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Belitung Nursing Journal (BNJ) is an internationally refereed publication that provides a venue for nursing scholarship with an Asian focus and perspectives from the region. Its objective is to highlight evidence on nursing science, management, healthcare policy, education, and practice within Asian communities worldwide, catering to a broad international readership.

BNJ welcomes various submissions, including original research, review articles, theory and concept development, and case studies on clinical and professional nursing topics from 49 Asian countries (according to the United Nations). Furthermore, BNJ accepts negative results, given that the research design is sound.

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Original Research

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Patient-centered care model based on self-efficacy to improve self-care and quality of life of people with type 2 diabetes mellitus: A PLS-SEM approach

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Abstract

Background: The current model for managing type 2 diabetes mellitus (T2DM) is healthcare provider-centered rather than patient-centered. This approach may overlook individual patients' unique needs, potentially impacting the effectiveness of T2DM management goals.
Objective: This study aimed to develop a patient-centered care model based on self-efficacy to enhance self-care and improve the quality of life for individuals with T2DM.
Methods: The study employed a cross-sectional design with a sample size of 250 respondents recruited through multistage random sampling, Jember regency, East Java, Indonesia. The study variables included exogenous factors (people with T2DM, situational treatment, family, and healthcare services) and endogenous factors (self-efficacy, self-care, and quality of life). Data were collected from August to December 2022 using a questionnaire and analyzed descriptively and inferentially using SEM-PLS.
Results: The developed model was a good fit with strong predictive relevance (SRMR = 0.065; Q2 = 0.049). All exogenous factors—people with T2DM, situational treatment, family, and healthcare services—significantly affected self-efficacy (42.2%, 37%, 8.1%, and 17.3%; p <0.001). Self-efficacy had a 61.6% effect on self-care, and self-care had a 27.1% effect on quality of life (p <0.001). Only situational treatment factors had a direct effect on self-care (21.7%; p <0.001). All exogenous factors also influenced the quality of life through self-efficacy and self-care (7%, 6.2%, 1.3%, and 2.9%; p <0.05).
Conclusions: A patient-centered care model based on self-efficacy for managing T2DM can improve self-care behaviors and quality of life for individuals with T2DM. This model can be utilized by nurses in healthcare services to enhance the management of T2DM.

Keywords

Indonesia; patient-centered care; self-efficacy; self-care; type 2 diabetes mellitus; quality of life; self-efficacy; delivery of healthcare

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Background

Type 2 diabetes mellitus (T2DM) is a chronic disease that requires proper medical management and ongoing self-care (American Diabetes Association, 2021). Self-care interventions are strategies designed to help individuals manage their own health (Huang et al., 2022). Chronic care models should be patient-centered, accommodating patients' needs and abilities (Bosire et al., 2021; Ruissen et al., 2021). Numerous studies have shown that most people with T2DM have self-care practices that fall into the moderate to poor categories (Duarte-Diaz et al., 2023; Gao et al., 2022; Khosravizadeh et al., 2024; Qin et al., 2020). Insufficient self-care practices, limited belief in the ability to manage one's health, feelings of sadness, and a lack of understanding of the condition are barriers to effective patient management, leading to adverse outcomes (Gode et al., 2022; Huang et al., 2022). Unrealistic treatment goals can result in complications and a reduced quality of life. Only 21% to 41.91% of individuals with T2DM report a good quality of life (Jafari et al., 2024; Seo, 2023), contributing to increased mortality rates (American Diabetes Association, 2021).

Several studies have identified diabetes self-efficacy as a key factor influencing self-care behavior, which in turn affects the quality of life (Clara et al., 2021; Hurst et al., 2020; Kong & Cho, 2020; Oluma et al., 2020). Both internal and external factors can influence diabetes self-efficacy. Internal factors include personal characteristics such as socio-demographic and psychosocial conditions. Variations in socio-demographic factors like age, gender, education level, income, marital status, and ethnicity can affect diabetes self-efficacy. Older patients with diabetes tend to have lower self-efficacy than younger ones (Kuang et al., 2021; Qin et al., 2020; Shaban et al., 2024; Zhang et al., 2023). Gender differences also contribute to varying levels of self-efficacy among individuals with T2DM, with women generally showing higher self-efficacy

than men (Hurst et al., 2020; Kuang et al., 2021; Mansyur et al., 2023). Women also tend to have better psychological resilience (Hurst et al., 2020), which may contribute to higher self-efficacy (Kuang et al., 2021; Mansyur et al., 2023). Low education and income levels may limit access to information and resources, potentially reducing self-efficacy (Kong & Cho, 2020; Kuang et al., 2021; Tapager et al., 2022). Diabetes patients without a life partner may also experience lower self-efficacy due to the lack of social support (Oluma et al., 2020). Racial differences can further influence self-efficacy (Brown et al., 2022; Qin et al., 2020), with studies indicating that non-Hispanic Blacks tend to have lower self-efficacy compared to non-Hispanic Whites or Hispanics (Brown et al., 2022). Psychosocial factors such as diabetes knowledge, motivation, coping skills, and the presence of distress also play a role in determining self-efficacy. Individuals with sufficient diabetes knowledge (Farley, 2020; Hurst et al., 2020; Tapager et al., 2022), high motivation for self-management (Hamidi et al., 2022; Lakerveld et al., 2020), positive coping strategies (Knowles et al., 2020; Li et al., 2022), and low diabetes-related distress (Gao et al., 2022; Li et al., 2022; Lin et al., 2021; Mansyur et al., 2023) are likely to have higher self-efficacy, enabling better self-care (Duarte-Diaz et al., 2023; Gao et al., 2022; Qin et al., 2020).

In addition to internal factors, external factors such as situational care, family, and health service factors can also impact diabetes self-efficacy. Situational care factors, including the duration of diabetes and the presence of complications, may influence self-efficacy. Longer durations of diabetes are associated with lower self-efficacy (Shaban et al., 2024). People with T2DM who experience complications tend to have reduced self-efficacy (Qin et al., 2020; Ruissen et al., 2021), leading to a decline in perceived health status (Brown et al., 2022), which further impacts self-efficacy (Oluma et al., 2020). Family factors, such as perceived family support, can also affect diabetes self-efficacy (Farley, 2020; Kuang et al., 2021). Differences in family dynamics may influence patients' perceptions of the support they receive (Farley, 2020). Additionally, health service factors can influence self-efficacy, with individuals with health insurance typically showing better self-efficacy regarding their ability to access health services (Brown et al., 2022). The quality of healthcare services received during treatment also plays a crucial role in determining diabetes self-efficacy. A robust healthcare system can enhance self-efficacy (Farley, 2020), leading to better self-management and a reduced risk of complications (Duarte-Diaz et al., 2023; Wolderufael & Dereje, 2021).

Effective behavior management is essential for achieving treatment goals in people with T2DM (American Diabetes Association, 2021). Healthcare providers should integrate diabetes care with a collaborative, patient-centered approach to optimize health outcomes and quality of life. This approach focuses on the unique needs and resources of each patient, empowering them to take a more active role in their care (Ruissen et al., 2021). Enhancing patient empowerment and supporting self-management can boost self-efficacy and perceived control in diabetes care (Duarte-Diaz et al., 2023), leading to improved treatment outcomes (Ruissen et al., 2021). High self-efficacy enables individuals to make more appropriate behavioral choices (Bandura, 2018). People with T2DM who have high self-efficacy are more likely to adhere to self-care practices (Duarte-Diaz et al., 2023; Gao et al., 2022; Qin et al., 2020), resulting in better health outcomes (American Diabetes Association, 2021; Gao et al., 2022; Ruissen et al., 2021). Good diabetes self-care practices can minimize disease complications by maintaining glucose levels within the normal range (Gode et al., 2022), improving health status, and reducing depression (Duarte-Diaz et al., 2023; Gao et al., 2022; Gode et al., 2022; Huang et al., 2022), as well as lowering the risk of complications (Duarte-Diaz et al., 2023; Wolderufael & Dereje, 2021), enhancing the quality of life for people with T2DM (Jafari et al., 2024; Seo, 2023).

Therefore, it is crucial to incorporate effective preventive strategies into current diabetes prevention recommendations to enhance the efficacy of T2DM prevention and control through lifestyle interventions. Healthcare providers, especially nurses, should design lifestyle change interventions that focus on increasing self-efficacy to achieve optimal outcomes. This study aimed to develop a patient-centered care model based on self-efficacy to improve self-care behavior and quality of life for people with T2DM. Additionally, this study sought to examine the interactions among patient variables, situational treatment factors, and family factors on T2DM self-efficacy, self-care, and quality of life.

Conceptual Framework

The study variables consist of both endogenous and exogenous factors. The exogenous variables include four factors: characteristics of people with T2DM (X1), treatment situation (X2), family support (X3), and healthcare services (X4). The endogenous variables consist of self-efficacy (Y1), self-care (Y2), and quality of life (Y3).

The factors related to people with T2DM include knowledge (X1.1), coping (X1.2), motivation (X1.3), and diabetes distress (X1.4). The indicators for treatment situational factors are perceived health status (X2.1), duration of diabetes (X2.2), and perceived self-care ability (X2.3). The indicator for family factors is family support (X3.1), while the indicator for healthcare service factors is perceived healthcare services (X4.1).

Self-efficacy is measured by indicators such as general nutrition (Y1.1), specific nutrition (Y1.2), blood glucose control (Y1.3), physical activity and weight control (Y1.4), and medication adherence (Y1.5). Diabetes self-care behaviors include diet (Y2.1), physical activity (Y2.2), medication adherence (Y2.3), self-monitoring of blood glucose levels (Y2.4), and foot care (Y2.5). The indicators for diabetes quality of life consist of physical (Y3.1), psychological (Y3.2), and social domains (Y3.3) (**Figure 1**).

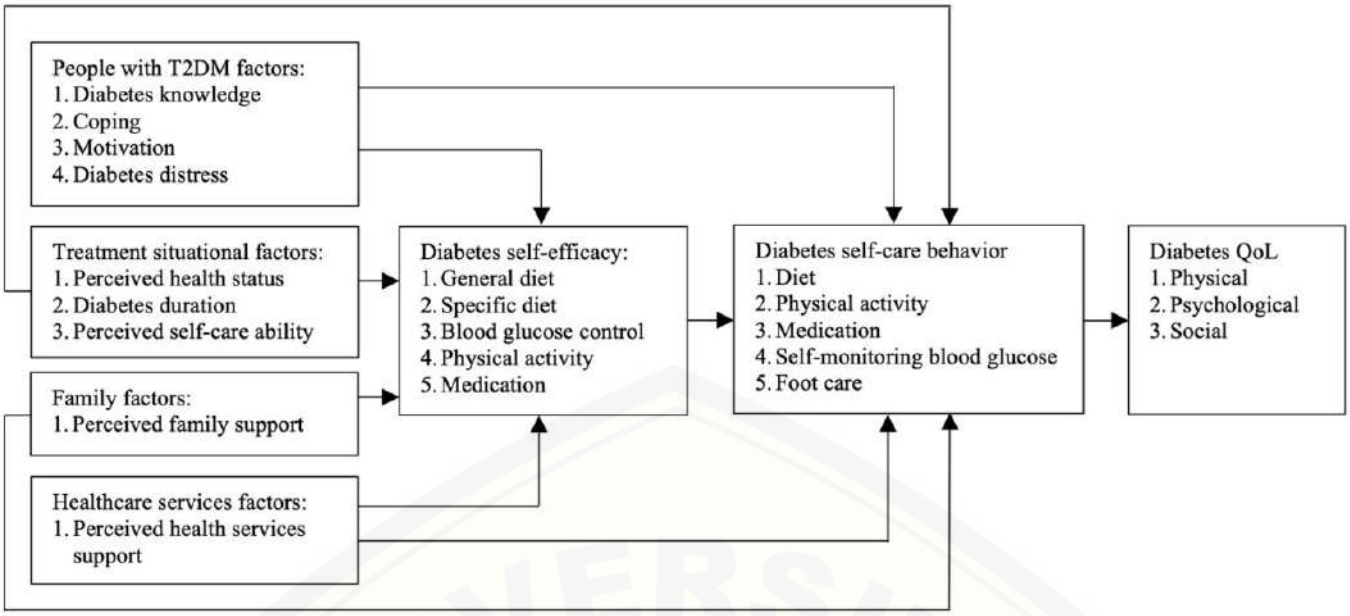

Figure 1 Conceptual framework

Methods

Study Design

A cross-sectional design was employed in this study.

Samples/Participants

The study was conducted in Jember Regency from August to December 2022. The sample consisted of people with T2DM who met the following inclusion criteria: 1) aged 40–65 years, 2) diagnosed with diabetes for over one year, 3) living with family, 4) not undergoing inpatient treatment at a hospital, and 5) having no communication difficulties. The sample size was calculated using the rule of thumb formula (5-10 times the estimated parameter) with multistage random sampling (Wang & Rhemtulla, 2021). The sample size was determined to be 5–10 times the 37 parameters, equating to a minimum of 185 respondents and a maximum of 370 respondents. The researchers decided on a sample size of 250 respondents.

Jember Regency was divided into five regions, and two public health centers (PHCs) were randomly selected from each region out of the 50 PHCs in Jember Regency. From each selected PHC, five villages were randomly chosen, and within each village, five respondents were randomly selected, resulting in a total of 250 respondents (**Figure 2**).

Instruments

The instruments used in this study were questionnaires consisting of:

1) The socio-demographic questionnaire contains questions about age, gender, education, income, marital status, and ethnicity. Apart from that, it also includes questions about diabetes duration (less than five years or more than five years), family types (nuclear family, extended family, single-parent family, and middle-aged family), health insurance status (have or not), and diabetes complications (presence or absence of complications);
2) The diabetes knowledge questionnaire, adapted from the Spoken Knowledge in Low Literacy Patients with Diabetes Scale (SKILLD) (Rothman et al., 2005), comprised 16 items with the Gutman scale (correct = 1; wrong = 0). Researchers categorized diabetes knowledge into low (<5.33), medium (5.33 – 10.65), and high (≥10.66).
3) The diabetes motivation questionnaire, adapted from the Treatment Self-Regulation Questionnaire (TSRQ) (Williams et al., 1998), comprised 19 items with a Likert scale (1 – 7). Researchers categorized diabetes care motivation into low (<57), medium (57 – 94.99), and high (≥95);
4) The diabetes coping questionnaire, adapted from the Coping Scale (Hamby et al., 2015), comprised 11 question items with a Likert scale (1 – 4). Researchers categorized coping skills into low (<22), medium (22 – 32.99), and high (≥33);
5) The diabetes distress questionnaire, adapted from the Diabetes Distress Scale (DSS) (Polonsky et al., 2005), comprised 17 items with a Likert scale (1 – 6). The total score is divided by 17 to produce the final score. Researchers categorized diabetes distress experienced by people with T2DM in managing diabetes into low (<2.68), medium (2.68 – 4.32), and high (≥4.33);
6) The perceived health status questionnaire, adapted from the SF-12 Indonesian Version (Arovah & Heesch, 2021), comprised 12 items. Items 1, 8, 9, 10, 11, 12 with Likert scale (1 – 5), items 2 and 3 Likert scale (1 – 3), and items 4, 5, 6 and 7 with the Guttman scale (1 – 2). Scoring was done with an online algorithm. Health status is categorized as poor (≤50), and good (>50);
7) The perceived self-care ability questionnaire, adapted from the Care Dependency Scale (CDS) (Dijkstra et al., 2012), comprised 15 items with a Likert scale (1-5). Researchers categorized perceived self-care ability into low (<35), medium (35–54.99), and high (≥55);

8) The perceived family support questionnaire, adapted from the Hensarling Diabetes Family Support Scale (HDFSS) (Hensarling, 2009), comprised 24 items with a Likert scale (1-5). Researchers categorized perceived family support into low (<56), medium (56 – 87.99), and high (≥88);
9) The perceived health service questionnaire, adapted from the Patient's Evaluation of the Quality of Diabetes Care Scale (PEQD) (Pouwer & Snoek, 2002), comprised 14 items with a Likert scale (1-5). Researchers categorized perceived health service into low (<37.67), medium (37.67-56.329), and high (≥56.33);
10) The diabetes self-efficacy questionnaire, adapted from the Diabetes Management Self-Efficacy Scale (DMSES) (Bijl et al., 1999), comprised 20 items with a Likert scale (1-5). Researchers categorized diabetes self-efficacy into low (<46.67), medium (46.67 – 73.32), and high (≥73.33);
11) The diet behavior questionnaire, adapted from the Self-Management Dietary Behaviors Questionnaire (SMDBQ) (Primanda et al., 2011), comprised 16 items with a Likert scale (1-4). Researchers categorized diet behavior into poor (<32), fair (32 – 47.99), and good (≥48);
12) The physical activity behavior questionnaire, adapted from the Baecke Physical Activity Questionnaire (BPAQ) (Baecke et al., 1982), comprised 18 items with a Likert scale (1-5). Researchers categorized physical behavior into poor (<5.6), fair (5.6-7.89), and good (≥7.90);
13) The medication behavior questionnaire, adapted from the Morisky Medication Adherence Scale (MMAS) (Morisky et al., 2008), comprised eight items with questions 1 to 7, a Guttman scale (0-1), and item 8 with a Likert scale (0-4). Researchers categorized medication behavior into poor (<6), fair (6-7), and good (8);
14) The Self-Monitoring Blood Glucose Behavior questionnaire, adapted from the Self-Monitoring Blood Glucose Questionnaire (SMBGQ) (Mansouri et al., 2015), comprised 26 items with a Likert scale (1-5). Researchers categorized SMBG behavior into poor (<78) and good (≥78);
15) The foot care behavior questionnaire, adapted from the Nottingham Assessment of Functional Footcare (NAFF) (Lincoln et al., 2007), comprised 21 items with a Likert scale (0-3). Researchers categorized foot care behavior into poor (<32) and good (≥32);
16) The diabetes quality of life questionnaire, adapted from the Diabetes Quality of Life Scale (DQoL) (Thiagarajan, 1998) comprised 30 items using a Likert scale (1-4). Researchers categorized the quality of life into low (<60), medium (60-89.99), and high (≥90).

Researchers obtained written permission to use three instruments: 1) the Baecke Physical Activity Questionnaire (BPAQ), 2) the Diabetes Quality of Life Scale (DQoL), and 3) the Nottingham Assessment of Functional Footcare (NAFF). Permissions for the other 12 instruments were not required, provided proper acknowledgment was given. The researchers have appropriately cited the sources in accordance with academic standards.

Out of the 15 instruments used, only the perceived health status instrument (SF-12) was available in Indonesian. The remaining instruments were translated and adapted (McKown et al., 2020). This process began with forward translation, in which bilingual experts translated the original instrument into the target language. An expert panel then reviewed the translation to ensure accuracy and cultural relevance. This was followed by back-translation, where a separate team translated the instrument back into the original language to check for consistency with the original version. After these steps, the researchers conducted validity and reliability tests on all instruments using a different dataset of 30 respondents. An instrument was considered valid and reliable if the calculated *r*-value was greater than the *r*-table value of 0.361 and if Cronbach's alpha was greater than 0.7. All the instruments were valid and reliable (**Table 1**).

Table 1 Results of instrument validity and reliability test

Variable	Instrument	*r*-value	Cronbach's alpha
Diabetes knowledge	SKILLD Scale	0.371 – 0.709	0.812
Diabetes motivation	TSR Questionnaire	0.463 – 0.821	0.727
Diabetes coping	Coping Scale	0.438 – 0.865	0.826
Diabetes distress	DDS	0.595 – 0.755	0.931
Perceived health status	SF-12 Indonesian Version	0.421 – 0.829	0.872
Perceived self-care ability	CDS	0.588 – 0.821	0.879
Perceived family support	HDFSS	0.499 – 0.866	0.966
Perceived health service	PEQDS	0.631 – 0.785	0.899
Diabetes self-efficacy	DMSES	0.454 – 0.762	0.842
Diet behavior	SMDBQ	0.464 – 0.872	0.921
Physical activity behavior	BPAQ	0.386 – 0.765	0.834
Medication behavior	MMAS	0.363 – 0.767	0.834
SMBG behavior	SMBGQ	0.443 – 0.833	0.867
Foot care behavior	NAFF	0.366 – 0.751	0.809
Quality of life	DQOL Scale	0.411 – 0.786	0.811

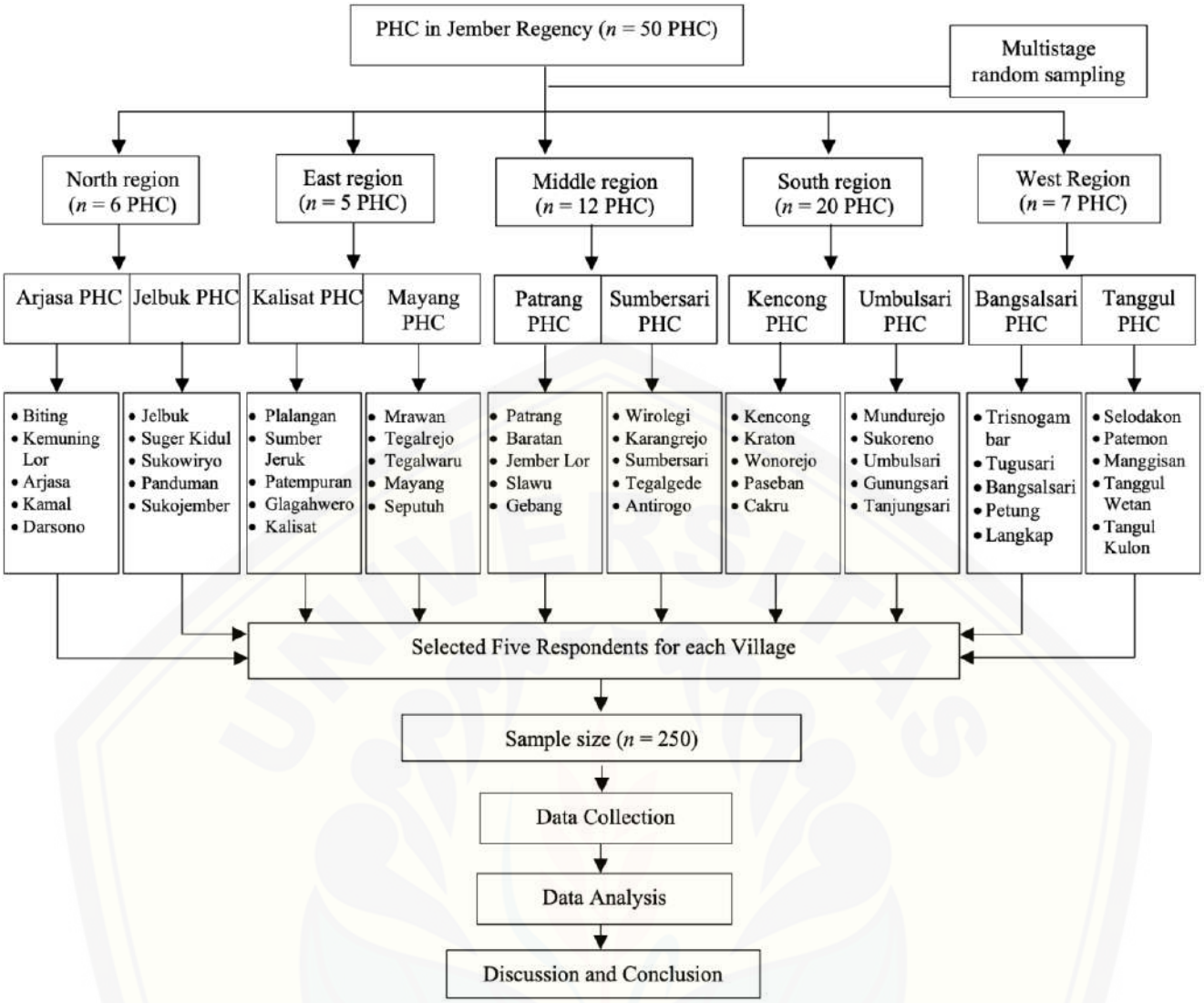

Figure 2 Multistage random sampling

Data Collection

Data were collected door-to-door (offline) using questionnaires and interviews. Before data collection, researchers provided prospective respondents with an overview of the study, including its purpose, benefits, and procedures. Those who agreed to participate were asked to sign a consent form. Researchers conducted the interviews in the respondents' homes, reading each questionnaire item aloud to reduce potential bias, particularly for those who could not read or were illiterate. The researchers recorded the respondents' answers, and after the interview session, the respondents were asked to sign off on the interview results.

Data Analysis

Data were analyzed descriptively to describe the characteristics of the respondents, using frequency distribution, central tendency (mean), and dispersion (range, standard deviation, and 95% confidence interval) with IBM SPSS Statistics V.26. Model development was conducted using path analysis via SEM-PLS with SMART-PLS V3 software. Measurement model analysis involved assessing 1) Convergent Validity Tests: Indicator loading >0.6 and average variance extracted (AVE) >0.5; 2) Internal Consistency Reliability Tests: Composite reliability >0.7 and Cronbach's alpha >0.7; and 3) Discriminant Validity Tests: Fornell-Larcker Criterion and HTMT <0.9.

Structural model analysis involved evaluating: 1) Model Fit Index Evaluation: SRMR <0.08, NFI >0.90, d_ULS <0.877, and d_G< 0.342 (with 95% CI), Chi-square calculated >Chi-square table (df = 492) = 544.709, and RMS theta <0.102; 2) Coefficient of Determination (R^2); 3) Effect Size (f^2); and 4 Predictive Relevance (Q^2 >0). Hypothesis testing was conducted using bootstrapping with a *t*-test (α = 0.05) (Hair et al., 2021; Hair et al., 2019).

Ethical Considerations

The study has received approval from the Health Research Ethics Committee of the Faculty of Dentistry, University of Jember, with number 1597/UN25.8/KEPK/DL/2022. Informed consent was ensured prior to data collection among the participants.

Results

Table 2 shows that the majority of respondents were 60–65 years old (34.8%), female (58.8%), had a primary education (43.2%), had an income level ≥RMW (56%), were married (77.2%), and identified as Madurese (56%). Most respondents

came from nuclear families (36.8%), had health insurance (76%), and did not have diabetes complications (69.2%). The average diabetes self-efficacy score was higher among respondents aged 40–44 years (74.50±13.828), males (63.37±15.615), those with higher education (70.52±14.900), those with a high-income level (69.99±15.011), married individuals (65.77±14.568), those identifying as Madurese (63.32±16.085), respondents from extended families (68.41±16.511), those with health insurance (68.41±13.285), and those without diabetes complications (70.07±12.176). Diabetes self-efficacy differed significantly based on age, education level, income level, marital status, family type, health insurance, and the presence of complications (p <0.001). However, it did not differ significantly based on gender (p = 0.438) or ethnicity (p = 0.320).

Table 2 Socio-demographic characteristics of the participants

Characteristics	*n* (%)	Diabetes Self-Efficacy					
		Low *n* (%)	Medium *n* (%)	High *n* (%)	Mean±SD (95% CI)	One-way ANOVA or Independent *t*-test	
						F or *t*	*p*
Age							
40 – 44	12 (4.8)	2 (0.8)	7 (2.8)	3 (1.2)	74.50±13.828 (69.33 – 79.66)	27.553	0.001
45 – 49	30 (12)	2 (0.8)	12 (4.8)	16 (6.4)	65.58±17.106 (54.71 – 76.45)		
50 – 54	51 (20.4)	0 (0)	24 (9.6)	27 (10.8)	71.96±12.503 (68.44 – 75.47)		
55 – 59	70 (28)	10 (4)	44 (17.6)	16 (6.4)	64.17±13.798 (60.88 – 67.46)		
60 – 65	87 (34.8)	40 (16)	44 (17.6)	3 (1.2)	50.75±14.237 (47.71 – 53.78)		
Total	250 (100)	54 (21.6)	131 (52.4)	65 (26)	62.40±16.569 (60.33 – 64.46)		
Gender							
Women	147 (58.8)	36 (14.4)	76 (30.4)	35 (14)	61.71±17.225 (58.91 – 64.52)	-0.707	0.438
Man	103 (41.2)	18 (7.2)	55 (22)	30 (12)	63.37±15.615 (60.32 – 66.42)		
Total	250 (100)	54 (21.6)	131 (52.4)	65 (26)			
Education level							
No school	30 (12)	7 (2.8)	18 (7.2)	5 (0.2)	59.83±13.076 (54.95 – 64.72)	3.068	0.029
Basic	109 (43.6)	27 (10.8)	60 (24)	22 (8.8)	60.28±16.957 (57.06 – 63.49)		
Middle	86 (34.4)	18 (7.2)	40 (16)	28 (11.2)	63.62±16.994 (59.97 – 67.26)		
High	25 (10)	2 (0.8)	13 (5.2)	10 (4)	70.52±14.900 (64.37 – 76.67)		
Total	250 (100)	54 (21.6)	131 (52.4)	65 (26)	62.40±16.569 (60.33 – 64.46)		
Income level							
<RMW	110 (44)	40 (16)	66 (26.4)	4 (1.6)	52.73±13.089 (50.25 – 55.20)	-9.544	0.001
≥RMW	140 (56)	14 (5.6)	65 (26)	61(24.4)	69.99±15.011 (67.48 – 72.50)		
Total	250 (100)	54 (21.6)	131 (52.4)	65 (26)	62.40±16.569 (60.33 – 64.46)		
Marital status							
Married	193 (77.2)	22 (8.8)	112 (44.8)	59 (23.6)	65.77±14.568 (63.70 – 67.84)	6.373	0.001
Unmarried/widow/er	57 (22.8)	32 (12.8)	19 (7.6)	6 (2.4)	50.98±17.922 (46.23 – 55.74)		
Total	250 (100)	54 (21.6)	131 (52.4)	65 (26)	62.40±16.569 (60.33 – 64.46)		
Ethnicity							
Javanese	110 (44)	31(12.4)	52 (20.8)	27 (10.8)	61.22±17.166 (57.97 – 64.46)	-0.996	0.320
Madurese	140 (56)	23 (9.2)	79 (31.6)	38 (15.2)	63.32±16.085 (60.63 – 66.01)		
Total	250 (100)	54 (21.6)	131 (52.4)	65 (26)	62.40±16.569 (60.33 – 64.46)		
Family type							
Nuclear	92 (36.8)	6 (2.4)	59 (23.6)	27 (10.8)	67.15±11.803 (64.71 – 69.60)	32.034	0.001
Extended	88 (35.2)	7 (2.8)	45 (18)	36 (14.4)	68.41±16.511 (64.91 – 71.91)		
Single parent	35 (14)	22 (8.8)	12 (4.8)	1 (0.4)	45.69±15.060 (40.51 – 50.86)		
Middle-aged	35 (14)	19 (7.6)	15 (6)	1 (0.4)	51.48±12.183 (47.30 – 55.67)		
Total	250 (100)	54 (21.6)	131 (52.4)	65 (26)	62.40±16.569 (60.33 – 64.46)		
Health financing							
No	60 (24)	46 (18.4)	13 (5.2)	1 (0.4)	43.35±10.384 (40.67 – 46.03)	-13.372	0.001
Yes	190 (76)	8 (3.2)	118 (47.2)	64 (25.6)	68.41±13.285 (66.51 – 70.31)		
Total	250 (100)	54 (21.6)	131 (52.4)	65 (26)	62.40±16.569 (60.33 – 64.46)		
Complications							
No	173 (69.2)	1 (0.4)	108 (43.2)	64 (25.6)	70.07±12.176 (68.24 – 71.90)	15.247	0.001
Yes	77 (30.8)	53 (21.2)	23 (9.2)	1 (0.4)	45.16±11.345 (42.58 – 47.73)		
Total	250 (100)	54 (21.6)	131 (52.4)	65 (26)	62.40±16.569 (60.33 – 64.46)		

Table 3 shows that most respondents had moderate levels of knowledge, coping, and distress (64.4%, 54.4%, and 57.2%, respectively) but had high levels of motivation (43.6%). The majority of respondents had been living with diabetes for more than five years (68.8%), had a good perceived health status (84.4%), and reported a high perceived self-care ability (96.4%).

However, most respondents perceived family support and healthcare services as being in the moderate range (69.6% and 55.2%, respectively). Most respondents had moderate

self-efficacy (52.4%) and self-care behaviors, including diet (53.2%) and physical activity (49.2%). They also reported good foot care practices (63.2%). In contrast, medication adherence and self-monitoring of blood glucose (SMBG) behaviors were categorized as low (86% and 58.8%, respectively). Despite these findings, the overall quality of life among respondents was high (55.6%).

Table 3 Description of the study variables

Variable	Category	*n* (%)	Mean±SD	95% CI
People with T2DM Factors				
Knowledge	Low	20 (8)	8.91±2.57	8.59 – 9.23
	Medium	161 (64.4)		
	High	69 (27.6)		
Motivation	Low	40 (16)	88.08±26.91	84.73 – 91.44
	Medium	101 (40.4)		
	High	109 (43.6)		
Coping	Low	13 (5.2)	31.03±5.37	30.36 – 31.70
	Medium	136 (54.4)		
	High	101 (40.4)		
Distress	Low	71 (28.4)	54.56±17.39	52.39 – 56.72
	Medium	143 (57.2)		
	High	36 (14.4)		
Treatment Situational Factors				
Perceived health status	Poor	39 (15.6)	38.88±11.68	37.42 – 40.34
	Good	211 (84.4)		
Diabetes duration (months)	≤5 years	78 (31.2)	41.83±18.43	39.53 – 44.12
	>5 years	172 (68.8)		
Perceived self-care ability	Low	4 (1.6)	71.35±7.69	70.39 – 72.31
	Medium	5 (2.0)		
	High	241 (96.4)		
Family Factors				
Perceived family support	Low	55 (22)	68.67±14.62	66.84 – 70.49
	Medium	174 (69.6)		
	High	21 (8.4)		
Healthcare Services Factors				
Perceived health services	Low	81 (32.4)	43.10±11.80	41.63 – 44.57
	Medium	138 (55.2)		
	High	31 (12.4)		
Diabetes Self-Efficacy	Low	54 (21.6)	62.40±16.57	60.33 – 64.46
	Medium	131 (52.4)		
	High	65 (26)		
Diabetes Self-Care Behavior				
Diet	Poor	29 (11.6)	44.03±9.44	42.86 – 45.21
	Fair	133 (53.2)		
	Good	88 (35.2)		
Physical activity	Poor	7 (2.8)	7.92±1.13	7.78 – 8.06
	Fair	123 (49.2)		
	Good	120 (48)		
Medication	Poor	215 (86)	4.54±1.42	4.37 – 4.72
	Fair	27 (10.8)		
	Good	8 (3.2)		
SMBG	Poor	147 (58.8)	72.57±17.57	70.38 – 74.75
	Good	103 (41.2)		
Foot care	Poor	92 (36.8)	36.06±12.67	34.48 – 37.64
	Good	158 (63.2)		
Diabetes Quality of Life	Low	1 (0.4)	92.83±11.37	91.42 – 94.25
	Medium	110 (44)		
	High	139 (55.6)		

The results of structural model test (**Table 4** and **Figure 3**) indicate that all indicators had a loading factor greater than 0.5, with an AVE value for each latent variable exceeding 0.5. Additionally, the composite reliability and Cronbach's alpha values were both above 0.7, demonstrating that all indicators in the model are valid and reliable. The discriminant validity test, conducted using the Fornell-Larcker Criterion, showed that each variable's value was greater than its correlations with other variables. The HTMT test results also revealed values below 0.9, indicating that the variables had good convergent consistency and could be clearly differentiated from one another.

Table 4 The results of the outer or measurement model test

Measurement Model Evaluation								
Convergent Validity and Reliability								
Variable	**Indicators**	**Convergent Validity**		**Reliability**				
		IL	**AVE**	**CR**	**CA**	**rho-A**		
(X1) PT2DMF	X1.1 Knowledge	0.917	0.700	0.902	0.852	0.887		
	X1.2 Coping	0.887						
	X1.3 Motivation	0.632						
	X1.4 Diabetes distress	0.879						
(X2) TSF	X2.1 PHS	0.919	0.755	0.902	0.838	0.865		
	X2.2 Diabetes duration	0.784						
	X2.3 PSCA	0.898						
(X3) FF	X3.1 PFS	1.000	1.000	1.000	1.000	1.000		
(X4) HSF	X4.1 PHS	1.000	1.000	1.000	1.000	1.000		
(I) DSE	I.1 General diet	0.904	0.728	0.930	0.905	0.910		
	I.2 Specific diet	0.906						
	I.3 Blood glucose	0.811						
	I.4 PA and weight	0.785						
	I.5 Medication	0.852						
(Y) DSCB	Y.1 Diet	0.807	0.613	0.884	0.830	0.898		
	Y.2 PA	0.592						
	Y.3 Medication	0.953						
	Y.4 SMBG	0.903						
	Y.5 Foot care	0.582						
(Z) DQOL	Z.1 Physical	0.923	0.796	0.921	0.874	0.914		
	Z.2 Psychological	0.924						
	Z.3 Social	0.826						
Discriminant Validity								
Fornell-Larcker Criterion								
	PT2DMF	**TSF**		**FF**	**HSF**	**DSE**	**DSCB**	**DQOL**
PT2DMF	0.837							
TSF	0.827	0.869						
FF	0.706	0.700		1.000				
HSF	0.820	0.776		0.615	1.000			
DSE	0.829	0.849		0.744	0.865	0.853		
DSCB	0.824	0.860		0.670	0.768	0.793	0.783	
DQOL	0.276	0.299		0.136	0.332	0.293	0.271	0.892
Heterotrait-Monotrait Ratio (HTMT)								
	PT2DMF	**TSF**		**FF**	**HSF**	**DSE**	**DSCB**	**DQOL**
PT2DMF								
TSF	0.898							
FF	0.748	0.759						
HSF	0.888	0.834		0.615				
DSE	0.826	0.855		0.782	0.868			
DSCB	0.877	0.799		0.706	0.818	0.889		
DQOL	0.317	0.341		0.139	0.344	0.320	0.307	

Note:

PT2DMF: People with T2DM Factors
TSF: Treatment Situational Factors
FF: Family Factors
HSF: Healthcare Services Factors
DSE: Diabetes Self-Efficacy
DSCB: Diabetes Self-Care Behavior
DQOL: Diabetes Quality of Life
PHS: Perceived Health Status
PSCA: Perceived Self-Care Ability
PFS: Perceived Family Support
PHS: Perceived health services
PA: Physical Activity
IL: Indicator Loading
AVE: Average Variance Extracted
DV: Discriminant Validity
CA: Cronbach Alpha
CR: Composite Reliability

Table 5 showed that the model was a good fit, with the SRMR at 0.065 (below 0.08), NFI at 0.919 (above 0.90), d_ULS at 0.784 (below 0.877 at 95% confidence), d_G at 0.312 (below 0.342 at 95% confidence), RMS theta at 0.098 (below 0.102), and the Chi-Square value (df = 492) at 986.945 (above 544.709). The model also demonstrated good predictive relevance, with Q^2 values of 0.690, 0.479, and 0.049 (all greater than 0). The R^2 values were 0.955, 0.805, and 0.073, indicating that factors such as treatment situational, family, and healthcare services influenced diabetes self-efficacy by 95.5%, diabetes self-care by 80.5%, and quality of life by 7.3%, respectively. The most significant factor affecting diabetes self-efficacy was treatment situational, with an effect size (f^2) of 0.635, which was considered high. People with T2DM also had a high effect size (f^2 = 0.630), while family factors had a small effect size (f^2 = 0.069), and healthcare services factors had a medium effect size (f^2 = 0.192, which was greater than 0.15 but less than 0.35).

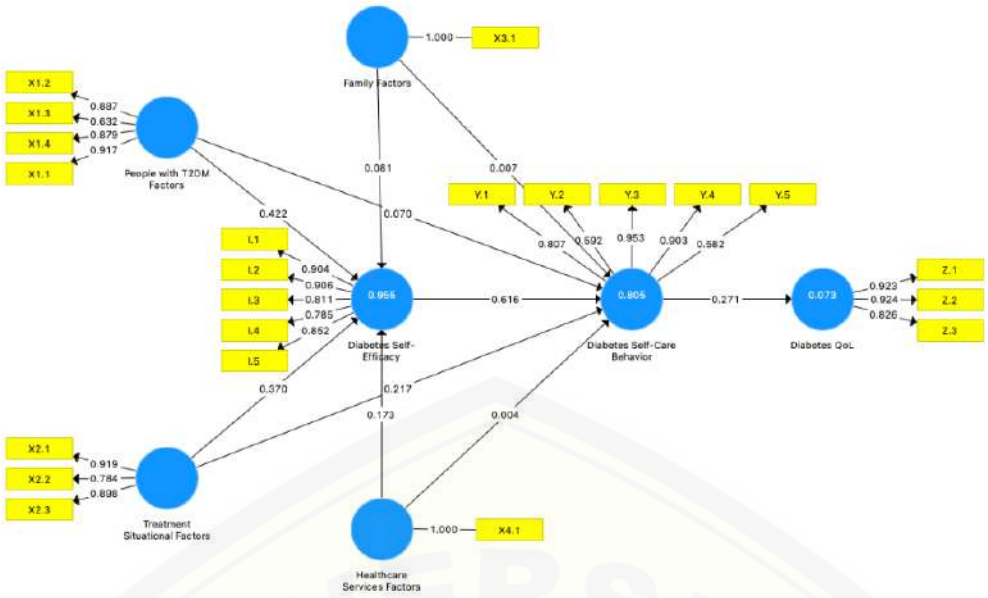

Figure 3 Structural model of the patient-centered care model based on self-efficacy to improve self-care and quality of life of people with T2DM: PLS-SEM

Table 5 Results of inner model or structural model test

Variable	Model fit							R2	f2			Q2
	Absolute fit					Incremental fit	Parsimonious fit					
	SRMR	d_ULS	d_G	RMS Theta	Chi-Square	NFI	AIC		DSE	DSCB	DQOL	
PT2DMF	0.065	0.784	0.312	0.098	986.945	0.919			0.630			
TSF									0.653			
FF									0.069			
HSF									0.192			
DSE							-767.074	0.955		0.087		0.690
DSB							-397.074	0.805			0.079	0.479
DQOL							-16.010	0.073				0.049

Note:

PT2DMF: People with type 2 diabetes mellitus factor; TSF: Treatment Situational Factors; FF: Family Factors; HSF: Healthcare Services Factors; DSE: Diabetes Self-Efficacy; DSB: Diabetes Self-care Behavior; DQOL: Diabetes Quality of Life; RMS Theta: Root mean Square Theta; SRMR: Standardized root mean residual

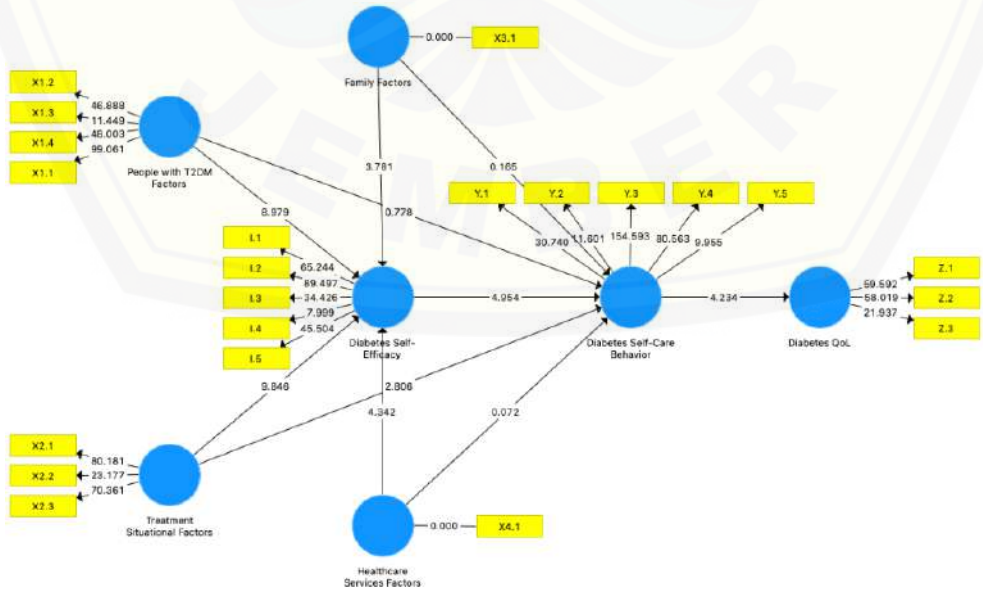

Figure 4 Structural model of the patient-centered care model based on self-efficacy to improve self-care and quality of life of people with T2DM: Significance test

Table 6 and **Figure 4** show that all exogenous factors—people with T2DM, treatment situational, family, and healthcare services—directly affected diabetes self-efficacy, with impacts of 42.2%, 37%, 8.1%, and 17.3%, respectively (p <0.05). Diabetes self-efficacy influenced diabetes self-care by 61.6%, and diabetes self-care affected quality of life by 27.1%. Additionally, the factors of people with T2DM, treatment situational, family, and healthcare services significantly influenced the quality of life through diabetes self-efficacy and self-care, with contributions of 7%, 6.2%, 1.3%, and 2.9%, respectively (p <0.05).

The final model can be seen in **Figure 5**.

Table 6 Result of path analysis and significance test

Variable	Coefficient	Mean	SD	CI 2.5 - 95%	*t*	*p*
PT2DMF→DSE	0.422	0.424	0.047	0.324 – 0.513	8.979	0.001
PT2DMF→DSCB	0.070	0.078	0.090	-0.102 – 0.255	0.778	0.437
PT2DMF→DSE→DSCB	0.260	0.251	0.058	0.146 – 0.362	4.481	0.001
PT2DMF→DSE→DSCB→DQOL	0.070	0.069	0.023	0.092 – 0.219	3.094	0.002
TSF→DSE	0.370	0.368	0.038	0.292 – 0.450	9.846	0.001
TSF→DSCB	0.217	0.227	0.077	0.077 – 0.386	2.806	0.005
TSF→DSE→DSCB	0.228	0.218	0.051	0.124 – 0.320	4.468	0.001
TSF→DSE→DSCB→DQOL	0.062	0.061	0.021	0.026 – 0.106	2.967	0.003
FF→DSE	0.081	0.082	0.021	0.045 – 0.123	3.781	0.001
FF → DSCB	0.007	0.009	0.045	-0.079 – 0.096	0.165	0.869
FF→ DSE→DSCB	0.050	0.048	0.016	0.021 – 0.085	3.035	0.003
FF→ DSE→DSCB→DQOL	0.013	0.013	0.006	0.005 – 0.026	2.385	0.017
HSF→DSE	0.173	0.171	0.040	0.102 – 0.263	4.342	0.001
HSF→DSCB	0.004	0.008	0.053	-0.096 – 0.107	0.072	0.943
HSF→DSE→DSCB	0.106	0.102	0.034	0.055 – 0.198	3.166	0.002
HSF→DSE→DSCB→DQOL	0.029	0.029	0.013	0.009 – 0.059	2.288	0.023
DSE→DSCB	0.616	0.593	0.124	0.339 – 0.814	4.954	0.001
DSCB→DQOL	0.271	0.277	0.064	0.154 – 0.392	4.234	0.001
DSE→DSCB→DQOL	0.167	0.165	0.054	0.074 – 0.266	3.112	0.002

Note:
PT2DMF: People with type 2 diabetes mellitus factor; TSF: Treatment Situational Factors; FF: Family Factors; HSF: Healthcare Services Factors; DSE: Diabetes Self-Efficacy; DSB: Diabetes Self-care Behavior; DQOL: Diabetes Quality of Life

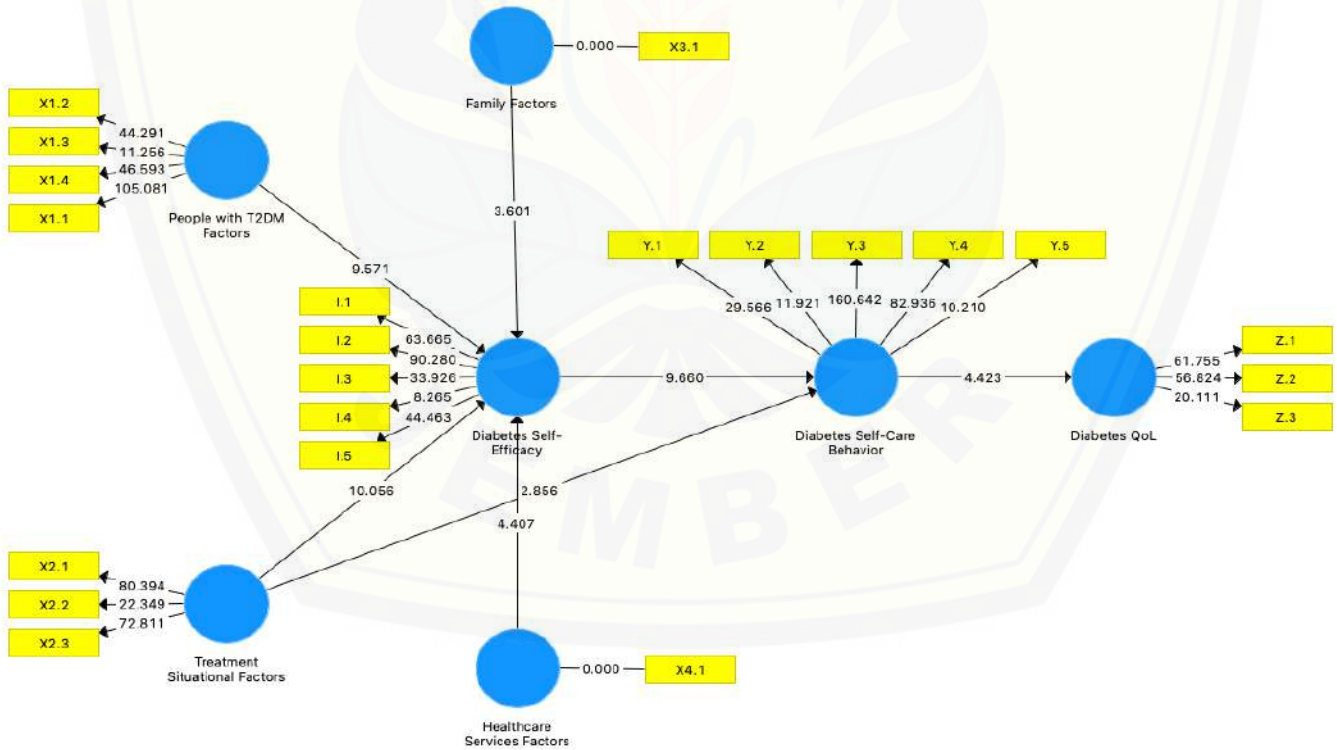

Figure 5 Structural model of the patient-centered care model based on self-efficacy to improve self-care and quality of life of people with T2DM: Final model

Discussion

The model developed in this study was a fit model with good predictive relevance. The modeling results indicated that self-efficacy was an intervening variable connecting the exogenous variables—people with T2DM, treatment situational factors, family, and healthcare services—with the endogenous variables of diabetes self-care and quality of life. These exogenous variables significantly influenced diabetes self-care and quality of life through diabetes self-efficacy.

The research results revealed that all exogenous factors simultaneously impacted the quality of life of people with

T2DM through self-efficacy and self-care behavior. Healthcare providers can enhance the quality of life by improving patients' self-care behavior. This can be achieved by addressing the exogenous factors, including knowledge about diabetes, positive coping, motivation, and managing diabetes distress. Efforts to improve self-care behavior should involve enhancing patients' perceived health status and self-care ability, considering the duration of diabetes, increasing perceived family support, and improving healthcare services. These factors collectively contribute to increased self-efficacy, which impacts self-care behavior and enhances the quality of life for people with T2DM.

The study found that the most significant factor influencing self-efficacy, and consequently self-care and quality of life, was the people with T2DM factor, including knowledge, coping, motivation, and diabetes distress. Specifically, the influence on self-efficacy was 42.2%, on diabetes self-care through diabetes self-efficacy was 26%, and on quality of life through diabetes self-efficacy and diabetes self-care was 7%. The study results were consistent with previous research, which indicated that diabetic patients with adequate diabetes knowledge have higher self-efficacy (Farley, 2020; Hurst et al., 2020; Tapager et al., 2022). Low access to information, health literacy, and healthcare services can diminish self-efficacy (Farley, 2020), impacting diabetes self-care (Rafferty et al., 2021). Individuals who have not received diabetes education have poorer self-care practices (Wolderufael & Dereje, 2021). High motivation (Hamidi et al., 2022; Lakerveld et al., 2020), positive coping (Knowles et al., 2020; Li et al., 2022), and lower diabetes-related distress are associated with better diabetes practices (Gao et al., 2022; Li et al., 2022; Lin et al., 2021; Mansyur et al., 2023). High motivation facilitates lifestyle changes and improves problem-solving abilities, leading to better management of diabetes and increased self-efficacy (Fidan et al., 2020). Individuals with high self-efficacy in managing nutrition, exercise, and medication demonstrate greater compliance with diabetes self-care (Duarte-Diaz et al., 2023; Gao et al., 2022; Qin et al., 2020).

Treatment situational factors had the second strongest influence after the people with T2DM factor on quality of life through self-efficacy and self-care behavior. Indicators of treatment situational factors include perceived health status, perceived self-care ability, and diabetes duration. Specifically, the influence on self-efficacy was 37%, on diabetes self-care through diabetes self-efficacy was 22.8%, and on quality of life through diabetes self-efficacy and diabetes self-care was 6.2%. These findings align with previous studies that suggest diabetes duration affects self-efficacy. A longer duration of diabetes and related complications can decrease self-efficacy (Qin et al., 2020; Ruissen et al., 2021; Shaban et al., 2024). Diabetes complications can also reduce perceived health status (Brown et al., 2022), impacting self-efficacy (Oluma et al., 2020).

Self-efficacy theory posits that previous experience (performance accomplishment) shapes self-efficacy and enables individuals to make appropriate behavior choices (Bandura, 2018). The experience gained from illness duration helps individuals acquire the necessary knowledge and skills for disease management, thereby increasing motivation and self-efficacy, which influences self-care behavior (Wolderufael & Dereje, 2021; Xie et al., 2020). The study results are consistent with previous research showing that illness duration impacts diabetes self-care (Wolderufael & Dereje, 2021; Xie et al., 2020). Improved self-care behavior may be associated with more frequent clinic visits for follow-up consultations (Xie et al., 2020). However, other studies suggest that a longer duration of diabetes correlates positively with comorbidities and complications, reducing self-care ability (Wolderufael & Dereje, 2021). People with T2DM who have a longer duration of illness but no complications exhibit higher self-efficacy and better diabetes self-care abilities (Wolderufael & Dereje, 2021; Xie et al., 2020).

Family factors had a weaker influence on quality of life through self-efficacy and self-care behavior, with perceived family support being the primary indicator. Specifically, the impact on self-efficacy was 8.1%, on diabetes self-care was 5%, and on quality of life was 1.3%. These results align with previous studies indicating that family support is crucial in diabetes management (American Diabetes Association, 2021). Chronic disease patients living with their families receive essential support for disease management (American Diabetes Association, 2021), which positively affects self-efficacy (Farley, 2020; Kuang et al., 2021). Family support enhances vicarious learning and verbal persuasion, improving emotional status and increasing self-efficacy. This, in turn, enhances cognition, motivation, and behavior selection (Bandura, 2018). Low family social support can reduce self-efficacy and diabetes self-care (Farley, 2020). Family support helps clients adopt diabetes self-care practices, including diet, physical activity, blood glucose monitoring, and medication adherence (Rondhianto et al., 2023; Wolderufael & Dereje, 2021). Patients living with family or caregivers are more likely to exercise regularly and less likely to engage in poor lifestyle habits compared to those living alone (Xie et al., 2020). Dissatisfaction with social support in diabetes management can significantly reduce diabetes self-care (Wolderufael & Dereje, 2021). Family support improves dietary behavior, strengthens positive emotions, and helps patients better cope with diabetes self-care (Fidan et al., 2020). It enables patients to make healthy lifestyle changes according to health workers' recommendations and enhances self-care behavior (Wolderufael & Dereje, 2021; Xie et al., 2020).

Healthcare services factors were the third strongest influence on the quality of life for people with T2DM, with perceived health services support being the key indicator. Specifically, the influence on self-efficacy was 17.3%, on diabetes self-care was 10.6%, and on quality of life was 2.9%. The study supports previous research indicating that perceived health services support significantly influences diabetes self-efficacy. The quality of healthcare services during treatment affects diabetes self-efficacy. A well-functioning health service system can enhance self-efficacy (Farley, 2020; Kuang et al., 2021; Mansyur et al., 2023), allowing for better self-management and reduced risk of complications (Duarte-Diaz et al., 2023; Wolderufael & Dereje, 2021). Healthcare providers should adopt a collaborative, patient-centered approach to optimize health outcomes and quality of life. Empowering patients and supporting self-management can improve self-efficacy and perceived control in diabetes care (Duarte-Diaz et al., 2023), leading to better treatment outcomes (Ruissen et al., 2021). Low health literacy regarding diabetes care can hinder disease management.

Therefore, healthcare providers must offer optimal support tailored to each patient's needs, particularly those with low health literacy and poor blood glucose control, to enhance diabetes care outcomes (Rafferty et al., 2021) through education and motivation (Malini et al., 2020). Social support positively affects motivation and competence in managing diabetes (Chen et al., 2022), while dissatisfaction with social support can lead to poor self-care practices (Wolderufael & Dereje, 2021). Adequate support in diabetes management is associated with reduced depressive symptoms, increased psychological resilience, and higher self-efficacy (Kuang et al., 2021; Mansyur et al., 2023), leading to better adherence to self-management behavior (Chen et al., 2022), glycemic control, and overall health outcomes (Mansyur et al., 2023), and improving the quality of life for people with T2DM (Kuang et al., 2021).

The study results align with previous research indicating that self-care positively affects quality of life (Jafari et al., 2024; Seo, 2023). Effective self-care is crucial for comprehensive diabetes management. Diabetes patients should manage their condition effectively, as recommended by health workers (American Diabetes Association, 2021), to minimize complications, maintain glucose levels within the normal range (Gode et al., 2022), reduce complications (Duarte-Diaz et al., 2023; Wolderufael & Dereje, 2021), improve health status (Duarte-Diaz et al., 2023; Gao et al., 2022; Gode et al., 2022; Huang et al., 2022), and enhance the quality of life for people with T2DM (Jafari et al., 2024; Seo, 2023).

Strengths and Limitations of the Study

This study is the first in Indonesia to model diabetes self-care, quality of life, and self-efficacy and to explore the connection between self-efficacy and the influencing factors in individuals with type 2 diabetes mellitus (T2DM). The objective was to clarify the components and relationships among these complex variables and their potential significance for clinical decision-making in T2DM patients. However, the study was limited to a community setting in the Jember Regency despite employing a multistage random selection method. It does not comprehensively analyze T2DM patients, especially concerning sociocultural variables.

Implications of the Study

The patient-centered care model focuses on enhancing patient self-efficacy. It was designed to address each patient's unique needs and facilitate their individual capabilities and resources. The study results can serve as a framework for advancing nursing science, particularly in the care of individuals with T2DM. They also provide valuable information and references for patient empowerment in managing T2DM. Practically, this model can assist nurses in implementing patient empowerment programs to improve self-care behavior and the quality of life for people with T2DM.

Conclusion

A patient-centered care model that emphasizes enhancing self-efficacy by strengthening exogenous factors (including factors related to people with T2DM, treatment situations, family, and healthcare services) can improve self-care and quality of life for individuals with T2DM. Healthcare providers can enhance these exogenous factors through patient-centered education, training, and mentoring adjusted to socioeconomic status (such as age, education level, income, marital status, family type, health financing, and complications) to improve factors related to individuals with T2DM (such as knowledge, motivation, coping skills, and diabetes distress). Empowerment efforts should also address treatment situational factors, including perceived health status, self-care ability, and diabetes duration while optimizing family and healthcare provider support. Strengthening these exogenous factors can enhance diabetes self-efficacy, self-care behaviors, and health-related quality of life by reducing the risk of complications. Future research could test this model further or explore additional factors influencing T2DM self-care and its impact on quality of life.

Declaration of Conflicting Interest

The authors declare no conflicts of interest that could potentially influence the impartiality of this research, its interpretation, or publication.

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Authors' Contributions

The authors confirm contribution to the paper as follows: study conception and design: Rondhianto; data collection: Rondhianto, Akhmad Zainur Ridla, Muhamad Zulfatul A'la; analysis and interpretation of results: Rondhianto, Akhmad Zainur Ridla, Kushariyadi; draft manuscript preparation: Rondhianto, Murtaqib Akhmad Zainur Ridla. All authors reviewed the results and approved the final version of the manuscript.

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Data Availability

The data that support the findings of this study are available upon request.

Declaration of Use of AI in Scientific Writing

There is nothing to disclose.

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