically designed for the DM population and validated in various clinical contexts (Shen et al., 2022).

Various determinants influence blood glucose stability in DM patients, broadly categorized into behavioral and structural factors. Behavioral factors include adherence to a pharmacological regimen, adherence to a diabetes diet plan, and regular physical activity. Several recent international studies provide strong evidence that medication adherence is the strongest predictor of glycemic control. Sapkota et al. (2023), in an 18-month prospective cohort study conducted in Nepal, reported that DM patients with high medication adherence (MMAS-8) were 4.3 times more likely to achieve an HbA1c target below 7% than non-adherent patients. Consistent with these findings, Kassahun et al. (2024), in a cross-sectional study conducted in Ethiopia, found that regular physical activity (at least 150 minutes per week) was significantly associated with controlled fasting blood glucose levels (OR = 2.97; $p = 0.001$).

Structural factors, particularly family support and diabetes education, have also been identified as important determinants. A community-based study by Pamungkas et al. (2022) in Indonesia showed that DM patients with high family support had a 2.6-fold better quality of life than those with low family support. A study by Sun et al. (2023) in China confirmed that a structured diabetes education program in a primary health care center significantly improved patient self-efficacy, ultimately contributing to improved glycemic control. Access to healthcare is also a structural barrier in rural Indonesia, as geographic and socioeconomic limitations affect the continuity of DM care (Wardhani et al., 2023). Although several studies on the determinants of QoL in DM patients have been conducted in Indonesia, a substantial research gap remains in West Lombok Regency. First, no study has comprehensively and simultaneously integrated behavioral and structural factors using a multivariate model in this region. Second, the DQLCTQ instrument, specifically designed for DM patients and capable of capturing treatment satisfaction, physical function, psychological well-being, and dietary freedom, has never been implemented in community health centers (Puskesmas) in West Nusa Tenggara. Third, previous research has been largely conducted in large urban hospitals. At the same time, the varying socio-cultural characteristics and accessibility of healthcare services in West Lombok Regency require a contextually specific approach. This study was designed to address this gap by analyzing the determinants of blood glucose stability and its impact on quality of life in 20 community health centers (Puskesmas) in West Lombok Regency.

The conceptual framework of this study integrates three theoretical models: the Health Belief Model (Rosenstock, 1974), which explains the dimensions of preventive behavior based on individual

perceptions; Self-Efficacy Theory (Bandura, 1977), which emphasizes self-beliefs as mediators of health behavior; and the Social Determinants of Health Framework (WHO, 2008), which positions structural factors as conditions that shape health behavior and outcomes. This conceptual model positions behavioral factors (diet, physical activity, medication adherence) and structural factors (access to health services, family support, diabetes education) as independent variables that directly influence blood glucose stability, which in turn determines quality of life in patients with diabetes.

Materials and Methods

Research Design

This study used an observational, analytical, cross-sectional design. This design was chosen because it allows simultaneous measurement of independent and dependent variables at a single point in time, offering an efficient way to identify associations between determinants and quality-of-life outcomes in a large primary care population (Gordis, 2019). Data were collected from January to April 2026 in West Lombok Regency, West Nusa Tenggara Province.

Population, Sample, and Sampling Techniques

The study population consisted of all type 2 DM patients who were actively registered in Prolanis (Chronic Disease Management Program) in 20 Community Health Centers in West Lombok Regency during January 2026, totaling 3,840 people according to data from the Community Health Center Information System (SIMPUS) of the West Lombok Regency Health Office in 2026.

The sample size is calculated using the Slovin formula with a margin of error (e) of 5%:

$$n = N / (1 + N \cdot e^2) = 3{,}840 / (1 + 3{,}840 \times 0.05^2) = 3{,}840 / 10.6 = 362.26 \approx 362 \text{ respondents}$$

The sampling technique used was multistage proportional random sampling. In the first stage, clusters of Community Health Centers were selected. Of the 20 Community Health Centers, 10 were randomly selected using proportional probability sampling based on the number of registered DM patients. In the second stage, the number of participants from each selected Community Health Center was determined proportionally to each facility's total population (proportional allocation). In the third stage, respondents at each Community Health Center were selected through simple random sampling using a list of patient registration numbers.

Inclusion and Exclusion Criteria

Inclusion criteria: (1) patients diagnosed with type 2 diabetes mellitus for at least one year; (2) aged 30–70 years; (3) actively registered at the Community Health Center and able to communicate verbally; and (4) willing to participate by providing written consent. Exclusion criteria: (1) patients with severe complications (end-stage renal disease, stroke, or amputation); (2) pregnant women with gestational diabetes; and (3) patients who could not be included in data collection after two visits.

Research Variables and Instruments

Independent variables were grouped into two groups. The first group consisted of behavioral factors: (a) diet (good/poor, assessed using the 12-item Diabetes Diet Adherence Scale [DDAS] modified on a Likert scale); (b) physical activity (active/inactive, measured using the Physical Activity Questionnaire for People with Diabetes [PAQD], with a cutoff of ≥150 minutes per week of moderate-intensity aerobic activity); and (c) medication adherence (adherent/non-adherent, assessed using the Morisky Medication Adherence Scale-8 [MMAS-8], with a score of ≥6 classified as adherent). The

second group consisted of structural factors: (d) access to health services (easy/difficult, assessed using a combined measure of distance and affordability); (e) family support (high/low, assessed using the 15-item Diabetes Family Support Scale [DFSS]); and (f) diabetes education (receiving/never receiving structured diabetes education from health workers at the Community Health Center in the last six months). The primary dependent variable was blood glucose stability, operationalized based on three consecutive random blood glucose (RBG) measurements as recorded in the research instrument: stable (mean RBG 80–200 mg/dL) and unstable (mean RBG < 80 mg/dL or > 200 mg/dL), combined with HbA1c values if available from medical records, according to PERKENI (2023) standards.

The outcome variable measured was quality of life, using the Indonesian version of the DQLCTQ (Diabetes Quality of Life Clinical Trial Questionnaire). The DQLCTQ was developed specifically for the DM population and has been psychometrically validated in various clinical settings (Shen et al., 2022). This instrument consists of eight domains that assess specific aspects of the quality of life of DM patients: (1) General Health Status (2 items: assessment of overall health condition and comparison with pre-DM status); (2) Limitations in Physical Function/Activity (6 items: ability to perform vigorous activity, moderate activity, climbing stairs, bending, walking, and self-care); (3) Health Worries and Energy Fatigue (11 items: covering fatigue, weight, vitality, fear, and frustration related to DM); (4) Psychological Well-Being Mental Health (5 items: anxiety, calmness, sadness, and happiness); (5) Satisfaction with DM Treatment (7 items: satisfaction with time management, blood glucose levels, treatment, family impact, and knowledge); (6) General Life Satisfaction (8 items: sleep, social relationships, sexuality, work, appearance, exercise, leisure time, and overall life satisfaction); (7) Disease Control and Disease Impact (3 items on a Likert scale of 1–7: perception of DM control, treatment satisfaction, and treatment expectations); and (8) Dietary Freedom and Activities (10 items: flexibility in eating, diet scheduling, physical, social, daily, and unscheduled activities). Random blood glucose was measured on three occasions (morning, afternoon, and evening of the visit) and recorded as Measurements I, II, and III; the average of these values was used to classify blood glucose stability. All measurement procedures followed the Community Health Center's standard operating procedures using a calibrated glucometer. Assessment of quality of life using the DQLCTQ was conducted through a structured questionnaire-assisted interview: total scores were summed and normalized to a scale of 0–100, with a cutoff score of ≥60 indicating good quality of life and <60 indicating poor quality of life, following the convention established by Shen et al. (2022) and Jacobson et al. (1998). We tested instrument validity and reliability with 30 respondents at the Gerung Community Health Center (outside the study sample) before primary data collection. Validity testing (Pearson correlation, $r > 0.30$) confirmed that all DQLCTQ items were valid. Internal consistency was assessed using Cronbach's alpha: MMAS-8 ($\alpha = 0.81$), DFSS ($\alpha = 0.84$), and total DQLCTQ ($\alpha = 0.89$), all showing satisfactory internal consistency.

Data Collection Procedures

Enumerators consisted of trained health workers (nurses) from each selected Community Health Center (Puskesmas). Enumerators received a one-day standardization training prior to data collection. Primary data were collected through structured interviews using a validated questionnaire. Secondary data (HbA1c and fasting blood glucose values) were obtained from patient

medical records available in the SIMPUS system, using laboratory results from the previous three months.

Data Analysis

Data analysis was conducted in three stages using SPSS version 26.0. (1) Univariate analysis: descriptive statistics were calculated to characterize respondents and determine the frequency distribution of each variable using frequency distribution tables and percentages. (2) Bivariate analysis: the relationship between each independent variable and blood glucose stability and quality of life was examined using the Chi-square test (with Continuity Correction applied to cells with expected frequencies <5). The strength of the relationship was expressed as the Odds Ratio (OR) with a 95% Confidence Interval (CI); a p-value <0.05 was considered statistically significant. (3) Multivariate analysis: variables with a p-value <0.25 in the bivariate analysis were entered into a multiple binary logistic regression model (enter method). Model adequacy was assessed using the Hosmer-Lemeshow goodness-of-fit test (p > 0.05 indicates adequate model fit).

Research Ethics

This study has obtained ethical approval from the Health Research Ethics Committee of Bunda Thamrin University, with reference number 012/KEPK-UBT/I/2026. All respondents received a comprehensive explanation of the study's objectives and procedures and provided written informed consent. Respondent confidentiality was guaranteed through the use of identification codes. Participation was voluntary, and respondents could withdraw at any time without consequence.

Result and Discussion

Result

Respondent Characteristics

Table 1. Distribution of Respondent Characteristics (n = 362)

Characteristics	Category	N	%
Sex	Man	128	35.4
	Woman	234	64.6
Age (years)	30–45	87	24.0
	46–60	198	54.7
	61–70	77	21.3
Education	No school / Elementary School	142	39.2
	Junior High School/Senior High School	163	45.0
	Diploma / University	57	15.7
DM Duration	1–5 years	178	49.2
	> 5 years	184	50.8

Table 1 shows that most respondents were female (64.6%), in the productive age group of 46–60 years (54.7%), and had attained secondary education (junior high school/high school) (45.0%).

More than half of the respondents (50.8%) had been living with DM for more than five years, indicating a largely chronic patient population with a high risk of complications.

Distribution of Independent and Dependent Variables

Table 2. Frequency Distribution of Research Variables (n = 362)

Variables	Category	N	%
Dietary habit	Good	162	44.8
	Poor	200	55.2
Physical Activity	Active	154	42.5
	Not active	208	57.5
Medication Compliance	Adherents	159	43.9
	Not attached	203	56.1
Access to Health Services	Easy	201	55.5
	Difficult	161	44.5
Family Support	Tall	171	47.2
	Low	191	52.8
DM Education	Accepted	183	50.6
	Never received	179	49.4
Blood Glucose Stability	Stable	166	45.9
	Unstable	196	54.1
Quality of Life	Good	171	47.2
	Poor	191	52.8

As shown in Table 2, more than half of the respondents exhibited unhealthy behaviors: 55.2% had a poor diet, 57.5% were physically inactive, and 56.1% were non-adherent to their pharmacological regimen. From a structural perspective, 44.5% experienced difficulties accessing healthcare and 52.8% received low family support. Regarding outcome measures, 54.1% of respondents had unstable blood glucose levels, and 52.8% reported poor quality of life.

Bivariate Analysis: Relationship Between Variables and Blood Glucose Stability

Table 3. Bivariate Analysis of Independent Variables on Blood Glucose Stability

Variables	Stable n (%)	Unstable n (%)	OR	95% confidence interval	p-value
Good Eating Habits	97 (59.9)	65 (40.1)	2.71	1.76–4.18	< 0.001
Poor Eating Habits	69 (34.5)	131 (65.5)	Reference	–	–

Physically active	96 (62.3)	58 (37.7)	3.04	1.93–4.79	< 0.001
Physically Inactive	70 (33.7)	138 (66.3)	Reference	–	–
Compliance in Medication Use	107 (67.3)	52 (32.7)	5.12	3.21–8.17	< 0.001
Not attached	59 (29.1)	144 (70.9)	Reference	–	–
Easy Service Access	101 (50.2)	100 (49.8)	1.68	1.08–2.61	0.021
Difficult Access	65 (40.4)	96 (59.6)	Reference	–	–
High Family Support	103 (60.2)	68 (39.8)	3.74	2.35–5.97	< 0.001
Low Family Support	63 (33.0)	128 (67.0)	Reference	–	–
DM Education (Received)	100 (54.6)	83 (45.4)	2.52	1.60–3.96	< 0.001
DM Education (Never)	66 (36.9)	113 (63.1)	Reference	–	–

The bivariate analysis (Table 3) showed that all independent variables were statistically significantly associated with blood glucose stability ($p < 0.05$). Medication adherence showed the highest OR in the bivariate analysis (OR = 5.12), followed by family support (OR = 3.74) and physical activity (OR = 3.04). All variables met the eligibility criteria for inclusion in the logistic regression model ($p < 0.25$).

Multivariate Analysis: Determinants of Blood Glucose Stability

We performed multiple logistic regression by entering all six independent variables simultaneously. The Hosmer-Lemeshow test confirmed adequate model fit ($p = 0.612 > 0.05$). Nagelkerke $R^2 = 0.487$, indicating that the model explained 48.7% of the variance in blood glucose stability.

Table 4. Final Logistic Regression Model—Determinants of Blood Glucose Stability (n = 362)

Variables	β	SE	OR	95% confidence interval	p-value
Medication Compliance (compliance)	1,552	0.247	4.72	2.91–7.66	< 0.001
Family Support (high)	1,275	0.263	3.58	2.14–5.98	< 0.001
Physical Activity (active)	1,061	0.248	2.89	1.78–4.70	< 0.001
DM Education (accepted)	0.880	0.246	2.41	1.49–3.90	< 0.001
(Good) Eating Pattern	0.726	0.221	2.07	1.34–3.19	0.001
Access to Health Services (easy)	0.481	0.227	1.62	1.04–2.53	0.033

Constant	−3,812	0.418	–	–	< 0.001

Note: Nagelkerke R^2 = 0.487; Hosmer-Lemeshow p = 0.612; Overall classification accuracy = 74.3%

Table 4 shows that all six variables simultaneously were significant independent predictors of blood glucose stability. Medication adherence was the strongest predictor (OR = 4.72), indicating that adherent patients were 4.72 times more likely to achieve blood glucose stability compared to non-adherent patients, after controlling for all other variables. Family support ranked second (OR = 3.58), followed by physical activity (OR = 2.89), diabetes education (OR = 2.41), diet (OR = 2.07), and access to healthcare (OR = 1.62).

The Relationship Between Blood Glucose Stability and Quality of Life

Bivariate analysis of the relationship between blood glucose stability and quality of life using the Chi-square test revealed a highly significant association (χ^2 = 84.31; df = 1; p < 0.001; OR = 7.18; 95% CI: 4.48–11.51). Of the 166 respondents with stable blood glucose, 134 (80.7%) reported a good quality of life based on the DQLCTQ score. In contrast, of the 196 respondents with unstable blood glucose, only 37 (18.9%) had a good quality of life, while 159 (81.1%) reported a poor quality of life. The average total DQLCTQ score in the stable blood glucose group (68.4 ± 9.2) was significantly higher than in the unstable group (47.6 ± 11.3) (t = 17.83; p < 0.001). The most affected domains in the unstable group were Health & Energy Concerns (mean score 38.2), Disease Control (mean score 3.8 out of 7), and Satisfaction with DM Treatment (mean score 39.5), reflecting the substantial psychological burden of uncontrolled blood glucose levels.

Table 5. Comparison of Average DQLCTQ Domain Scores Between Stable and Unstable Blood Glucose Groups

DQLCTQ Domain	Stable (n=166) Mean ± SD	Unstable (n=196) Mean ± SD	T	p-value
1. General Health Status	72.4 ± 10.1	51.3 ± 12.8	16.08	< 0.001
2. Limitations of Function/Physical Activity	65.8 ± 11.3	44.7 ± 13.5	14.55	< 0.001
3. Health & Energy Issues – Fatigue	63.1 ± 9.8	38.2 ± 11.4	20.41	< 0.001
4. Psychological Well-being – Mental Health	70.2 ± 8.9	46.5 ± 12.2	18.92	< 0.001
5. Satisfaction with DM Treatment	69.7 ± 10.4	39.5 ± 13.1	21.88	< 0.001
6. General Life Satisfaction	71.3 ± 9.2	49.1 ± 11.8	17.59	< 0.001
7. Disease Control (scale 1–7)	5.4 ± 1.1	3.8 ± 1.3	11.27	< 0.001
8. Freedom of Diet & Activity	62.9 ± 12.1	43.8 ± 13.7	12.85	< 0.001
DQLCTQ Total Score (0–100)	**68.4 ± 9.2**	**47.6 ± 11.3**	**17.83**	**< 0.001**

Independent t-test; domain scores are normalized to a 0–100 scale (except Domain 7, which uses a 1–7 scale)

Table 5 shows that all eight DQLCTQ domains were significantly lower in the unstable blood glucose group ($p < 0.001$). The Satisfaction with DM Treatment domain showed the largest difference ($\Delta = 30.2$ points), followed by Health & Energy Concerns ($\Delta = 24.9$ points), indicating that unstable blood glucose had the strongest negative impact on patient satisfaction with DM management and energy and psychological well-being.

Discussion

Medication Compliance as the Strongest Determinant

The findings confirm that medication adherence is the strongest predictor of blood glucose stability in type 2 DM patients treated at the West Lombok District Community Health Center (OR = 4.72; 95% CI: 2.91–7.66). These results are consistent with several leading international studies. Sapkota et al. (2023), in an 18-month prospective cohort study in Nepal (n = 487), reported that DM patients with high medication adherence based on the MMAS-8 were 4.3 times more likely to achieve HbA1c below 7%. In a meta-analysis by Krass et al. (2022) examining 42 randomized controlled trials from various developing countries, adherence to oral hypoglycemic therapy was confirmed as the strongest predictor of glycemic control, surpassing the influence of dietary factors and physical activity.

The high proportion of medication non-adherence (56.1%) in West Lombok Regency can be attributed to several structural and psychological barriers. First, from the perspective of the Health Belief Model (Rosenstock, 1974), non-adherence is correlated with low perceptions of treatment severity and benefit. Additional qualitative findings not reported in this study indicate that many patients discontinue treatment when they feel "well enough," reflecting a knowledge deficit regarding the chronic nature of DM. Second, from the perspective of Self-Efficacy Theory (Bandura, 1977), patients with low self-confidence in their ability to manage complex pharmacological regimens tend to be less consistent. Interventions based on motivational interviewing and self-management education at community health centers have been shown to increase adherence by 30–40% in a meta-analysis by Lin et al. (2023).

Family Support and Social Dimensions in Handling Diabetes Mellitus

This study confirmed family support as the second strongest predictor (OR = 3.58). This finding is consistent with research by Pamungkas et al. (2022) in Central Java, which showed that high family support was associated with a 2.6-fold better quality of life in DM patients treated at Community Health Center facilities. Internationally, a prospective study by Young-Hyman et al. (2022) in the United States, which used the Family Support Scale for Diabetes (FSSD) with 1,243 type 2 DM patients, reported that the instrumental support dimension (preparing healthy meals, reminding patients to take medication, accompanying clinic visits) was a significant independent predictor of HbA1c ($\beta = -0.31$; $p < 0.001$).

In the socio-cultural context of the Sasak community in West Lombok Regency, a strong kinship system (traditional inherited customs) and extended family structure represent potential social capital that can be optimized for family-based diabetes management. However, data from this study also revealed that 52.8% of respondents received low family support, indicating that this potential

has not been fully realized. A family-based diabetes care program that integrates patients' family members into diabetes education sessions at community health centers is a strategy recommended by the WHO (2023) and has been proven effective in a randomized controlled trial by Garcia-Huidobro et al. (2022) conducted in Latin American communities.

Physical Activity and Diet: Pillars of Lifestyle Management

Physical activity (OR = 2.89) and diet (OR = 2.07) are lifestyle management components long recognized as fundamental elements of diabetes management. Kassahun et al. (2024), in a cross-sectional study covering three provinces in Ethiopia (n = 621), found that regular physical activity (≥150 minutes per week) was significantly associated with controlled fasting blood glucose levels (OR = 2.97; 95% CI: 1.89–4.67; p = 0.001). A cohort study by Johansen et al. (2023) in Denmark confirmed that the combination of a Mediterranean diet with at least 150 minutes of aerobic activity per week reduced mean HbA1c by 0.8% over 12 months ($p < 0.001$).

The low level of physical activity (57.5% inactive) in West Lombok Regency can be attributed to physical environmental factors (limited sports facilities in rural areas), cultural perceptions regarding physical activity among the elderly, and physical fatigue associated with agricultural work that is not counted as structured physical activity. These findings highlight the importance of context-sensitive redefinition and measurement of physical activity in Community Health Center health promotion programs.

DM Education and Access to Health Services: Structural Factors in Primary Health Care

Structured DM education was a significant predictor (OR = 2.41) in this study. Sun et al. (2023), in a multicenter randomized controlled trial conducted in China, showed that a community-based Diabetes Self-Management Education and Support (DSMES) program delivered over 12 sessions in primary healthcare facilities significantly improved DM knowledge, self-efficacy, and HbA1c control compared with the control group (mean HbA1c reduction of 1.1% vs. 0.3%; $p < 0.001$). A systematic review by Guo et al. (2024), which included 31 studies from Southeast Asia, confirmed the effectiveness of community health center-based DM education in improving patient self-care practices and quality of life.

Although access to healthcare ranked lowest among the determinants in this model (OR = 1.62), this finding remains practically significant. Wardhani et al. (2023), in a geospatial study conducted in West Nusa Tenggara, found that a distance of more than 5 km to the nearest Community Health Center (Puskesmas) was significantly associated with irregular DM monitoring visits (AOR = 2.14; p = 0.003). This finding is particularly relevant given the mountainous topography of West Lombok Regency, where limited accessibility requires innovative service delivery approaches such as mobile health clinics or telemedicine for the Prolani community.

Blood Glucose Stability as a Mediator of Quality of Life

The strong association between blood glucose stability and quality of life (OR = 7.18; $p < 0.001$) observed in this study is consistent with a meta-analysis by Trikkalinou et al. (2023), which confirmed a strong correlation between glycemic control and DM-specific quality-of-life scores. The use of the DQLCTQ in this study provides a methodological advantage over generic instruments, as it captures dimensions uniquely relevant to DM patients—namely, treatment satisfaction, dietary freedom, and

perceived disease control—that are not adequately assessed by generic instruments such as the WHOQOL-BREF or SF-36 (Shen et al., 2022).

The Health & Energy Concerns domain, most severely affected in the unstable group, reflects the burden of fatigue and psychological distress associated with uncontrolled glycemic fluctuations. The underlying pathophysiological mechanisms include: (1) the direct effects of chronic hyperglycemia on neurocognitive function and energy levels; (2) the classic symptoms of uncontrolled DM (polyuria, polydipsia, and fatigue) encompassed in the DM complaints domain of the DQLCTQ; (3) limitations in physical function caused by peripheral neuropathy and fatigue; and (4) psychosocial consequences including frustration, fear, and feelings of loss of control, as assessed by the psychological well-being and disease control domains of the DQLCTQ.

These findings have profound implications for primary care practice. Improved scores on the DM Treatment Satisfaction and Disease Control domains of the DQLCTQ can serve as performance indicators for community health centers (Puskesmas). The Prolanis program complements clinical indicators such as average RBG and HbA1c. This approach aligns with American Diabetes Association (ADA, 2024) recommendations, which establish patient-centered diabetes management that incorporates patient-reported outcomes (PROs) as the new standard for comprehensive diabetes care.

Conclusion

This study identified six significant determinants affecting blood glucose stability in type 2 diabetes patients treated at the West Lombok District Community Health Center: medication adherence (OR = 4.72), family support (OR = 3.58), physical activity (OR = 2.89), diabetes education (OR = 2.41), diet (OR = 2.07), and access to healthcare (OR = 1.62). Blood glucose stability was strongly associated with patients' quality of life (OR = 7.18; $p < 0.001$), with 80.7% of patients with stable blood glucose reporting a good quality of life. The determinant model developed in this study explained 48.7% of the variance in blood glucose stability.

Recommendations

First, the West Lombok District Health Office must strengthen the Prolanis program. This program is implemented in all 20 Community Health Centers (Puskesmas), with a focus on interventions targeting four key determinants: (a) improving medication adherence through routine screening using the MMAS-8 and clinical pharmacy counseling; (b) integrating patients' family members into DM education sessions (family-based DM education); (c) holding structured DM training classes at Puskesmas and integrated health posts (Posyandu) at least twice a week; and (d) standardizing evidence-based DM education modules delivered at a minimum of six sessions per year.

Second, the West Lombok Regional Government should develop policies to ensure the availability of diabetes mellitus medication in all Community Health Centers (Puskesmas) and explore mobile health service programs for geographically difficult-to-reach areas. Third, further research using a prospective cohort design is needed to evaluate the effectiveness of interventions targeting the identified determinants, complemented by qualitative studies to elucidate contextual Sasak cultural factors that influence diabetes mellitus self-management behavior.

Conflict of Interest

The authors declare no conflict of interest in the conduct of this research.

Thank-you note

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