

Predictors of Diabetes Self-Management Behaviour Among Type 2 Diabetics in Saudi Arabia: A Cross-Sectional Study

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Background: Type 2 Diabetes Mellitus (T2DM) requires effective self-care behaviors and social support to manage the condition and prevent complications. This study aimed to examine the influence of demographic characteristics and perceived social support on diabetes self-management behaviors in individuals with T2DM.

Methods: An analytical cross-sectional design was employed to collect data from 300 T2DM patients using validated questionnaires from April to May 2023. Self-care behaviors were assessed using a Summary of Diabetes Self-Care Activities-Arabic (SDSCA-Arabic), while perceived social support was measured using a Diabetes Care Profile (DCP) using an Arabic Social Support subscale. Descriptive statistics, correlation analysis, and regression analysis were performed to examine the relationships and predictors of self-care behaviors.

Results: Patients exhibited varying levels of self-care behaviors, with exercise and blood sugar testing being the most frequently reported activities. Additionally, the findings revealed that health education on self-examining regarding the feet, exercising, comorbidities, perceived social support, medical insurance, and gender were significant predictors of diabetes self-management behaviors. These factors collectively accounted for 21.2% of the variance in self-management behavior levels. Specifically, health education on self-examining regarding the feet ($\beta = -0.286$, $p = 0.001$) and exercising ($\beta = -0.175$, $p = 0.001$) showed a negative association, while perceived social support ($\beta = 0.235$, $p = 0.001$) demonstrated a positive association with self-management behaviors.

Conclusion: The study highlights the importance of comprehensive health education programs that address multiple aspects of diabetes management and the role of social support in fostering better self-management behaviors. It also emphasizes the influence of demographic factors on self-management, with individuals with higher comorbidities exhibiting better self-management behaviors and those with medical insurance showing poorer self-management behaviors. These findings have implications for nursing practice, suggesting the need for tailored interventions, effective education, and support networks to enhance self-management behaviors in T2DM patients.

Keywords: type 2 diabetes mellitus, self-care behaviors, perceived social support, cross-sectional study, health promotion, Saudi Arabia

Introduction

Diabetes mellitus is a prevalent and complex disease with a significant global impact, affecting approximately 5%–10% of adults worldwide and representing the most common chronic endocrine disorder.¹ Type 2 Diabetes Mellitus (T2DM) which accounts for over 90% of all diabetes cases globally, is a metabolic condition marked by insufficient insulin production and resistance, leading to high blood sugar levels.² In Saudi Arabia, the estimated prevalence of Type 2 Diabetes Mellitus (T2DM) is approximately 25% among the population.¹ The long-term implications of diabetes include micro- and macro-vascular complications, encompassing conditions such as retinopathy, nephropathy, neuropathy,

myocardial infarction, hypertension, and cerebrovascular disease,³ which necessitate considerable financial resources for management.⁴

Given the substantial burden of diabetes-related complications, effective diabetes self-management behaviors (DSMB) are essential for improving health outcomes.⁵ This study aims to delve into the unique context of Saudi Arabia, exploring how factors such as demographic characteristics, health-related aspects, diabetes-specific factors, and perceived social support influence DSMB in patients with T2DM. While previous research, exemplified by Ausili, Rossi, Rebora, Luciani, Tonoli, Ballerini, Androni, Vellone, Riegel and Di Mauro,⁶ has examined similar relationships, this study takes a distinct approach by focusing on the impact of social support and utilizing two comprehensive theoretical frameworks - Pender's Health Promotion Model (HPM) and the Middle-Range Theory of Self-Care of Chronic Illness. By adopting these frameworks, this study gains a comprehensive understanding of how these factors collectively influence individuals' behavior within the specific context of Saudi Arabia.

Incorporating Pender's HPM, which focuses on motivating individuals to modify unhealthy behaviors and improve health⁷, this study seeks to uncover how demographic factors, health-related elements, diabetes-specific factors, and perceived social support influence behavior, while also integrating the Middle-Range Theory of Self-Care of Chronic Illness proposed by Riegel, Jaarsma and Strömberg.⁸ This theory emphasizes the significance of self-care maintenance, monitoring, and management, as well as the role of confidence in self-care, health system factors, community resources, and family support. By integrating these two models, this study endeavors to offer a nuanced understanding of DSMB and its influencing factors, contributing to the existing body of knowledge on this critical topic. Importantly, this study addresses a significant gap in the literature by specifically investigating the impact of demographic characteristics, health-related factors, diabetes-specific factors, and perceived social support on DSMB in T2DM patients in Saudi Arabia. While previous studies have explored some of these factors individually, there is a lack of comprehensive research that considers the collective influence of these factors within the specific context of Saudi Arabia. By addressing this research gap, this study aims to provide valuable insights into the unique challenges and facilitators of DSMB in this population.

Method

Design

An analytical cross-sectional design was used to answer the study research questions:

1. What are the relationships between demographic (age, gender, education, marital status, income, employment status, occupation, and number of family members), health-related factors (medical insurance, comorbidities), diabetes-specific factors (duration of diabetes, health education), and perceived social support with diabetes self-management behavior among patients with T2DM?
2. Which variables measured in this study (demographic, health-related factors, diabetes-specific factors, and perceived social support) demonstrate the strongest predictive power for diabetes self-management behavior among patients with T2DM?

Study Sample

Non-probability convenience sampling was used to recruit potential participants. The sample size (n) was calculated using the following formula: $n = (z^2 * p * q) / (s^2 / 24)$. Therefore, if we want to estimate a proportion of 0.05 with a 95% confidence level and a margin of error corresponding to a standard deviation of 0.5, we would need a sample size of approximately 354 individuals.

Setting

The study was conducted at the Asir Diabetes Center (ADC) in the Asir region of Saudi Arabia.

Inclusion and Exclusion Criteria

The inclusion criteria required that the adult patients with T2DM be (a) age ≥ 18 years old; (b) oriented and mentally competent, (c) patients who can read, write, and communicate in Arabic; and (d) A hemoglobin A1c (HbA1c) level of

6.5% (48 mmol/mol) or higher. The exclusion criteria of participants are: (a) <18 years old; (b) patients who are unable to read, write, and communicate in Arabic; and (c) T1DM patients and pregnant women with gestational diabetes mellitus (GDM); (d) less than 1 year diagnosed with T2DM.

Study Instruments

The Summary of Diabetes Self-Care Activities-Arabic (SDSCA-Arabic)

The researcher utilized the Summary of Diabetic Self-Care Activity (SDSCA)-Arabic version to measure the diabetes self-management behaviors.⁹ The SDSCA-Arabic is a self-administered eight-item scale with four subscales designed to assess diabetes self-management behaviors, including two items for general diet, two items for exercise, two items for blood glucose testing, and two items for foot care. A medication sub-scale is not included in the SDSC-A. The medication sub-scale was removed due to its ceiling effects and lack of consistency among participants, which resulted in unsatisfactory reliability. Participants in the SDSCA-Arabic are asked to report how many days in the previous week they engaged in self-management behavior. For example, participants are asked, “On how many of the last seven days did you participate in at least 30 minutes of physical activity?”. This instrument is an eight-point Likert scale ranging from 0 to 7, with 0 representing “not at all” and 7 representing “every day” and higher scores indicating adequate self-management. Permission to use the instrument to measure diabetes self-management behaviors was obtained from the author.

The test-retest reliability of the scale was found to be $r = 0.91$, with an internal consistency of Cronbach's $\alpha = 0.76$. The Cronbach's α of the subscales for diet, exercise, blood glucose monitoring and foot care were as follows: diet, 0.89; exercise, 0.83; blood glucose testing, 0.92; and foot care, 0.77.⁹ According to AlJohani, Kendall and Snider,⁹ the analysis of the content validity revealed a representativeness level (R-CVI) of 95% and a clarity score (C-CVI) of 94.8%. These scores indicated good agreement. The internal consistency of Cronbach's alpha in this study was calculated to be 0.74.

Perceived Social Support Scale

This instrument was adapted from the Diabetes Care Profile (DCP), which is based on the Health Belief Model and consists of 14 scales with 234 items that assess the social and psychological factors of diabetes and its treatment.¹⁰ The Arabic version of the Diabetes Care Profile (DCP) social support subscale is a self-reported scale for measuring perceived social support (51, 95). The Social Support subscale is divided into two domains that reflect different types of social support.¹¹ Each domain contains six items labeled “a” through “f”, for a total of 12 items, with each item measured on a 5-point Likert scale ranging from (1) strongly disagree to (5) strongly agree, with an additional “not applicable” option. An example of an item measuring social support includes “my family or friends help and support me a lot to follow my meal plan.” Regarding support from family and friends for diabetes and its management, each domain score ranges from 6 (least supported) to 30 (best supported). The overall score for diabetes and its treatment by family and friends ranges from 12 (least supported) to 60 (best supported) (51, 95). The researcher contacted the instrument's author and obtained permission to use it in this study.

In a community-based study, the Cronbach α reliability coefficient of DCP-SS was 0.69; in a hospital-based study, it was $r = 0.73$ (51, 95). In addition, the scale was translated into Arabic and tested on 51 adolescents with type 1 diabetes, yielding a Cronbach's α reliability coefficient of 0.65.¹² The DCP-SS has also been used in Lebanese T2DM patients, demonstrating good reliability with a Cronbach's α of 0.88.¹¹ The internal consistency of Cronbach's alpha in this study was calculated to be 0.78.

Data Collection Procedures

Participants in the study were provided with study materials, including questionnaires and consent forms, in a white envelope from April to May 2023. The questionnaires were designed to maintain anonymity by not requesting personal information. Before data collection, the researcher obtained permission from the diabetic center and addressed any concerns or questions with the appropriate contact person. A private area within the center was designated for participants to complete the survey.

The researcher was present at the center during regular business hours from Sunday to Thursday, from 9 a.m. to 3 p.m., to recruit potential participants and collect data. Additionally, potential participants with Type 2 Diabetes Mellitus (T2DM) were approached during their regular visits to the diabetic center for appointments with physicians or diabetes educators. The researcher personally contacted potential participants, provided information about the study, and invited them to participate.

Participants were informed about the study, their roles, and the time required to complete the questionnaires in a private room at the center. The risks and benefits of participation were also discussed. It was emphasized that participation was voluntary, and participants would not receive monetary compensation. Participants were assured that they could refuse to answer personal or sensitive questions and had the right to withdraw from the study without facing any penalties or threats to their treatment.

Consent forms were provided, and participants were requested to read them carefully before signing. Each participant was assigned a unique study ID number, which was recorded on all study documents. Participants completed a demographic survey and two self-reported questionnaires, with the researcher available for assistance or clarification during the data collection process. The completed questionnaires were sealed in an envelope.

Data Analysis

The Statistical Package for Social Science (SPSS) SPSS®-PC version 28 For Windows was used to analyze the data. The significance level was set at .05 for all statistical analyses. The study used Pearson product-moment correlation coefficients to explore relationships between sociodemographic characteristics, health-related factors, diabetes-specific factors, perceived social support, and diabetes self-management behaviors. Multiple regression analyses were conducted to examine the predictive variables and their impact on diabetes self-management behaviors.

Result

Description of Sample Characteristics

In this study, 365 participants were included, with diverse demographic characteristics. The mean age was 49.85 years, and the average number of family members was 7.19. The majority were male (57.0%) and married (63.8%). Many participants had a bachelor's degree (30.1%), and most reported having diabetes for more than five years (77.0%). The majority lacked medical insurance coverage (90.2%) (Table 1).

Table 1 Demographic Characteristics of the Participants (N = 365)

Characteristics	n	%	M	SD
Age			49.85	19.01
Number of family members			7.19	3.642
Number of family members living with the patient			4.78	2.390
Gender				
Male	203	57.0		
Female	153	43.0		
Marital status				
Single	84	23.6		
Married	227	63.8		
Divorced	4	1.1		
Widowed	41	11.5		

(Continued)

Table 1 (Continued).

Characteristics	n	%	M	SD
Education				
Illiterate	69	19.4		
Elementary	42	11.8		
Intermediate	26	7.3		
Secondary	92	25.8		
Bachelor's degree	107	30.1		
Master's degree or higher	20	5.6		
Income				
Less than 5000 SAR per month	184	51.7		
5000–10,000 SAR per month	89	25.0		
11,000–20,000 SAR per month	71	19.9		
More than 20,000 SAR per month	12	3.4		
Occupation				
Civil government employee	169	47.5		
Military government employee	16	4.5		
Private sector employee	26	7.3		
Businessman (trader)	5	1.4		
Retired	88	24.7		
Unemployed	52	14.6		
Medical insurance				
Yes	35	9.8		
No	321	90.2		

Abbreviations: M, Mean; SD, Standard Deviation.

A significant proportion received diabetes education (74.7%), including self-care behavior education. The participants had varied employment statuses, with civil government employees being the largest group (47.5%). Around 41.0% reported having at least one comorbidity, with hypertension being the most common (10.1%). (Table 2).

Table 2 Diabetes Duration, Diabetes Related Education and Comorbidities (N = 365)

Characteristics	n	%
Diabetes duration		
Less than 1 year	4	1.1
1–5 years	78	21.9
More than 5 years	274	77.0

(Continued)

Table 2 (Continued).

Characteristics	n	%
Diabetes education		
Yes	266	74.7
No	90	25.3
Education on self-care behaviors		
Yes	233	65.4
No	123	34.6
Education on checking blood sugar		
Yes	290	81.5
No	66	18.5
Education on exercising		
Yes	299	84.0
No	57	16.0
Education on a specific diet		
Yes	299	84.0
No	57	16.0
Education on self-examining regarding feet care.		
Yes	177	49.7
No	179	50.3
Comorbidities		
Yes	146	41.0
No	210	59.0
Name of the disease		
Hypertensive	36	10.1
Thyroid gland	19	5.3
Asthma	59	16.6

Descriptive Characteristics of Diabetes Self-Management Behavior (DSMB) and Diabetes Care Profile: Social Support Survey (DCP-SS-Arabic)

The mean score for overall self-management behavior was 2.79 days per week ($SD = 1.59$), indicating infrequent engagement in self-care activities. Among the specific sub-scales, exercise had the highest mean score of 2.58 (± 2.12), followed by blood sugar testing with a mean score of 3.56 (± 2.52). On the other hand, foot care was reported the least frequently, with a mean score of 1.91 (± 2.88). The participants reported a moderate level of perceived social support, as indicated by a mean SSQ score of 45.66 (± 8.51). The Social Support subscale consists of two domains, each representing different types of social support. The mean score for the first domain was 24.80 (± 5.33), and for the second domain, it was 20.86 (± 4.93), suggesting a moderate level of social support in various aspects among the participants (Table 3).

Table 3 Descriptive Statistics of the Study Variables (N = 365)

Variables	M±SD
Summary of Diabetic Self-Care Activity -Arabic Scale (SDSCA)	2.79±1.59
SDSCA_Diet_score	3.13±2.38
SDSCA_Exer_score	2.58±2.12
SDSCA_BST_score	3.56±2.52
SDSCA_Footcare_score	1.91±2.88
Perceived Social Support (SSQ)	45.66±8.51
The first domain of SSQ	24.80±5.33
The second domain of SSQ	20.86±4.93

Abbreviations: M, Mean; SD, Standard Deviation.

Relationships Between Selected Demographic, Health-Related Factors, Diabetes-Specific Factors, Perceived Social Support, and Diabetes Self-Management Behavior in Saudi Adults with DMT2

There was a significant negative correlation between diabetes education and DSMB ($r = -0.185$, $p < 0.001$), indicating that participants who received more diabetes education tended to exhibit lower diabetes self-management behavior. Similarly, training on self-care behaviors for diabetes ($r = -0.232$, $p < 0.001$), health education on exercising ($r = -0.235$, $p < 0.001$), health education on a specific diet ($r = -0.162$, $p = 0.002$), and health education on self-examining regarding the feet ($r = -0.286$, $p < 0.001$) showed significant negative correlations with DSMB. These findings suggest that individuals who received more comprehensive health education in these areas tended to exhibit lower levels of diabetes self-management behavior (Table 4).

Table 4 Bivariate Correlation for the Study Variables (N = 365)

Variable	DSMB <i>r</i> value	P-value
Age	-0.054	0.312
Gender	0.091	0.085
Marital status	-0.016	0.767
Education level	0.033	0.539
Diabetes duration	0.026	0.623
Diabetes education	-0.185*	0.000
Training on self-care behaviors for diabetes	-0.232*	0.000
Health education on checking blood sugar at home	-0.106*	0.047
Health education on exercising	-0.235*	0.000
Health education on a specific diet	-0.162*	0.002
Health education on self-examining regarding the feet	-0.286*	0.000
Income	-0.027	0.616

(Continued)

Table 4 (Continued).

Variable	DSMB <i>r</i> value	P-value
Occupation	-0.023	0.670
Number of family members	0.089	0.095
Family members living with the patient	0.014	0.786
Comorbidities	0.177*	0.001
Medical insurance	-0.112*	0.035
Perceived social support	0.248*	0.000

Note: * $p \leq 0.05$.

Abbreviation: DSMB, Diabetes Self-Management Behaviors.

Additionally, perceived social support showed a significant positive correlation with DSMB ($r = 0.248$, $p < 0.001$), indicating that higher levels of perceived social support were associated with better diabetes self-management behavior. Furthermore, chronic diseases demonstrated a significant positive correlation with DSMB ($r = 0.177$, $p = 0.001$), suggesting that individuals with a higher number of comorbidities tended to exhibit better diabetes self-management behavior. However, medical insurance showed a significant negative correlation with DSMB ($r = -0.112$, $p < 0.001$), indicating that patients with medical insurance were associated with poor diabetes self-management behavior.

Factors Predicting the Diabetes Self-Management Behavior Among Saudi Adult DMT2

Stepwise linear multiple regression analysis was conducted to determine the effect of various factors on diabetes self-management behavior. The final model included six variables: health education on self-examining regarding the feet, health education on exercising, comorbidities, perceived social support, medical insurance, and gender. These variables accounted for 21.2% of the variance in diabetes self-management behavior levels ($R^2 = 0.212$, $p \leq 0.05$). The weights (Beta) of the predictor variables indicated their influence on self-management behavior levels.

Health education on self-examining regarding the feet had a significant negative effect on self-management behavior ($\beta = -0.286$, $p = 0.001$), while perceived social support had a significant positive effect ($\beta = 0.235$, $p = 0.001$). Similarly, health education on exercising ($\beta = -0.175$, $p = 0.001$), comorbidities ($\beta = -0.153$, $p = 0.002$), medical insurance ($\beta = -0.120$, $p = 0.013$), and gender ($\beta = 0.100$, $p = 0.038$) showed significant associations with self-management behavior. An increase in perceived social support and gender were associated with higher self-management behavior, while an increase in health education on self-examining regarding the feet, health education on exercising, comorbidities, and medical insurance was associated with lower self-management behavior. The changes in explained variance and β coefficients are presented in Table 5.

Table 5 Significant Predictors of Level of Diabetes Self-Management Behavior Among the Study Variables, (N= 365)

Variables	R^2	R^2 Change	t	β	P-value
Health education on foot care.	0.212	0.082	-5.60	-0.286	0.001*
Perceived social support		0.055	4.74	0.235	0.001*
Health education on exercising		0.028	-3.43	-0.175	0.001*
Comorbidities		0.023	-3.16	-0.153	0.002*
Medical insurance		0.014	-2.48	-0.120	0.013*
Gender		0.010	2.08	0.100	0.038*

Note: β = partial correlation, $R = 0.460$, R^2 Change represents the change in the coefficient of determination (R -squared) when a specific predictor variable is added to the model, * $P \leq 0.05$.

Discussion

The findings of this study shed light on important aspects of diabetes self-management behaviors and perceived social support among patients with T2DM in the Asir region of Saudi Arabia. By examining the influence of demographic, health-related factors, diabetes-specific factors and social support on self-management behaviors, this study contributes to the understanding of factors that can improve diabetes outcomes and prevent complications.

Diabetes Self-Management Behavior Level in T2DM Patients

The results of this study revealed a mean DSMB score of 2.79 days per week ($SD = 1.59$), indicating the least frequent self-management behavior among the participants. These findings align with previous studies that have reported similar levels of DSMB in T2DM patients, suggesting that adherence to self-care activities can be challenging for individuals with T2DM.^{13,14} The least frequent self-management behavior observed in this study may be attributed to the multifaceted nature of T2DM management and the complexities associated with self-care tasks. Factors such as lack of knowledge, limited resources, and psychosocial barriers could contribute to suboptimal adherence to self-management behaviors. These challenges may require targeted interventions and comprehensive support to improve DSMB in T2DM patients. However, it is important to acknowledge that studies report higher self-management behaviors in T2DM patients.¹⁴ These studies indicate that some individuals adhere better to self-care activities, achieving higher DSMB scores. The discrepancies in findings could be influenced by various factors, including differences in study populations, cultural backgrounds, access to healthcare resources, and interventions implemented to promote self-management.

The findings reveal interesting patterns in the self-management behaviors of the patients with T2DM in the Asir region of Saudi Arabia. The participants reported varying levels of engagement in different self-management activities. The mean SDSCA_Diet_score was found to be 3.13, indicating a moderate level of adherence to dietary self-management behaviors among the participants. This finding suggests that there is room for improvement in terms of dietary choices and adherence to recommended dietary guidelines. Healthcare professionals can play a crucial role in providing targeted education and support to enhance dietary self-management practices in T2DM patients. These findings are consistent with existing literature.^{15,16}

The mean SDSCA_Exer_score was 2.58, indicating a moderate level of engagement in exercise or physical activity among the participants. Regular exercise is known to have numerous benefits for T2DM patients, including improved glycemic control and cardiovascular health. However, the findings suggest that there is a need to promote and encourage a higher level of physical activity in this population. Healthcare providers can emphasize the importance of incorporating regular exercise into the daily routines of T2DM patients and provide guidance on suitable exercise options. These findings are consistent with existing literature.^{17,18}

The mean SDSCA_BST_score was 3.56, indicating a relatively higher level of engagement in self-monitoring of blood sugar levels. Regular blood sugar monitoring is a critical aspect of diabetes management, enabling patients to make informed decisions about medication dosages and lifestyle modifications. The findings suggest that the participants recognize the importance of blood sugar monitoring and are actively involved in this self-management behavior. However, further education and support may be needed to ensure consistent and accurate monitoring practices. These findings are consistent with existing literature.^{19,20}

Interestingly, the mean SDSCA_Footcare_score was 1.91, indicating a relatively lower level of engagement in foot care behaviors among the participants. Proper foot care is essential for preventing complications such as foot ulcers and infections in individuals with T2DM. The findings suggest that there is a need to improve awareness and education regarding foot care practices among T2DM patients in the Asir region. Healthcare providers should focus on emphasizing the significance of regular foot examinations, proper hygiene, and appropriate footwear choices to reduce the risk of foot-related complications. These findings are consistent with existing literature.^{21,22}

Perceived Social Support Level in T2DM Patients

The results of this study revealed a mean SSQ score of 45.66 ± 8.51 , indicating a moderate level of perceived social support among the participants. These findings are consistent with previous research studies that reported similar social

support levels among individuals with T2DM.²³ It is worth noting that social support plays a crucial role in promoting self-management behaviors and improving overall health outcomes in individuals with chronic conditions like T2DM.

The SSQ consists of two domains, each containing six items that capture different aspects of social support. The mean score for the first domain was 24.80 ± 5.33 , while the mean score for the second domain was 20.86 ± 4.93 . These scores suggest that participants reported a moderate level of different types of social support. The first domain represents emotional and instrumental support, while the second represents informational and appraisal support. The availability of multiple types of social support can contribute to better-coping mechanisms and improved self-management among individuals with T2DM.

The moderate level of perceived social support observed in this study may be attributed to the challenges individuals face in managing T2DM and the need for support from various sources. Therefore, it is crucial to recognize the importance of social support networks, including family, friends, healthcare professionals, and diabetes support groups, in providing assistance, encouragement, and practical guidance to individuals with T2DM.

Disagreeing studies suggest that some individuals may report higher levels of perceived social support.^{24,25} These findings could be influenced by factors such as cultural differences, variations in study populations, and the measurement tools used.

Demographic, Health-Related Factors, and Diabetes-Specific Factors Associated with Diabetes Self-Management Behaviors

This study contributes to the limited body of research on factors influencing diabetes self-management behaviors in the Saudi Arabian population. While previous studies have explored self-management behaviors in various contexts, few have specifically investigated this topic in Saudi Arabia. Therefore, this study fills a gap in the literature by providing insights into the unique factors that influence self-management behaviors in this particular population.

Diabetic Health Education

One notable finding was the significant negative correlation between diabetes education and diabetes self-management behaviors. Surprisingly, participants who received more diabetes education exhibited lower self-management behavior. This finding contradicts the common belief that increased education on diabetes would lead to better self-management. However, it is important to consider the potential confounding factors in this relationship. For example, it is possible that individuals who received more diabetes education already had more severe cases of diabetes or faced greater challenges in managing their condition. As a result, their lower levels of self-management behavior could be attributed to the complexity of their diabetes management rather than the education itself.

Additionally, the correlation analysis revealed significant negative correlations between health education and self-management behaviors. Specifically, training on self-care behaviors for diabetes, health education on physical activity, health education on a specific diet, and health education on self-examining regarding the feet were all negatively associated with self-management behaviors. These findings suggest that individuals who received more comprehensive health education in these areas tended to exhibit lower levels of self-management behavior. One possible explanation for these negative correlations could be the overwhelming nature of the information provided during health education sessions in the studied primary healthcare center. Individuals who received extensive education on various aspects of diabetes management may have found it challenging to incorporate all the recommended behaviors into their daily routines. As a result, they may have experienced difficulties in implementing and maintaining consistent self-management behaviors, leading to lower self-management behaviors. These findings are inconsistent with previous studies that found a positive association between health education and different self-management behaviors such as medication adherence, regular monitoring of blood glucose levels, and adherence to dietary and exercise recommendations.^{24,26} This suggests that the impact of education on self-management behaviors may vary depending on individual characteristics, such as the severity of the disease and the individual's ability to integrate and apply the learned information effectively.

Diabetic Comorbidities

The positive correlation between comorbidities and self-management behaviors aligns with previous research suggesting that individuals dealing with multiple health conditions may develop a heightened sense of responsibility and engagement in managing their overall health, including diabetes.^{27,28} The experience of managing multiple comorbidities may contribute to increased knowledge, skills, and awareness of the importance of self-care. Additionally, individuals with multiple comorbidities may interact more frequently with healthcare providers, leading to enhanced education and support for managing their health conditions, including diabetes.

Medical Insurance

An intriguing finding from this study is the significant negative correlation between medical insurance and self-management behaviors. This suggests that patients with medical insurance were associated with poorer diabetes self-management behavior. This finding contradicts expectations, as medical insurance is often considered a facilitator of access to healthcare services and resources, which could potentially improve self-management behaviors. Socioeconomic factors could influence the negative correlation between medical insurance and DSMB. It is possible that individuals with limited financial resources or lower socioeconomic status, despite having medical insurance, face barriers such as high out-of-pocket costs for medications and supplies, limited access to healthy food options, or transportation challenges, which can adversely affect their ability to engage in optimal diabetes self-management. The current literature does not provide evidence regarding the correlation between medical insurance and self-management behaviors in individuals with diabetes. Therefore, it is imperative to conduct further research to investigate the intricate relationship between medical insurance and self-management behaviors. This research gap underscores the importance of exploring how medical insurance influences self-management behaviors in individuals with diabetes, as it can have significant implications for healthcare policies and interventions to improve diabetes management outcomes.

Gender

The results of this study demonstrated that gender significantly predicted self-management behaviors in individuals with T2DM. Specifically, the results found that females exhibited higher self-management behaviors than males. This finding aligns with previous research in the field, indicating a consistent trend of higher engagement in self-management behaviors among females across various chronic diseases, including diabetes²⁹.

Several factors may contribute to the observed gender differences in self-management behaviors in the current study. Firstly, it is possible that females have a greater inclination towards health-related behaviors and a stronger sense of responsibility for their health. In addition, societal norms and gender roles may influence this, where women are often socialized to prioritize health and well-being. Consequently, females in the current study may demonstrate higher motivation and commitment to engage in self-management behaviors, such as adhering to treatment regimens, monitoring blood glucose levels, following dietary recommendations, and engaging in physical activity.

Furthermore, differences in healthcare-seeking behavior and access to healthcare resources may contribute to the gender disparities in self-management behaviors. Females generally have better access to healthcare services, regularly visit, and are more likely to seek medical advice and support. This proactive healthcare-seeking behavior may facilitate greater awareness and knowledge of self-management practices, leading to more effective diabetes management.

On the other hand, males may face unique challenges that hinder their engagement in self-management behaviors. For example, societal expectations of masculinity in Saudi Arabia often emphasize self-sufficiency and downplay health concerns, which may discourage help-seeking behaviors and self-care practices. Moreover, cultural factors and traditional gender norms may discourage males from openly discussing health-related issues or seeking support, further influencing their self-management behaviors.

Perceived Social Support and Diabetes Self-Management Behaviors

The findings of this study provide insights into the relationship between perceived social support and diabetes self-management behavior among individuals with T2DM. The results reveal a significant positive correlation between perceived social support and self-management behaviors. The positive association found between social support and self-management behaviors underscores the importance of support networks in fostering better diabetes management. These

findings emphasize the significance of incorporating social support interventions into diabetes care and highlight the potential of peer support programs, family involvement, and community resources in promoting self-management behaviors. These findings are consistent with prior research that has emphasized the positive impact of social support on self-management behaviors in T2DM.^{24,27}

Agreeing studies have consistently highlighted the importance of social support in facilitating diabetes self-management. Social support can provide emotional, instrumental, and informational assistance to individuals, helping them cope with the challenges of managing diabetes. Emotional support offers understanding, empathy, and encouragement, which can positively influence motivation and adherence to self-care practices. Instrumental support provides tangible assistance with medication management, meal planning, and physical activity, enhancing the practical aspects of self-management. Informational support equips individuals with the knowledge and skills necessary for effective self-care, enabling informed decision-making.

On the other hand, one study presents conflicting results regarding the association between perceived social support and self-management behaviors.³⁰ This study has suggested that the relationship may be more complex and multifaceted. While perceived social support can be beneficial for individuals' motivation and self-efficacy in managing diabetes, it is important to consider various contextual factors that may influence the impact of social support. These factors could include cultural differences, individual preferences, and the quality of support received. Additionally, the level and type of social support may vary among different populations and settings, leading to divergent findings across studies.

In light of the agreeing studies, the positive correlation observed in this study supports the notion that perceived social support plays a crucial role in promoting diabetes self-management behaviors. Individuals who perceive higher levels of social support may feel more empowered, motivated, and confident in their ability to engage in self-care practices. In addition, they may have access to informational resources, practical assistance, and emotional encouragement, which collectively contribute to improved self-management behaviors.

Implications for Nursing Practice

The findings of this study have important implications for nursing practice in caring for individuals with T2DM. Nurses should focus on individualized health education, particularly emphasizing foot care and self-examination. They should also assess and facilitate social support networks for patients, provide comprehensive health education on various aspects of diabetes self-management, consider the impact of comorbidities, and advocate for improved healthcare access and insurance coverage. By implementing these strategies, nurses can support patients in adopting effective self-management behaviors and improve their overall diabetes care.

Limitations

This study has certain limitations that should be considered when interpreting the results. The participants were recruited from a specific healthcare setting, limiting the generalizability to other populations. The cross-sectional design prevents establishing causal relationships. Self-reported measures may be subject to biases. Other unexplored factors and cultural influences may impact self-management behaviors. Self-selection bias may have influenced the results due to voluntary participation. The study's cultural context may restrict generalizability to other cultural backgrounds.

Conclusion

This study provides a comprehensive examination of the various factors influencing diabetes self-management in individuals with T2DM. The analysis encompasses demographic, health-related, and diabetes-specific factors, as well as perceived social support. Through this holistic approach, significant predictors of self-management behaviors have been identified, including health education on foot self-examination, exercise, comorbidities, perceived social support, medical insurance, and gender. These findings emphasize the complex interplay of these variables in shaping self-management behaviors among T2DM patients. Moreover, this study introduces a new idea for consideration, namely the exploration of innovative technologies or digital health interventions that may enhance traditional approaches to diabetes self-management. By investigating the potential of digital tools such as mobile apps for self-monitoring or telehealth

platforms for self-management behaviors, the study offers a forward-looking perspective on enhancing self-management practices in T2DM patients.

Patient Privacy Protection Statement

We desensitized all the data that can be used to identify patients' personal information, such as their names, hospitalization IDs, and telephone numbers, to protect the privacy of patients.

Data Sharing Statement

The data that support the results of this study are available from the corresponding author upon reasonable request.

Statement of Ethics

The study protocol has been reviewed and approved by the Ethics Committee of the King Khalid University (HAPO-06-8-001) and the General Directorate of Health Affairs-Aseer Region (REC-6-3-2023). Informed consent was obtained from all individuals participating in the study. The patients' privacy and personal identity information were well protected. The protocol of the study is compliant with Declaration of Helsinki.

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Author Contributions

All authors made a significant contribution to the work reported, whether that is in the conception, study design, execution, acquisition of data, analysis and interpretation, or in all these areas; took part in drafting, revising or critically reviewing the article; gave final approval of the version to be published; have agreed on the journal to which the article has been submitted; and agree to be accountable for all aspects of the work.

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