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ORIGINAL RESEARCH

Analysis of Factors Related to Diabetes Self-Management in Patients with Type 2 Diabetes Mellitus in Rural Areas

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Abstract

Background: Type 2 diabetes mellitus (T2DM) is a global health problem with an increasing prevalence. Most related studies focus on Diabetes Self-Management (DSM) in urban populations or general contexts, leaving a gap in understanding the specific factors affecting DSM among rural T2DM patients. Therefore, there is limited understanding of the factors that influence DSM in rural T2DM patients.
Purpose: This study aimed to investigate DSM in rural T2DM patients and its associated factors
Methods: This study employed a cross-sectional design. The samples involved 146 patients with T2DM from the community health center in Ogan Komering Ulu Regency, Indonesia, selected using a simple random sampling technique. Diabetes Knowledge Questionnaire (DKQ), Diabetes Management Self-Efficacy Scale (DMSES), Hensarling Diabetes Family Support Scale (HDFSS), and Diabetes Self-Management Instrument (DSMI) were used for data collection. The t-test, ANOVA, Pearson correlation, and multiple linear regression were used to analyze the data.
Results: The study found a significant relationship between gender (p=0.001), knowledge (p=0.001), self-efficacy (p=0.001), and family support (p=0.032) with DSM in rural T2DM patients. However, the multiple regression analysis revealed that self-efficacy (β=0.392, p=0.001), gender (β=0.283, p=0.001), and duration of DM (β=-0.189, p=0.012) significantly affected DSM in patients with T2DM in rural areas, explaining 28 percent of the variance (R^2=0.280).
Conclusion: The results indicated a significant relationship between gender, knowledge, self-efficacy, and family support with DSM in T2DM patients in rural areas, with self-efficacy being the most dominant factor affecting DSM. This study recommends that community nurses can play a pivotal role in designing and implementing interventions enhancing self-efficacy. Additionally, the involvement of *PROLANIS,* collaborating with key community figures, is crucial to increasing community participation and support for effective diabetes self-management.

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1. Introduction

The increasing prevalence of Type 2 Diabetes Mellitus (T2DM) is becoming a global disease burden and is recognized as a serious public health problem with a significant impact on human life (Khan et al., 2020). It is estimated that 529 million adults are living with diabetes, representing 10.5% of the global population (International Diabetes Federation [IDF], 2021). Worldwide, an estimated 176.6 million individuals with diabetes reside in rural areas, reflecting a global prevalence of 8.3% as of 2021 (IDF, 2021). In the United States, rural areas have been found to have a higher burden of T2DM compared to urban areas (Dugani et al., 2021). This phenomenon is also evident in Indonesia, where there has been a significant increase in diabetes cases, particularly in rural regions (Ministry of Health, Republic of Indonesia [MoHRI], 2024).

T2DM cases have become a focus of healthcare as one of the highest causes of death in Indonesia (Hidayat et al., 2022). Recent data show a significant increase in the population with

diabetes (MoHRI, 2024). Also, it is noteworthy that the prevalence of T2DM increased significantly from 10.9% in 2018 to 11.7% in 2023 among the population aged 15 years and older, as measured by blood sugar levels. These figures highlight a notable increase, suggesting a rise of approximately 0.8% in new cases among people with diabetes in Indonesia during this period. However, the prevalence of T2DM patients living in rural areas (11.2%) is slightly lower than in urban areas (12.1%) (MoHRI, 2024).

Although the data in Indonesia show that the number of people with T2DM is lower in rural areas than in cities, it should be noted that the number of T2DM cases in rural areas continues to increase (MoHRI, 2024). A previous study conducted by Asril et al. (2020) in rural Bali found that lifestyle behaviors in rural communities play a crucial role in the management and prevention of T2DM. In addition, there is limited knowledge about diabetes in rural areas, particularly in the rural regions of West Kalimantan, Indonesia (Damhudi et al., 2021). Kristina et al. (2020) reported that rural communities in Indonesia tend to have less knowledge about T2DM management, which is closely associated with lower education levels in these communities.

Rural areas have unique challenges in diabetes care (Ma et al., 2023). Limited access to case detection is a gap to consider (Timm et al., 2020). Patients with T2DM in rural areas face challenges related to accessing healthcare over longer distances (Dugani et al., 2021), maintaining continuity of care (Oh, 2022), and a limited number of healthcare professionals (Jin et al., 2017). It is predicted that this pattern will continue unless the patients can effectively manage their self-care (Alodhayani et al., 2021). In Indonesia, programs such as *PROLANIS* (chronic disease management program) have been implemented in community health centers to address these gaps (Fadlilah et al., 2024; Mubarak et al., 2024). However, its effectiveness in rural areas requires further investigation.

Self-care management in diabetes is an effective way to minimize the risk of complications and to improve the patient's quality of life (Bhunga et al., 2023; Chen et al., 2022). Prior research by Alsayed Hassan et al. (2022) in Qatar reported that patients with DM who have poor self-care management are associated with a poor quality of life. Self-care management in patients with T2DM can be affected by knowledge (Phoosuwan et al., 2022), self-efficacy (Hurst et al., 2021), and family support (Keke & Quinn, 2020).

There have been extensive studies on Diabetes Self-Management (DSM) conducted in urban areas of Indonesia, with a focus on urban populations. A study by Kurnia et al. (2017) in Malang City found that diabetes management in adults with T2DM can be improved by enhancing self-efficacy and situational influences. Another study by Ulfah et al. (2022) in the same city also showed that self-care behavior among diabetes patients is significantly associated with the duration of diabetes, illness perception, family support, and community support. In addition, Rachmawati et al. (2019), in their study in Depok City, found a significant correlation between diabetes literacy and DSM in older people with T2DM. The limited number of studies on DSM in rural areas highlights the limitations and unaddressed gaps in Indonesia.

The care of people with diabetes in rural areas is essential because it requires long-term disease management (McAlexander et al., 2022). The increase in diabetes cases in rural areas needs to be highlighted to explain sustainable care behaviors. Limited availability of structured diabetes education programs specifically tailored for rural communities further exacerbates the issue. To date, there have been limited studies on the factors related to DSM in rural areas of Indonesia. This study is well-suited to the context of rural areas, increases patient understanding, and facilitates more effective self-care management of diabetes in these areas. Therefore, this study aimed to analyze some factors that influence DSM in T2DM patients in rural areas.

2. Methods

2.1. Research design

This study used a cross-sectional design to examine the association between knowledge, self-efficacy, family support, gender, education, and duration of DM towards DSM and to identify the factor that most dominantly affects DSM in patients with T2DM in rural areas.

2.2. Setting and samples

This study was conducted at a community health center in Ogan Komering Ulu Regency, South Sumatra Province, Indonesia. G*Power 3.1 was used to calculate the sample size ($f2$=0.15; α=0.05, and power (1-β)=0.95). A medium effect size ($f2$=0.15) was deemed appropriate to detect

meaningful relationships between the variables while maintaining a balance between statistical power and sample size requirements (Cohen, 2013). Considering six independent variables, the calculated total sample size was determined to be 146 respondents. Sample selection was done using simple random sampling. Respondents were selected from this sample using randomization techniques with an Excel formula. The inclusion criteria for respondents in this study were: 1) age ≥19 years; 2) patients with T2DM without acute complications; 3) willing to participate as respondents; and 4) able to read Bahasa Indonesia. The exclusion criteria included patients who experienced a decrease in health status (such as shaking, dizziness, or weakness).

The determination of the research area refers to the regulation of the Minister of Health of the Republic of Indonesia No. 43 of 2019, which includes the characteristics of community health centers in rural areas. These areas should meet at least 3 out of the 4 criteria, namely: 1) more than 50% of the population is engaged in the agricultural or maritime sector; 2) it has facilities including schools with a radius of more than 2.5 km, markets and urban areas with a radius of more than 2 km, hospitals with a radius of more than 5 km, and it does not have facilities in the form of hotels; 3) households with electricity coverage are less than 90%; and 4) there is road access and transportation to the facilities mentioned in number 2 (Minister of Health the Republic of Indonesia, 2019).

2.3. Measurement and data collection

The study used four questionnaires and sociodemographic questions to measure its variables. The sociodemographic questions included initial name, gender, education, and T2DM duration. Permission to use the questionnaires was obtained. The first questionnaire was the Diabetes Knowledge Questionnaire (DKQ) developed by Garcia et al. (2001) to measure diabetes-related knowledge. This questionnaire, originally in English and Spanish, consisted of 24 questions with "yes", "no", and "don't know" response options. Items were scored as correct or incorrect, and the correct items were summed to obtain a total score. The measurement results were expressed as a total score ranging from 0 to 24. Subsequently, the score was converted into a percentage by dividing the number of correct answers by the total number of questions and multiplying by 100. Based on the percentage scores, participants' knowledge levels were categorized into three groups: poor knowledge (<55%), fair knowledge (56–75%), and good knowledge (76–100%). This study used the Indonesian version of the questionnaire by Zakiudin et al. (2022). The DKQ was considered valid, as all 24 items had item-total correlation coefficients (r) greater than the r table value of 0.334, indicating acceptable construct validity (Zakiudin et al., 2022).

The second questionnaire was the Diabetes Management Self-Efficacy Scale (DMSES) used to measure diabetes management self-efficacy (Sturt et al., 2010). Originally written in English, this questionnaire consisted of three dimensions: magnitude, strength, and generality, which were incorporated into 16 question items. The scale used a Likert scale ranging from 1 to 5 (1=unsure, 2=less sure, 3=fairly sure, 4=sure, and 5=very sure), with the highest score of 80 and the lowest score of 16. The final result indicated that the higher the respondent's score, the higher the self-efficacy. In this study, an Indonesian version adapted by Clara (2014) was used. All question items were valid, with item-total correlation coefficients exceeding the r table value of 0.361, and reliable with a Cronbach's alpha value of 0.865 (Clara, 2014).

The third questionnaire was the Hensarling Diabetes Family Support Scale (HDFSS) by Hensarling (2009), which measures the perceived family support of adults with T2DM. It consisted of emotional, reward, instrumental, and informational dimensions, with a total of 29 question items. The scale used a Likert scale (1=never, 2=rarely, 3=often, and 4=always). The lower the score, the lower the family support for diabetics is, and vice versa. This study used the Indonesian version of the questionnaire by Yusra (2011), in which all item-total correlation coefficients exceeded the r table value of 0.361, indicating acceptable validity. The instrument also demonstrated high internal consistency with a Cronbach's alpha coefficient of 0.96 (Yusra, 2011).

The fourth questionnaire was the Diabetes Self-Management Instrument (DSMI), developed by Lin et al. (2008), to measure self-management in adults with T2DM. Originally written in English, this questionnaire consisted of 35 question items with four response options using a Likert scale ranging from 1 (never) to 4 (always). The DSMI included five subscales: self-integration (10 items), self-regulation (9 items), interaction with health professionals and significant others (9 items), self-monitoring blood glucose (4 items), and adherence to the recommended therapy (3 items). The total score for the instrument ranges from 35 to 140, with

higher scores representing a higher frequency of self-management activities. This study used the Indonesian version of the questionnaire by Rahayu and Chen (2020), known as the IDN-DSMI, with a Cronbach's alpha of 0.96 for the overall instrument and 0.84-0.93 for the subscales. The construct validity was supported by confirmatory factor analysis (CFA), with composite reliability (CR) values ranging from 0.83 to 0.93 and average variance extracted (AVE) ranging from 0.38 to 0.66 across the five domains (Rahayu & Chen, 2020).

The researchers collected the data from December 2023 to January 2024. Participants were invited to participate in the study, and the primary researcher obtained informed consent before distributing the questionnaires. Before distribution, the researcher explained the study's title, objectives, and eligibility criteria to the participants. They were also assured of the confidentiality of their information, their right to withdraw from the study at any time before data collection was completed, and the low-risk nature of the study was emphasized.

2.4. Data analysis

Data entry and analysis were conducted using the Statistical Package for Social Sciences (SPSS) version 21. Frequency, percentage, mean, and standard deviation were used to describe the data. The data normality was tested using the Kolmogorov-Smirnov test, and the results showed that the data were normally distributed (p>0.05). Therefore, an ANOVA test was used to analyze significant differences in knowledge and education regarding DSM. An independent t-test was used to analyze significant differences between gender and duration of DM on DSM, and Pearson product-moment correlation was used to assess the relationships between self-efficacy and family support on DSM. A multiple linear regression test was also conducted to identify significant influencing factors. Results were considered statistically significant at an alpha ≤0.05.

2.5. Ethical consideration

This study received ethical approval from STIKes Alifah Padang with the reference number 000100/KomiteEtikPenelitianSTIKesAlifahPadang/2024. Prior to data collection, the researchers ensured that respondents were fully informed about the study and their rights to participate in the study before they signed the informed consent form.

3. Results

3.1. Characteristics of respondents and their relationships with DSM

The demographic characteristics of the respondents are shown in Table 1. Most respondents were female (57.7%), had a secondary education level (58.2%), had a duration of T2DM >5 years (60.3%), and had sufficient knowledge about diabetes (50.7%). The mean of self-efficacy score and family support score were 46.62(13.36) and 69.19(16.69), respectively. Bivariate analysis of the factors showed that knowledge, gender, self-efficacy, and family support were significantly related to DSM in patients with T2DM in rural areas (p<0.05) (Table 1).

Table 1. Characteristics of respondents and their relationships with DSM (n=146)

Characteristics	*f* (%)	Mean (SD)	DSM Mean (SD)	*r/t/F*	*p*
Gender					
Female	84(57.5)		67.12(21.19)	t = -3.74	0.001
Male	62(42.5)		79.32(18.07)		
Education					
Higher	12(8.2)		76.08(16.25)	F = 0.31	0.731
Secondary	85(58.2)		71.35(22.03)		
Elementary	49(33.6)		73.02(73.02)		
Duration of T2DM					
⩽5 years	58(39.7)		74.90(19.34)	t = 1.22	0.221
>5 years	88(60.3)		70.59(21.58)		
Knowledge					
Poor	40(27.4)		67.10(23.61)	F = 7.55	0.001
Fair	74(50.7)		78.54(17.20)		
Good	32(21.9)		64.38(20.62)		
Self-efficacy		46.62(13.36)		r = 0.39	0.001
Family Support		69.19(16.69)		r = 0.17	0.032

Note. F=one-way analysis of variance; *t*=independent t-test; *r*=Pearson product moment correlation

3.2. Factors affecting DSM in patients with T2DM in rural areas

Before conducting the multiple linear regression, the researchers tested the assumptions of linearity, independence, homoscedasticity, and normality, and confirmed that all of these assumptions were met. As presented in Table 2, the regression model showed that self-efficacy (β=0.392, *p*=0.001), gender (β=0.283, *p*=0.001), duration of T2DM (β=-0.189, *p*=0.012), and family support (β=0.126, *p*=0.084) significantly influenced DSM. Self-efficacy was also found to have the most significant influence on DSM of all the factors, as it had the largest β-value of 0.392. The model explained that 28% of the variance in DSM in T2DM patients in rural areas was affected by these factors. This means that these factors could predict 28% of the variation in DSM. Other factors explained the remaining 72%.

Table 2. Multiple linear regression model of diabetes self-management in rural areas (n=146)

Factors	B	Std.Error	β	t	*p*	R^2
(Constant)	40.253	9.473	-	4.249	0.001	
Self-Efficacy	0.609	0.113	0.392	5.382	0.001	
Family Support	0.157	0.090	0.126	1.741	0.084	0.280
Gender	11.845	3.039	0.283	3.898	0.001	
Duration of T2DM	-8.007	3.132	-0.189	-2.557	0.012	

4. Discussion

This study investigated the associated factors of Diabetes Self-Management (DSM) in T2DM patients in rural areas. The results showed a significant relationship between gender, knowledge, self-efficacy, family support, and DSM in T2DM patients in rural areas. However, the multiple linear regression analysis, as indicated by the equation model, showed that self-efficacy, sex, duration of T2D, and family support significantly influenced DSM in patients with T2D in rural areas. Additionally, our analysis highlighted self-efficacy as the most dominant factor influencing DSM in T2DM patients in rural areas.

In terms of gender, this study found that male respondents had a higher mean score of DSM compared to female respondents. Males' higher DSM scores could reflect greater confidence or autonomy in managing their condition. Conversely, the lower scores among females may indicate gender-based disparities in health behavior, where females may face more obstacles in consistently applying DSM practices (Guo et al., 2024). These obstacles may be influenced by treatment, diabetes knowledge, perceived benefit, perceived self-efficacy, social support, and situational influences (Kurnia et al., 2017). Therefore, the relationship between gender and DSM in this context highlights the need for tailored health education and support strategies that consider gender-specific challenges to improve diabetes outcomes for both females and males (Ciarambino et al., 2022).

This study also revealed that knowledge, self-efficacy, and family support were significantly associated with DSM. Regarding the relationship between self-efficacy and DSM, the study's results align with a study in Malaysia conducted by Gunggu et al. (2016), which showed that self-efficacy was a predictor of DSM. Similarly, a study conducted in Iran by Karimy et al. (2018) showed that self-efficacy is a crucial prerequisite for self-management in individuals with diabetes. A study by Dehghan et al. (2017) supported this, indicating that self-efficacy is one of the key factors that can significantly contribute to the success of diabetes control and self-care. Individuals have the ability to perform self-management to meet their health needs. Self-efficacy plays an important role in shaping the self-management behaviors required to effectively manage T2DM (Qin et al., 2020). By strengthening these beliefs, individuals can be more confident in facing daily challenges related to their health status, which in turn can improve their overall quality of life (Çalli & Kartal, 2021). Therefore, improving self-efficacy to manage T2DM may be an effective strategy to improve health and well-being outcomes for them.

This study also highlighted the concern of respondents' low knowledge about diabetes. This result aligns with Dinesh et al. (2016) in rural settings in India, which showed that only 24.25% of the study's participants had good knowledge. Another study reported a low level of knowledge about different components of diabetes management among people with diabetes in a rural setting in Eastern Cape, South Africa (Owolabi et al., 2022). Knowledge is a foundational element that contributes significantly to DSM. Adequate knowledge enables individuals to understand the

principles and purpose of DSM. A higher level of diabetes-related knowledge empowers patients to set realistic goals (Hurst et al., 2021). Knowledge about self-care management of individuals with T2DM has a significant relationship with rural settings (Popoviciu et al., 2022; Wang et al., 2023). In rural settings, access to health information and services is often limited, so knowledge about diabetes management is critical for individuals to manage their health condition effectively (Hailu et al., 2019).

In addition, the result showed that family support was significantly associated with DSM. This finding aligns with previous studies conducted by Tang et al. (2023) in China and Diriba et al. (2023) in Western Ethiopia, both of which reached similar conclusions. Family support plays a vital role in the self-care management of individuals with T2DM, especially in rural areas (Tang et al., 2023). Family involvement in chronic disease management involves a series of steps and strategies undertaken by the family to cope with the physical, emotional, and social challenges associated with the chronic health conditions of family members (Setyoadi et al., 2023). Therefore, given the limitations in rural settings and recognizing the important role of families in the self-care management of individuals with T2DM, it is crucial to support families in providing the needed support to family members living with diabetes (Thirsk & Schick-Makaroff, 2021).

Based on multiple regression analysis, this study found that self-efficacy, gender, duration of T2DM, and family support significantly influenced DSM in patients with T2DM in rural areas. These findings underscore the critical role of gender, education, and family support in the success of DSM interventions. The implementation of DSM plays a significant role in improving the quality of life and reducing the risk of complications for people with T2DM in rural areas (Tang et al., 2023). Highlighting the challenges of limited access and resources, it is important for people living with diabetes to have adequate skills and knowledge to manage their own condition (Ma et al., 2023). This is particularly relevant in the context of the *PROLANIS* (Chronic Disease Management Program), which emphasizes the importance of community-based care and self-management in Indonesia (Mubarak et al., 2024). Through the lens of *PROLANIS*, DSM strategies can be integrated into structured interventions such as education sessions, peer support groups, and routine health monitoring, thereby addressing barriers to care in resource-limited rural areas. The *PROLANIS* program serves as a potential framework to integrate these findings into actionable strategies. By leveraging its existing infrastructure, DSM practices can be aligned with community health initiatives, ensuring sustainable and contextually relevant interventions in rural areas. *PROLANIS* can collaborate with key community figures, which is crucial to increasing community participation and support for effective diabetes self-management (Fadlilah et al., 2024).

5. Implication and limitation

This study has several important implications for DSM in T2DM patients in rural areas. The findings highlight the importance of improving patients' self-efficacy. Health professionals, especially nurses, are expected to strengthen interventions that focus on improving patients' self-efficacy through targeted health education programs. Additionally, integrating DSM strategies into *PROLANIS* programs can be beneficial in addressing barriers related to access and support in rural areas. However, this study has limitations. The use of participants from a single setting might hinder the generalizability of the findings to a broader population across Indonesia, given its diverse ethnicities, cultures, and varying healthcare facilities.

6. Conclusion

This study concluded that knowledge, self-efficacy, gender, and family support were related to DSM in patients with T2DM in rural areas. Moreover, the multiple linear regression analysis highlighted self-efficacy as the most dominant influencing factor in DSM among T2DM patients in rural areas. This study suggests that further research is needed on self-efficacy in people with T2DM in rural areas, including its influencing factors and potential interventions to improve it. The study also recommends that community nurses can play a pivotal role in designing and implementing interventions that enhance self-efficacy in T2DM patients, such as education programs, peer support groups, and tailored counseling sessions. Additionally, the involvement of *PROLANIS*, in collaboration with key community figures, is crucial for increasing community participation and support for effective diabetes self-management. A suggested policy direction is to utilize community resources in rural areas to create health-conscious communities. These

communities can leverage various initiatives and facilities to provide basic health services, health education, and support to the local population.

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Author contribution

All authors (MAA, JS, ER, RADS, PG) contributed substantially to the study design, data collection, analysis, and interpretation of results. All authors drafted and revised the article, approved the published version, and agreed to take responsibility for all aspects of the work.

Conflict of interest

The authors declare that they have no potential conflicts of interest related to this study, their authorship of this article, and/or its publication.

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