Jordan Journal of Nursing Research, **2024**; 1-16
DOI: https://doi.org/10.14525/JJNR.v3i2.07

Jordan Journal of Nursing Research

www.jjnr.just.edu.jo

A Literature Review of Self-care Behaviors among Patients with Diabetes Using the Theory of Planned Behavior

Bouthayna Damen AL-Dalaen, RN, MSN [1]; Abdulkarim Alzayyat, RN, MSN [2*]

1 Surgical Department, Royal Medical Services, Amman, Jordan.
*2 Al-Basher Hospital, Amman, Jordan. * Corresponding Author. Email: Sclassroom68@gmail.com.*

ARTICLE INFO

Article History:
Received: November 12, 2023
Accepted: March 24, 2024

ABSTRACT

Background: Taking into consideration the increment of the diabetes mellitus (DM) prevalence rate, the importance of effective management strategies becomes more pronounced in promoting the well-being of patients affected by the condition. Among the various approaches to managing DM, self-care behaviors (SCBs) have emerged as crucial elements contributing to positive outcomes. ***Purpose*:** This review of literature aims to investigate and examine current research, offering a detailed comprehension of the SCBs practiced by individuals with diabetes. ***Methods*:** Self-care encompasses a wide spectrum of activities. However, the focus of our literature search and review is medication adherence (MA) and physical activities (PA). The authors used the following databases: CINAHL, MEDLINE, PubMed, EBSCO, and Google Scholar scientific databases. The forthcoming keywords were utilized: diabetes, SCBs (similar terms like self-care, self-care management and, self-care practices are used), DM, MA, PA, and the theory of planned behavior (TPB). ***Results*:** This review included 39 studies. The rates of MA ranged from 26% to 94%. Conversely, the rates of adherence to PA ranged from 9% to 77%. Correlates for MA and PA were identified. ***Conclusion*:** This thorough literature review has explored the complex domain of SCBs in individuals with DM, employing the TPB as its guiding framework. This review offered valuable insights into the factors impacting the incorporation of SCBs within the framework of diabetes management. ***Implications for Nursing*:** The findings of this review give directions for nursing researchers and practitioners, so as to develop effective interventions for individuals with DM.

Keywords: SCBs, DM, PA, MA, TPB.

What does this paper add?

1. Few studies have investigated diabetes self-care behaviors (SCBs).
2. This study provides a comprehensive review for the available literature concerning SCBs among patients with diabetes mellitus (DM).
3. SCBs, such as physical activity and medication adherence, play significant roles in the management and prevention of DM.

Introduction

Diabetes mellitus (DM) can be described as a persistent metabolic health condition distinguished by the increment of the glucose level in the blood (Balaji et al., 2019). This condition caused an important health issue internationally with profound implications for both individuals and healthcare systems (Mukhtar et al., 2020). Given that there is an escalation in diabetes-prevalence rate, the importance of effective management strategies has become increasingly critical to promote the well-being of the patients affected by the

condition and alleviate unwanted adverse impacts of DM (Gregg et al., 2023). Among the diverse approaches to managing diabetes, self-care behaviors (SCBs) have emerged as essential contributors to achieving positive outcomes (Prabawati & Natalia, 2020).

SCBs encompass a broad spectrum of activities undertaken by individuals to maintain and enhance their health, playing a crucial role, particularly in the context of chronic illnesses, such as DM (Rajkumar et al., 2023). Individuals who have DM are frequently responsible for managing various aspects of their condition, including blood-glucose monitoring, medication adherence (MA), dietary choices, physical activity (PA), foot care, and emotional well-being (Afaya et al., 2020). However, this literature review specifically focuses on MA and PA. The effectiveness of these SCBs is paramount in achieving glycemic control, preventing complications, and enhancing overall health-related outcomes (Afaya et al., 2020; Ong-Artborirak et al., 2023). The literature on SCBs among patients with diabetes is extensive, reflecting global recognition of its significance within the research community. Nevertheless, a comprehensive synthesis of this body of knowledge is imperative to identify trends, gaps, and emerging themes.

Aim and Research Questions

This literature review aims to investigate and analyze existing research, offering a nuanced understanding of the SCBs practiced by individuals with diabetes. The researchers used the subsequent research questions to guide the present review:

1. What are the levels of MA and PA identified in the existing literature for patients with diabetes?
2. What factors are associated with SCBs according to the existing literature?
3. What roles does the Theory of Planned Behavior (TPB) play in performing SCBs, as revealed in the existing literature?

Problem Statement

DM remains a substantial global health challenge, with an increasing prevalence that necessitates a thorough understanding of effective-management strategies (Lovic et al., 2020). Among the diverse approaches to diabetes management, SCBs have emerged as pivotal in promoting optimal health outcomes and preventing complications (Ausili et al., 2017). While the literature contains numerous studies investigating various facets of SCBs among individuals having DM (Afaya et al., 2020; Mogre et al., 2019), a critical examination reveals gaps that warrant further exploration.

Present research often neglects the impact of traditional, socio-economic, as well as environmental aspects on SCBs among patients who have DM. Understanding how these contextual variables influence the adoption and adherence to SCBs is crucial for tailoring interventions that are both effective and culturally sensitive.

With the rapid advancement of technology, there is a noticeable gap in the literature concerning the integration of technological tools in promoting SCBs. Exploring the role of digital health interventions and mobile applications could provide valuable insights into innovative approaches for enhancing SCBs among individuals with DM.

Numerous studies concentrate on the short-term outcomes of SCBs, creating a void in our comprehension of the sustained adherence to these behaviors over the long term. Examining the endurance of SCBs over an extended period is crucial for devising interventions that foster consistent engagement and yield positive health outcomes.

It is imperative to address these gaps and challenges to advance our understanding of SCBs among patients with DM. This literature review aims to consolidate existing knowledge, pinpoint research gaps, and establish the foundation for future investigations contributing to the development of targeted and effective interventions for DM self-care.

Study Significance

Conducting a literature review on SCBs among patients with diabetes holds significant importance, given its potential to address crucial gaps, inform evidence-based practices, and contribute to enhancing diabetes-management strategies. This study carries several key implications. Firstly, a comprehensive understanding of SCBs in diabetes is essential for healthcare professionals, including nurses. By synthesizing existing literature, this review can offer insights into effective clinical interventions, enabling healthcare providers to customize patient-centered approaches that align with the diverse needs of individuals managing diabetes.

Moreover, identifying and promoting effective SCBs can lead to an enhancement in the control of

glucose level in the blood, a decrement of the negative impacts of diabetes complications, and an improvement in the overall well-being for individuals who have DM. This study aims to contribute valuable insights that can guide interventions focused on optimizing patient well-being. Additionally, the findings of this literature review can inform healthcare policies related to diabetes management. Serving as a foundation for identifying gaps in the literature, it paves the way for future-research endeavors. By highlighting areas that warrant further exploration, it contributes to the ongoing dialogue within the research community and stimulates the development of a robust and evolving knowledge base.

In essence, the significance of this literature review extends beyond the synthesis of existing knowledge. It lies in its potential to inform clinical practice, optimize patient outcomes, tailor interventions to diverse populations, integrate technology effectively, empower patients through education, influence healthcare policies, and shape the research agenda for future investigations in the dynamic field of diabetes SCBs.

Theory of Planned Behavior

This theory was designed by the scholar Icek Ajzen in 1991. The theory aimed to foretell the behavior of each person. It is worthy to indicate that using of Theory of Planned Behavior (TPB) as a conceptual outline to investigate SCBs for clients having DM, primarily MA and PA, was limited in the previous literature. The main foundation of this theory was reasoned action theory. TPB proposed that three constructs are responsible for any behavior; these constructs are perceived behavioral control (PBC), subjective norms (SNs), as well as behavioral attitudes (Conner, 2020).

According to the TPB, behavioral attitudes, the first predictor, involve the individual feeling as well as thinking concerning a behavior, encompassing effective in addition to instrumental attitudes. Effective attitudes reflect the perceived enjoyment or lack thereof, while instrumental attitudes relate to perceived benefits or harms. These can be complex, with individuals often holding a mix of instrumental as well as effective attitudes (Yang et al., 2019).

The next construct of theory, SN, pertains to the support or lack thereof from family, friends, or significant others. This can be divided into injunctive norms, where others encourage or discourage the deeds, as well as descriptive norms, predicting the behaviors or deeds of those other persons belonging to particular social groups (Conner, 2020). The last construct, PBC, determines a person's self-belief concerning the capability to perform the intended actions or deeds, reflecting the perception of overcoming potential barriers and challenges (Dilekler et al., 2021).

This theory proposed that individuals are more probably to participate or perform the behavior once those persons find it enjoyable, perceive good benefits, receive support and encouragement, and believe that they have the ability to meet task demands (Ferreira & Pereira, 2017). In the context of DM, which represents a significant life stressor, nurses play a vital role in helping clients control this tension and be committed to the required changes in their lifestyle and performing SCBs (Arambepola et al., 2016).

Patients' attitudes concerning SCBs significantly influence their likelihood of performing these behaviors (Macedo et al., 2017). For instance, if individuals with diabetes believe that engaging in physical activity will positively impact their chronic illness, they are more likely to participate. Similarly, subjective norms consider the opinions of those in the patient's social circle, shaping the patient's behavior based on others' beliefs, particularly close acquaintances. In essence, subjective norms answer the question, "What do others think about the behavior?"

PBC in diabetes examines whether patients believe that they have the means or tools required for behavior demonstration. If patients perceive physical limitations or financial constraints, they are less likely to engage in physical activity (Lin et al., 2020). In short, perceived behavioral control answers the question, "Can I do it?" These constructs significantly shape the patient's inclination to perform SCBs (Dilekler et al., 2021).

Summary

DM is a devastating chronic illness with an alarming prevalence rate. The literature indicates that SCBs play a crucial role in managing diabetes among affected patients. While SCBs encompass various activities, this review focuses on MA and adherence to PA. The objective of this review is to critically analyze studies investigating SCBs among patients with DM. Three research questions guide this literature review, and the utility of TPB and its three major predictors (i.e., behavioral attitudes, SN, and PBC) in the context of SCBs among patients with DM is highlighted.

Methods

Search Strategy

The researchers employed several scientific databases, including CINAHL, MEDLINE, PubMed, EBSCO, and Google Scholar. A comprehensive search strategy was implemented using specific keywords: "SCBs" (along with comparable terms like self-care practices, self-care management, and self-care), "patients with diabetes mellitus" (DM) (and equivalent terms, such as DM patients and diabetes patients), "medication adherence" (including oral hypoglycemic agent and anti-diabetic medication, medication commitment), "physical activity" (encompassing exercise, physical fitness, and sport), and "theory of planned behavior" (TPB), in various combinations.

Eligibility Criteria of This Review

The eligibility criteria for this literature review are delineated as follows. Firstly, studies considered for inclusion should have been published between 2013 and 2020, with certain exceptions made for older references that covered essential data not found within the specified time frame. Additionally, the definitions of study concepts and instruments were sourced from these selected references. Secondly, the studies must be presented in the English language. Thirdly, the focus of the study should center on the SCB experience of adults with diabetes. Lastly, the study should discuss the relationships between TPB constructs and health behaviors, such as adherence to PA and diabetic MA. To ensure a comprehensive and thorough exploration of all relevant arguments and themes in the literature, the researchers utilized all available resources, including journals not available electronically, the university library catalogue, and unpublished dissertations.

Summary

This section discussed the methodology used in the present review. The researchers utilized five databases to retrieve the articles. These databases were: CINAHL, MEDLINE, PubMed, EBSCO databases, in addition to Google Scholar. A wide range of keywords have been used incorporating SCBs, DM, MA, PA as well as TPB. Strict eligibility criteria were employed to include the intended studies. The criteria were about publication period, publication language, and studied variables.

Results

Study Selection

The database search yielded a total of 1200 studies, with an additional 20 studies identified through forward and backward reference checking. Initially, the researchers removed duplicates (n=720). Subsequently, they conducted title and abstract screening for the remaining articles (n=500). Out of these, 250 were deemed eligible for full-text retrieval, and full-text articles were obtained for 190 studies. It is noteworthy that access to the full text of 60 articles was not possible, as they were studies published in local paper-based journals or conference abstracts. Following the full-text review, a total of 39 studies met the eligibility criteria for this review and were included in the results' synthesis. Table 1 summarizes the studies included in this review.

Table 1. Summary table about studies concerning SCBs among patients with diabetes

	Authors	Year	Title	Methods	Variables	Results
1	Farr, Sheehan, Curkendall, Smith, Johnston, and Kalsekar	2014	Retrospective analysis of long-term adherence to and persistence with DPP-4 inhibitors in US adults with type-2 diabetes mellitus.	A retrospective cohort study	Adherence to and persistence on anti-diabetic medications	In comparison with patients who used thiazolidinediones or sulfonylureas therapy, the study participants who used dipeptidyl peptidase-4 inhibitors' therapy had significantly better adherence and persistence.
2	Krass, Schieback, and Dhippayom	2015	Adherence to diabetes medication: A systematic review.	A systematic literature review	The prevalence of adherence as well as factors related to medication-taking behaviour	There is great variability regarding the level of adherence in the literature. Only few studies reported high level of MA. Predictors for diabetes medication-taking behavior included depression and medication cost.

3	Awodele and Osuolale	2015	Medication adherence in type-2 diabetes patients: Study of patients in Alimosho general hospital, Igando, Lagos, Nigeria.	This study was descriptive, retrospective and prospective	MA and clinical outcomes of type-2 diabetes	About a half of the participants had unaffordable attitude toward medication. Patient age and gender are significantly correlated with MA. Health education resulted in a higher rate of MA and an improvement in clinical parameters.
4	Habtu, Uwingabire, Mureithi, and Gashegu	2019	Knowledge and attitude of diabetes mellitus and adherence to treatment regimen among diabetic patients attending Kirehe district hospital, Rwanda.	A descriptive, cross-sectional study	The level of knowledge and attitude of diabetes as well as MA	There were low levels of knowledge and attitude towards DM. Also, most of the patients (64.6%) had adequate MA. Good knowledge, patient age and education level were significant predictors of MA.
5	Marinho, Moram, Rodrigues, Leite, Salles, and Cardoso	2018	Treatment adherence and its associated factors in patients with type-2 diabetes: Results from the Rio de Janeiro type-2 diabetes cohort study.	A descriptive, cross-sectional study	SCBs of type-2 diabetes. Also, factors connected with good adherence to SCBs.	Adherence to SCBs in middle-aged to elderly type-2 diabetes was good. Correlates of adherence included age, body mass index (BMI), occupational performance, emotional status and cholesterol.
6	Basu, Garg, Sharma, Singh, and Garg	2018	Adherence to self-care practices, glycemic status and influencing factors in diabetes patients in a tertiary care hospital in Delhi.	A cross-sectional, observational study	Adherence to SCBs	MA level is high (82.4%) among the participants. Predictors of medication non-adherence included education level and hypertension comorbidity.
7	Sankar, Lipska, Mini, Sarma, and Thankappan	2015	The adherence to medications in diabetic patients in rural Kerala, India.	A descriptive, cross-sectional survey	MA	MA level among the study participants is poor (26%). Poor adherence is more common among those who received limited instructions from their health-care providers.
8	Alqarni, Alrahbeni, Qarni, and Qarni	2018	Adherence to diabetes medication among diabetic patients in the Bisha governorate of Saudi Arabia: A cross-sectional survey.	A descriptive, cross-sectional study	MA	Most of the participants (42.9%) had an intermediate level of MA. Correlates of adherence included number of associated co-morbidities, glycated hemoglobin (A1c) and occupational status.
9	Adwan and Najjar	2013	The relationship between demographic variables and diabetes self-management in diabetic patients in Amman city, Jordan.	A descriptive, cross-sectional study	Diabetes self-management	There is a weak positive correlation between income and diabetes self-management. Conversely, there is a weak negative correlation between duration of diabetes and diabetes self-management.
10	Nejaddadgar, Solhi, Jegarghosheh, Abolfathi, and Ashtarian	2017	Self-care and related factors in patients with type-2 diabetes.	A descriptive, cross-sectional study	SCBs	Most of the participants had a poor level of SCBs. Correlates of SCBs included gender, education, marital status, and income.
11	Lima-Dellamora, Osorio-de-Castro, Madruga, and Azeredo	2017	Use of pharmacy records to measure treatment adherence: A critical review of the literature.	An exploratory literature review	Indicators of adherence to pharmaco-therapy	The literature revealed that indicators can be useful for identifying patients with medication-seeking behavior-related problems and analysis of persistence.

12	Abebaw, Messele, Hailu, and Zewdu	2016	Adherence and associated factors towards antidiabetic medication among type-II diabetic patients on follow-up at University of Gondar hospital, northwest Ethiopia.	A descriptive institutional-based cross-sectional study	MA status and associated factors	The participants had a high level of adherence (85.1%). Correlates of MA included knowledge about DM and its medications, duration of diabetes, and level of education.
13	Elsous, Radwan, Al-Sharif, and Abu Mustafa	2017	Medication adherence and associated factors among patients with type-2 diabetes mellitus in the Gaza Strip, Palestine.	A descriptive, cross-sectional study	MA and associated factors	MA level among study participant is suboptimal. Correlates of MA included perception of disease's severity and female gender.
14	Gharaibeh, and Tawalbeh	2018	Diabetes self-care management practices among insulin-taking patients.	A descriptive, cross-sectional study	Level of diabetes self-care management and its predictors	Level of SCBs among participants is suboptimal. Furthermore, level of SCBs is affected by the type of diabetes and the type of medication (insulin, or insulin and tablets).
15	Horii, Momo, Yasu, Kabeya, and Atsuda	2019	Determination of factors affecting medication adherence in type-2 diabetes mellitus patients using a nationwide claim-based database in Japan.	A descriptive, retrospective study	Status of MA	About a half of the participants were adherent to medication during the study period. Predictors of MA included total number of visits ≥17, male sex, age 50–<60 years, and number of medications.
16	Hashimoto et al.	2019	The relationship between patients' perception of type-2 diabetes and medication adherence: A cross-sectional study in Japan.	A descriptive, cross-sectional study	Patients' perception of type-2 DM as well as MA	Predictors of MA included diabetes knowledge, one factor of patient's perception (living an orderly life), family history of DM, and BMI.
17	Maina	2016	Factors associated with non-adherence to oral hypoglycemic medications among adult type-2 diabetes mellitus outpatients attending Mbagathi district hospital, Nairobi, Kenya.	A descriptive, cross-sectional study	MA and associated factors	About a half of the participants were non-adherent to oral diabetic medication(s). Using of several oral diabetic medications and forgetfulness were correlates for non-adherence to oral hypoglycemic agents.
18	Fukuda and Mizobe	2017	Impact of non-adherence on complication risks and healthcare costs in patients newly-diagnosed with diabetes.	A descriptive, retrospective study	Non-adherence to diabetes treatment and the occurrence of DM complications	No significant differences were observed between the adherent and non-adherent groups for the macro-vascular complications.
19	Simpson, Lin, and Eurich	2016	Medication adherence affects risk of new diabetes complications: A cohort study.	A population-based, retrospective cohort study	MA and incidence of DM complications	Good adherence was associated with a lower risk of a new microvascular or macrovascular diabetes complications.
20	Yashkin and Sloan	2018	Adherence to guidelines for screening and medication use: Mortality and onset of major macrovascular complications in elderly persons with diabetes mellitus.	A secondary-data analysis study	MA and severe macrovascular complications	MA led to lower mortality, congestive heart failure, acute myocardial infarction and stroke/transient ischemic attack.

21	Akbar, Anderson, and Gallegos	2015	Predicting intentions and behaviours in populations with or at-risk of diabetes: A systematic review.	A systematic review study	The utility of the TPB	Intention was the most predictive construct for all behaviours.
22	Fai, Anderson, and Ferreros	2017	Role of attitudes and intentions in predicting adherence to oral diabetes medications.	A descriptive, cross-sectional, correlational study	MA	About a half of the participants reported low MA. The findings support the theory of planned behavior model and identify important correlations between attitudes, intentions and behaviors. Besides, the results underscore the need for promoting positive attitudes and positive intentions in effective adherence to the use of oral anti-hyperglycemic regimens.
23	Wu and Liu	2016	Association between patients' beliefs and oral anti-diabetic medication adherence in a Chinese type-2 diabetic population.	A descriptive, cross-sectional study	Beliefs and MA	About 45.4% of patients with type-2 DM reported adherence to medication. TPB model that could be used to examine MA.
24	Mohebi, Parham, Sharifirad, Gharlipour, Mohammadbeigi, and Rajati	2018	Relationship between perceived social support and self-care behavior in type-2 diabetics: A cross-sectional study.	A descriptive, cross-sectional study	Diabetes SCBs and perceived social support	There is a significant positive correlation between SCBs and social support.
25	Fattahi, Nikanjam, Mehr, and Moghimbeigi	2020	Predictors of physical activity in type-2 diabetic patients based on the Theory of Planned Behavior.	A descriptive, cross-sectional study	PA and constructs of TPB	About a half of patients had moderate levels of PA. TPB and demographic variables have key roles in diabetic PA.
26	Paleeratana	2019	Predicting diabetic self-care management based on the theory of planned behavior among elderly with type-2 diabetes in Thailand.	A cross-sectional, correlative, predictive study	Self-care management, behavioral intention, and perceived behavioral control	A half of the participants had moderate levels of SCBs. Perceived behavioral control is critical to predicting behavioral intention and diabetic SCBs.
27	Rahmati-Najarkolaei et al.	2017	Determinants of lifestyle behavior in Iranian adults with prediabetes: Applying the theory of planned behavior.	A descriptive, prospective study	Socio-cognitive factors, the (TPB) constructs	TPB may be a useful model to predict behaviors of PA and dietary choice among pre-diabetic people.
28	Al-Sahouri, Merrell, and Snelgrove	2019	Barriers to good glycemic control levels and adherence to diabetes-management plan in adults with type-2 diabetes in Jordan: A literature review.	A literature-review study	Adherence to the diabetes-management plan	The level of adherence to SCBs is still unsatisfactory among patients in Jordan. The review illustrated the influence of socio-cultural factors and lifestyles as determinants of SCBs.
29	Karimy, Koohestani, and Araban	2018	The association between attitude, self-efficacy, and social support and adherence to diabetes self-care behavior.	A descriptive, cross-sectional study	Self-efficacy, attitude towards self-care, social support, and adherence to diabetes SCBs	Predictors for SCBs included social support, self-efficacy and attitude towards SCBs.

30	Lima, Benedetti, Oliveira, Bavaresco, and Rech	2019	Physical activity is associated with knowledge and attitudes to type-2 diabetes in elderly.	A quantitative, cross-sectional, population-based study	PA	Predictors for PA included having a positive attitude toward SCBs, having good knowledge of DM and, age being above 70 years.
31	Bullard, Ji, An, Trinh, Mackenzie, and Mullen	2019	A systematic review and meta-analysis of adherence to physical-activity interventions among three chronic conditions: Cancer, cardiovascular disease, and diabetes.	A systematic review, and meta-analysis	Adherence rates to aerobic PA	Average adherence rate to aerobic PA was 77%. In relation to adherence to PA, no statistically significant differences were found between the three chronic diseases; cancer, cardiovascular disease, and DM.
32	Alhariri, Daud, and Saghir	2017	Factors associated with adherence to diet and exercise among type-2 diabetes patients in Yemen.	A descriptive, cross-sectional study	Adherence to diet and PA	The participants had low levels of adherence to PA (15 %) and diet (21 %). There is a significant correlation between adherence to dietary regimen, PA and good glycaemic control.
33	Koponen, Simonsen, and Suominen	2017	Determinants of physical activity among patients with type-2 diabetes: The role of perceived autonomy support, autonomous motivation, and self-care competence.	A descriptive, cross-sectional study	Engagement in PA, perceived autonomy support autonomous, motivation, and self-care competence	Only few respondents (27%) were doing PA. Correlates of engagement in PA included autonomous motivation.
34	Bhatti, Manzoor, Korai, and Khaliq	2018	Impact of socio-demographic factors on self-care practices among patients with type-2 diabetes in Lahore, Pakistan: An exploratory study.	An exploratory, cross-sectional study	SCBs	Participants did not fully meet the standards of diabetes SCBs. Associates with adherence to SCBs included monthly household income, educational level, marital status, sex, and age.
35	Parajuli, Saleh, Thapa, and Ali	2014	Factors associated with non-adherence to diet and physical activity among Nepalese type-2 diabetes patients: A cross-sectional study.	An analytical, cross-sectional study	Adherence to PA and exercise, and associated factors	Few participants (21%) are well adherent to PA. On the other hand, most of the respondents (88%) were non-adherent to dietary advice. Correlates of non-adherence to dietary advice included poor knowledge about DM advice by people other than physicians, farther distance from hospital, joint or extended family members, increasing age and female gender. Correlates for non-adherence to PA included: Low socio-economic class, divorced status, and negative family history of DM.

36	Jadawala, Pawar, Patel, Patel, Patel, and Bansal	2017	Factors associated with non-adherence to diet and physical activity among diabetes patients: A cross-sectional study.	A descriptive, cross-sectional study	Adherence to PA and exercise, and associated factors	About a half of participants were adherent to PA. Moreover, most of the respondents (76%) were having healthy diet. Barriers to dietary practices included food gatherings, eating in restaurant and foods offered by others. Barriers to PA included laziness and lack of time.
37	Mutyambizi, Pavlova, Hongoro, and Groot	2020	Inequalities and factors associated with adherence to diabetes self-care practices amongst patients at two public hospitals in Gauteng, South Africa.	A descriptive, unique health-facilities-based, cross-sectional survey	Adherence to diabetes SCBs and inequalities in these SCBs	There is suboptimal adherence to SCBs including PA, MA as well as dietary diversity. Concerning inequalities, rich participants had higher levels of PA and dietary diversity.
38	Bilal, Osman, and Omer	2017	Association of physical activity and complications of diabetes among patients having type-2 diabetes mellitus.	A descriptive, hospital-based, cross sectional study	PA as well as development of the complications of diabetes	Only few participants (24 %) were doing PA. Performing PA leads to controlled levels of blood glucose, (HbA1c), and total cholesterol.
39	Bukht, Ahmed, Hossain, Masud, Sultana, and Khanam	2019	Association between physical activity and diabetic complications among Bangladeshi type-2 diabetic patients.	A descriptive, hospital-based, cross-sectional study	PA and incidence of diabetes complications	The great majority of the participants (74%) had low PA. Significant associations were evident between PA and three complications of DM: nephropathy, hypertension, and retinopathy.

General Characteristics of Included Studies

In relation to the context of the included studies, this review revealed that the studies were conducted in various regions across the globe. Seven studies were conducted in the Arab world, with three in Jordan (Adwan & Najjar, 2013; Al-Sahouri et al., 2019; Gharaibeh & Tawalbeh, 2018), one in Palestine (Elsous et al., 2017), one in Yemen (Alhariri et al., 2017), one in Saudi Arabia (Alqarni et al., 2018), and one in Sudan (Bilal et al., 2017). Five studies were conducted in Iran (Fattahi et al., 2020; Karimy et al., 2018; Mohebi et al., 2018; Nejaddadgar et al., 2017; Rahmati-Najarkolaei et al., 2018). Five studies were conducted in African countries, including one in South Africa (Mutyambizi et al., 2020), one in Kenya (Maina, 2016), one in Ethiopia (Abebaw et al., 2016), one in Nigeria (Awodele & Osuolale, 2015), and one in Rwanda (Habtu et al., 2019). Four studies were conducted in the United States of America (Farr et al., 2014; Fai et al., 2017; Simpson et al., 2016; Yashkin & Sloan, 2018). Three studies were conducted in India (Basu et al., 2018; Jadawala et al., 2017; Sankar et al., 2015). Three studies were conducted in Japan (Fukuda & Mizobe, 2017; Hashimoto et al., 2019; Horii et al., 2019). Two studies were conducted in Brazil (Lima et al., 2019; Marinho et al., 2018). The remaining studies were conducted in various locations, including one in Pakistan (Bhatti et al., 2018), one in Bangladesh (Bukht et al., 2019), one in China (Wu & Liu, 2016), one in Nepal (Parajuli et al., 2014), one in Thailand (Paleeratana, 2019), and one in Finland (Koponen et al., 2017).

Regarding the employed design, all eligible studies were quantitative. Specifically, most of the included studies utilized a descriptive cross-sectional approach (n=22), five studies used review designs, five studies used a retrospective approach, two studies used a prospective approach, two studies used correlational designs, one study used an exploratory cross-sectional design, one study involved secondary-data analysis, and one study was observational. The total number of participants in the reviewed articles was 387,301, ranging from 100 participants in the smallest study (Bilal et al., 2017) to 238,372 in the largest study (Farr et al., 2014). The mean age of the participants, as reported by 23 studies, ranged from 46 years to 78 years.

Aspects of Diabetes Self-care Behaviors

Considering all domains of self-care behaviors (SCBs), the results of this review revealed that MA was the most investigated SCB (n = 16), followed by PA

(n=9). The remaining studies reported different domains of SCBs, including self-monitoring of blood glucose, dietary habits, and foot care.

On the other hand, this review illustrated significant variations among the identified studies in terms of the tools used to assess SCBs. The Morisky Medication Adherence Scale (MMAS) (Morisky et al., 1986; Morisky et al., 2008) was employed by six studies to measure the status of MA among the study participants (Abebaw et al., 2016; Elsous et al., 2017; Fai et al., 2017; Mutyambizi et al., 2020; Sankar et al., 2015; Wu & Liu, 2016). Similarly, the Summary of Diabetes Self-care Activities questionnaire (SDSCA) (Toobert et al., 2000) was used by five studies (Basu et al., 2018; Jadawala et al., 2017; Marinho et al., 2018; Mohebi et al., 2018; Nejaddadgar et al., 2017).

The Global Physical Activity Questionnaire (GPAQ) (World Health Organization, 2012) was utilized by two studies (Mutyambizi et al., 2020; Parajuli et al., 2014). Similarly, the International Physical Activity Questionnaire (IPAQ) (Craig et al., 2003) was employed by two studies (Fattahi et al., 2020; Lima et al., 2019). The remaining studies used heterogeneous tools.

Adherence to Anti-diabetic Medication Use/Taking Behaviors

The operational definitions of MA varied among the reviewed studies, depending on the utilized tools. Some studies measured adherence in terms of the number of days the patient had the medication over a seven-day period (Basu et al., 2018; Habtu et al., 2019; Jadawala et al., 2017; Maina, 2016; Marinho et al., 2018; Mohebi et al., 2018; Nejaddadgar et al., 2017). A higher number of days with medication indicated a higher level of adherence. On the other hand, one study measured MA over a two-week period (Alqarni et al., 2018), and three studies measured MA over several years (Farr et al., 2014; Fukuda & Mizobe, 2017; Horii et al., 2019).

The identified studies reported a wide range of adherence rates to anti-diabetic medication, spanning from 26% to 94%. Only a few studies reported high rates of MA (Abebaw et al., 2016; Basu et al., 2018; Fukuda & Mizobe, 2017; Krass et al., 2015; Marinho et al., 2018).

From a different perspective, three studies reported the reasons for non-adherence among the participants (Abebaw et al., 2016; Elsous et al., 2017; Maina, 2016). These reasons included forgetfulness, having multiple oral diabetic medications, being busy, being away from home, being careless, feeling bad for taking the medications, and feeling better. Some of the identified literature also shed light on socio-demographic and clinical factors that influence or correlate with MA (Abebaw et al., 2016; Awodele & Osuolale, 2015; Alqarni et al., 2018; Basu et al., 2018; Elsous et al., 2017; Hashimoto et al., 2019; Krass et al., 2015; Marinho et al., 2018). A wide range of factors was reported, including patient age, gender, education level, body mass index (BMI), occupational performance, emotional status, medication cost, family history of DM, knowledge about DM and its medications, perception of the disease's severity, duration of diabetes, depression, hypertension comorbidity, and glycated hemoglobin (A1c).

Adherence to Physical Activity or Exercising

According to this review, the criteria used to determine adherence to PA varied among the identified studies. Seven studies measured adherence based on the frequency (days) and duration (minutes) of PA during the last week (Alhariri et al., 2017; Bhatti et al., 2018; Bukht et al., 2019; Fattahi et al., 2020; Jadawala et al., 2017; Koponen et al., 2017; Lima et al., 2019). Good adherence to PA was defined as performing PA for at least one half an hour on at least 5 days per week.

Conversely, two studies measured adherence in terms of METs (a unit representing oxygen consumption during PA) (Parajuli et al., 2014; Rahmati-Najarkolaei et al., 2017). Rahmati-Najarkolaei et al. (2017) reported that an adequate level of PA (or good adherence) is to achieve a minimum of 600 MET-minutes per week, while Parajuli et al. (2014) considered scoring of at least 1500 METs min/week as a criterion for good adherence.

The identified literature also showed variations in the rates of adherence to PA among participants, ranging from 9% to 77%. Regarding the role of demographics and other clinical factors in PA, the identified literature reported several correlates of PA, including knowledge of DM, age above 70 years (Lima et al., 2017), glycemic control (Alhariri et al., 2017), autonomous motivation (Koponen et al., 2017), socio-economic class, marital status, and family history of DM (Parajuli et al., 2014).

The Impact of the Theory of Planned Behavior on Self-care Behaviors

For numerous years, researchers have utilized

health-behavior theories to gain a deeper understanding of the cognitive processes underlying the adoption of health-related behaviors (Akbar et al., 2015). The TPB postulates that behavioral intention is a key predictor of engaging in a specific behavior, influenced by attitudes, SN, and PBC. Understanding how these factors operate in the context of Self-care Behaviors (SCBs) in diabetes is crucial for developing effective interventions and improving health outcomes. Four studies were identified that explored the relationship between TPB constructs (attitudes, SN, & PBC) and adherence to diabetes SCBs (Akbar et al., 2015; Fattahi et al., 2020; Paleeratana, 2019; Rahmati-Najarkolaei et al., 2017).

According to the systematic review by Akbar et al. (2015), a limited number of studies have examined the ability of the TPB to predict outcomes in populations with diabetes or those at risk. This review emphasizes variations in the effectiveness of the TPB in predicting behavior, indicating that the model's predictive power is contingent on specific behaviors and populations. Moreover, intention (18%-76%) was the most predictive construct for all behaviors. Through a descriptive cross-sectional approach, Fattahi et al. (2020) found that individuals who hold a favorable view (attitude) of PA engaged in only moderate levels of such activity. This implies that additional factors play a significant role in influencing behavior. Furthermore, the outcomes of this study (Fattahi et al., 2020) demonstrated the significant influence of the TPB and demographic factors on the well-being of diabetic patients, particularly in relation to PA. The connection between these variables and engagement in PA is of considerable importance. Similarly, Paleeratana (2019) reported that perceived behavioral control is critical in predicting behavioral intention and diabetic SCBs. Lastly, using a descriptive prospective design, Rahmati-Najarkolaei et al. (2017) showed that the TPB could serve as an effective framework for anticipating behaviors related to PA and dietary choices in individuals at risk of developing DM.

Summary

The final sample of the included studies included 39 studies. The review results indicated that the identified studies were conducted in different locations across the globe. However, few research projects were carried out in Europe. The great majority of the revised research articles were descriptive cross-sectional in nature. None of the included studies used a qualitative approach. The most investigated dimsnion of SCBs was MA. The most common tool for measuring MA was MMAS and most common tools for measuring PA were the GPAQ and the IPAQ. The findings of this review showed that there are huge differences among the revised literature in relation to MA rates which were distributed on a scale from 26% to 94%. On the other hand, the rates of adherence to PA ranged between 9% and 77%. Correlates for both MA and PA were identified.

Discussion

The synthesis of literature on SCBs mainly MA as well as participation in physical exercise for clients who have DM provides a nuanced comprehension of the multi-faceted aspects influencing diabetes management. This discussion section aims to critically analyze the key findings and identify patterns. The discussion section included a number of researchers' reflections based on the researchers' experience to explain some interesting findings and issues raised in this literature review. Additionally, the researchers provided implications for the important results of this review and these implications were presented in a distinct section. Limitations of the study alongside their remedy recommendations existed as a part of this discussion. At the last section of the discussion, a conclusion was offered to sum up the entire parts of this review study.

Medication Adherence for Clients Having DM

The present literature review illustrated a range of adherence rates to anti-diabetic medication, spanning from 26% to 94%. Similarly, previous literature showed a comparable range of MA for those clients having DM with results from 40 % to 90 % (Farr et al., 2014; Krass et al., 2015). This means that there are differences among the international literature regarding the rate of MA for the intended group of patients. This variation among the studies could be attributed to using different research methodologies, such as using different sampling plans and designs.

Studies consistently demonstrate a positive correlation between MA and improved glycemic control. However, variations exist in the magnitude of this impact, emphasizing the necessity for modified interventions derived from patient characteristics. The literature also highlights various factors influencing MA, including patients age, education level, medication costs, and the clinical factors of the disease.

Understanding these determinants is crucial for designing interventions that address barriers to adherence.

The role of healthcare providers emerges as a critical factor influencing MA. Healthcare providers can promote MA among patients with diabetes through education, counseling, monitoring, individualized treatment plans, addressing barriers to adherence, building trust, providing continuous support, and emphasizing the long-term benefits of adherence. By fostering collaborative relationships with patients and empowering them to participate in those practices that lead in diabetes control, healthcare providers can help improve MA and ultimately enhance patient outcomes. Effective communication, patient education, and personalized treatment plans contribute significantly to patient motivation, ultimately impacting adherence rates.

Physical Activity and Its Association with Diabetes Management

The literature underscores the positive effects of PA on glycemic control, insulin sensitivity, in addition to cardiovascular health for clients having DM. The type, intensity, as well as frequency of PA are crucial considerations for optimizing health outcomes. Despite the known benefits, numerous barriers hinder the integration of regular PA into the lives of individuals with diabetes. These barriers include time constraints, lack and laziness. Identifying and addressing these barriers is essential for promoting sustained engagement in PA.

Furthermore, it is worthy to indicate that the present review findings showed the influencing factors that impact the PA, mainly the PBC and SN. Similar results were evident in the previous literature on SCBs for clients who have DM (Al-Sahouri et al., 2019; Paleeratana, 2019). The association between PA, SN, as well as perceived behavioral control, underscores the importance of addressing social influences and individuals' beliefs and capabilities in promoting PA among patients with diabetes. By fostering positive SN and enhancing patients' confidence in their capability to perform PA, healthcare providers as well as intervention programs can support patients in adopting and maintaining active lifestyles, thereby improving diabetes management and overall health outcomes.

Recognizing the diverse needs and preferences of individuals with diabetes is crucial for the success of PA interventions. Tailoring exercise programs based on individual capabilities, preferences, and health status enhances engagement and adherence. Additionally, effective collaboration among healthcare providers, including endocrinologists, primary-care physicians, dietitians, and exercise physiologists, is essential for integrating PA recommendations into comprehensive diabetes-care plans.

Implications for Nursing

Nurses play a crucial role in educating patients with DM about SCBs. This includes promoting understanding of MA, blood-glucose monitoring, dietary modifications, participation in PA, and lifestyle changes. Nurses should develop educational materials and strategies that are tailored to individual patient needs, considering cultural and health-literacy factors. The literature review may highlight effective strategies for facilitating behavior change for patients with DM. Nurses need to be well-versed in motivational interviewing techniques and behavior-change theories to support patients in adopting positive SCBs. Effective diabetes management often requires collaboration among healthcare professionals. The literature review may underscore the importance of interdisciplinary teamwork. Nurses should actively engage with other healthcare providers, such as dietitians, pharmacists, and social workers, to ensure comprehensive and coordinated care for patients with diabetes. The literature may identify gaps in policies associated with DM care in addition to SCBs. Nurses can advocate for policy changes and contribute to the development of guidelines that support and enhance SCBs for clients who have DM. The literature review may reveal gaps in current knowledge or areas requiring further research. Future research should address methodological challenges, explore underexplored areas, and focus on developing sustainable interventions to further enhance our understanding of the intricate relationship between SCBs (such as PA & MA) and diabetes. Nurses should be encouraged to engage in and contribute to research efforts, ensuring that nursing practice depends on the best available evidence as well as evolves for satisfying the health conditions of patients having DM.

Conclusion

In conclusion, this comprehensive literature review has delved into the intricate realm of SCBs for clients

who have DM, utilizing the TPB as a guiding framework. The synthesis of existing research has provided valuable insights into the multifaceted aspects affecting the implementation and maintenance of SCBs for individuals complaining of DM.

The utilization of the TPB has proven instrumental in elucidating the cognitive determinants-attitudes, SN, and PBC-underlying SCBs. The examination of diverse studies has illuminated the impact of these components on patients' intentions and subsequent actions related to MA, PA, dietary choices, and other critical facets of diabetes self-care.

The review has underscored the significance of MA as a cornerstone in diabetes care, emphasizing its essential function in achieving and sustaining optimal control of glucose level in the blood. The exploration of various studies has shed light on the diverse determinants influencing MA, ranging from socio-economic factors and healthcare-system characteristics to individual perceptions and beliefs.

Simultaneously, the literature has highlighted the equally vital role of PA in promoting overall health and managing diabetes effectively. The synthesis of research findings underscores the positive associations between regular PA and improved glycemic control, enhanced cardiovascular health, and the avoidance of adverse outcomes of DM.

In the ever-evolving landscape of diabetes care, this review sets the stage for future-research endeavors that delve deeper into the intricate connections between MA, PA and outcomes of diabetes. By addressing gaps in the literature and refining intervention strategies, we can contribute to the ongoing efforts aimed at enhancing the well-being for clients navigating the complexities of diabetes.

Acknowledgements

This paper and the research behind it would not have been possible without the exceptional support of my supervisor, Zeinab Hassan Al-Wahsh.

Conflict of Interests

The authors declare that they have no conflict of interests.

Funding or Sources of Financial Support

This research paper is funded by the University of Isra'a.

REFERENCES

Abebaw, M., Messele, A., Hailu, M., & Zewdu, F. (2016). Adherence and associated factors towards anti-diabetic medication among type-II diabetic patients on follow-up at University of Gondar hospital, northwest Ethiopia. *Advances in Nursing, 2016*, 1-7. https://doi:10.1155/2016/8579157

Adwan, M.A., & Najjar, Y.W. (2013). The relationship between demographic variables and diabetes self-management in diabetic patients in Amman city, Jordan. *Global Journal of Health Science, 5* (2), 213. https://doi:10.5539/gjhs.v5n2p213

Afaya, R.A., Bam, V., Azongo, T.B., Afaya, A., Kusi-Amponsah, A., Ajusiyine, J.M., & Abdul Hamid, T. (2020). Medication adherence and self-care behaviours among patients with type-2 diabetes mellitus in Ghana. *PloS One, 15* (8), e0237710.

Ajzen, I. (1991). The theory of planned behavior. *Organizational Behavior and Human Decision Processes, 50* (2), 179-211

Akbar, H., Anderson, D., & Gallegos, D. (2015). Predicting intentions and behaviours in populations with or at-risk of diabetes: A systematic review. *Preventive Medicine Reports, 2*, 270-282. https://doi:10.1016/j.pmedr.2015.04.006

Alhariri, A., Daud, F., & Saghir, S.A.M. (2017). Factors associated with adherence to diet and exercise among type-2 diabetes patients in Yemen. *Diabetes Management, 7* (3), 264-271. ISSN 1758-1907.

Alqarni, A.M., Alrahbeni, T., Qarni, A.A., & Qarni, H.M.A. (2018). Adherence to diabetes medication among diabetic patients in the Bisha governorate of Saudi Arabia: A cross-sectional survey. *Patient Preference and Adherence, 13*, 63-71. https://doi:10.2147/ppa.S176355

Al-Sahouri, A., Merrell, J., & Snelgrove, S. (2019). Barriers to good glycemic control levels and adherence to diabetes-management plan in adults with type-2 diabetes in Jordan: A literature review. *Patient Preference and Adherence, 13*, 675-693. https://doi:10.2147/PPA.S198828

Arambepola, C., Ricci-Cabello, I., Manikavasagam, P., Roberts, N., French, D.P., & Farmer, A. (2016). The impact of automated brief messages promoting lifestyle changes delivered *via* mobile devices to people with

type-2 diabetes: A systematic literature review and meta-analysis of controlled trials. *Journal of Medical Internet Research*, *18* (4), e86.

Ausili, D., Bulgheroni, M., Ballatore, P., Specchia, C., Ajdini, A., Bezze, S., ..., & Genovese, S. (2017). Self-care, quality of life and clinical outcomes of type-2 diabetes patients: An observational cross-sectional study. *Acta Diabetologica*, *54*, 1001-1008.

Awodele, O., & Osuolale, J.A. (2015). Medication adherence in type-2 diabetes patients: Study of patients in Alimosho general hospital, Igando, Lagos, Nigeria. *African Health Sciences*, *15* (2), 513-522. https://doi: 10.4314/ahs.v15i2.26

Balaji, R., Duraisamy, R., & Kumar, M.P. (2019). Complications of diabetes mellitus: A review. *Drug Invention Today*, *12* (1), 98.

Basu, S., Garg, S., Sharma, N., Singh, M.M., & Garg, S. (2018). Adherence to self-care practices, glycemic status and influencing factors in diabetes patients in a tertiary care hospital in Delhi. *World Journal of Diabetes*, *9* (5), 72.

Bhatti, Z.I., Manzoor, N., Korai, N.A., & Khaliq, I.H. (2018). Impact of socio-demographic factors on self-care practices among patients with type-2 diabetes in Lahore, Pakistan: An exploratory study. *Journal of Fatima Jinnah Medical University*, *12* (4), 166-171.

Bilal, M.M., Osman, A.A.M., & Omer, A.R. (2017). Association of physical activity and complications of diabetes among patients having type-2 diabetes milletus. *International Journal of Current Research and Review*, *9* (8), 12-16.

Bukht, M.S., Ahmed, K.R., Hossain, S., Masud, P., Sultana, S., & Khanam, R. (2019). Association between physical activity and diabetic complications among Bangladeshi type-2 diabetic patients. *Diabetes & Metabolic Syndrome: Clinical Research & Reviews, 13* (1), 806-809. https://doi:10.2147/PPA.S156043

Bullard, T., Ji, M., An, R., Trinh, L., Mackenzie, M., & Mullen, S.P. (2019). A systematic review and meta-analysis of adherence to physical-activity interventions among three chronic conditions: Cancer, cardiovascular disease, and diabetes. *BMC Public Health, 19* (1), 1-11. https://doi:10.1186/s12889-019-6877-z

Conner, M. (2020). Theory of planned behavior. *Handbook of Sport Psychology*, 1-18.

Craig, C.L., Marshall, A.L., Sjöström, M., Bauman, A.E., Booth, M.L., Ainsworth, B.E., ..., & Oja, P. (2003). International physical-activity questionnaire: 12-country reliability and validity. *Medicine & Science in Sports & Exercise*, *35* (8), 1381-1395.

Dilekler, İ., Doğulu, C., & Bozo, Ö. (2021). A test of theory of planned behavior in type-II diabetes adherence: The leading role of perceived behavioral control. *Current Psychology*, *40*, 3546-3555

Elsous, A., Radwan, M., Al-Sharif, H., & Abu Mustafa, A. (2017). Medication adherence and associated factors among patients with type-2 diabetes mellitus in the Gaza Strip, Palestine. *Frontiers in Endocrinology*, *8*, 100, 1-9. https://doi:10.3389/fendo.2017.00100

Fai, E.K., Anderson, C., & Ferreros, V. (2017). Role of attitudes and intentions in predicting adherence to oral diabetes medications. *Endocrine Connections*, 6 (2), 63-70. https://doi:10.1530/EC-16-0093

Farr, A.M., Sheehan, J.J., Curkendall, S.M., Smith, D.M., Johnston, S.S., & Kalsekar, I. (2014). Retrospective analysis of long-term adherence to and persistence with DPP-4 inhibitors in US adults with type-2 diabetes mellitus. *Advances in Therapy*, *31* (12), 1287-1305. https://doi:10.1007/s12325-014-0171-3

Fattahi, A., Nikanjam, R., Mehr, M. B., & Moghimbeigi, A. (2020). Predictors of physical activity in type-2 diabetic patients based on the theory of planned behavior. *Iranian Journal of Diabetes and Obesity. 11* (4), 226-232.

Ferreira, G., & Pereira, M.G. (2017). Physical activity: The importance of the extended theory of planned behavior in type-2 diabetes patients. *Journal of Health Psychology*, *22* (10), 1312-1321. https://doi:10.1177/1359105315626787

Fukuda, H., & Mizobe, M. (2017). Impact of non-adherence on complication risks and healthcare costs in patients newly-diagnosed with diabetes. *Diabetes Research and Clinical Practice, 123*, 55-62. https://doi:10.1016/j.diabres.2016.11.007

Gharaibeh, B., & Tawalbeh, L. I. (2018). Diabetes self-care management practices among insulin-taking patients. *Journal of Research in Nursing*, *23* (7), 553-565. https://doi:10.1177/1744987118782311

Gregg, E., Buckley, J., Ali, M.K., Davies, J., Flood, D., Mehta, R., ..., & HPAAC Collaboration. (2023). Improving health outcomes of people with diabetes mellitus: Global target setting to reduce the burden of diabetes mellitus by 2030. *Lancet* (London, England), *401* (10384), 1302-1312.

Habtu, M., Uwingabire, S., Mureithi, C., & Gashegu, M.

(2019). Knowledge and attitude of diabetes mellitus and adherence to treatment regimen among diabetic patients attending Kirehe district hospital, Rwanda. *Journal of Diabetes and Clinical Practice, 2* (2).

Hashimoto, K., Urata, K., Yoshida, A., Horiuchi, R., Yamaaki, N., Yagi, K., & Arai, K. (2019). The relationship between patients' perception of type-2 diabetes and medication adherence: A cross-sectional study in Japan. *Journal of Pharmaceutical Health Care and Sciences, 5* (1), 1-10. https://doi:10.1186/s40780-019-0132-8

Horii, T., Momo, K., Yasu, T., Kabeya, Y., & Atsuda, K. (2019). Determination of factors affecting medication adherence in type-2 diabetes mellitus patients using a nationwide claim-based database in Japan. *PloS One, 14* (10), e0223431. https://doi:10.1371/journal.pone.0223431

Jadawala, H.D., Pawar, A.B., Patel, P.B., Patel, K.G., Patel, S.B., & Bansal, R.K. (2017). Factors associated with non-adherence to diet and physical activity among diabetes patients: A cross-sectional study. *National Journal of Community Medicine, 8* (2), 68-73. http://www.biomedcentral.com/1756-0500/7/758

Karimy, M., Koohestani, H.R., & Araban, M. (2018). The association between attitude, self-efficacy, and social support and adherence to diabetes self-care behavior. *Diabetology & Metabolic Syndrome, 10* (1), 1-6. https://doi:10.1186/s13098-018-0386-6

Koponen, A.M., Simonsen, N., & Suominen, S. (2017). Determinants of physical activity among patients with type-2 diabetes: The role of perceived autonomy support, autonomous motivation and self-care competence. *Psychology, Health & Medicine, 22* (3), 332-344. https://doi:10.1080/13548506.2016.1154179

Krass, I., Schieback, P., & Dhippayom, T. (2015). Adherence to diabetes medication: A systematic review. *Diabetic Medicine, 32* (6), 725-737. https://doi:10.1111/dme.12651

Lima, A.P.D., Benedetti, T.R.B., Oliveira, L.Z.D., Bavaresco, S.S., & Rech, C.R. (2019). Physical activity is associated with knowledge and attitudes to type-2 diabetes in elderly. *Journal of Physical Education, 30*, e3017. https://doi:10.4025/jphyseduc.v30i1.3017

Lima-Dellamora, E.D.C., Osorio-de-Castro, C.G.S., Madruga, L.G.D.S.L., & Azeredo, T.B. (2017). Use of pharmacy records to measure treatment adherence: A critical review of the literature. *Cadernos de Saúde Pública, 33*, e00136216. https://doi:10.1590/0102-311X00136216

Lin, C.-Y., Cheung, M.K., Hung, A.T., Poon, P.K., Chan, S.C., & Chan, C.C. (2020). Can a modified theory of planned behavior explain the effects of empowerment education for people with type-2 diabetes? *Therapeutic Advances in Endocrinology and Metabolism, 11*. https://doi:10.1177/2042018819897522

Lovic, D., Piperidou, A., Zografou, I., Grassos, H., Pittaras, A., & Manolis, A. (2020). The growing epidemic of diabetes mellitus. *Current Vascular Pharmacology, 18* (2), 104-109.

Macedo, M.M.L., Cortez, D.N., Santos, J.C.d., Reis, I.A., & Torres, H.d.C. (2017). Adherence to self-care practices and empowerment of people with diabetes mellitus: A randomized clinical trial. *Revista da Escola de Enfermagem da USP, 51*. https://doi:10.1590/S1980-220X2016050303278

Maina, E.W. (2016). *Factors associated with non-adherence to oral hypoglycemic medications among adult type-2 diabetes mellitus outpatients attending Mbagathi district hospital Nairobi, Kenya*. Doctoral Dissertation, University of Agriculture and Technology.

Marinho, F.S., Moram, C., Rodrigues, P.C., Leite, N.C., Salles, G.F., & Cardoso, C.R. (2018). Treatment adherence and its associated factors in patients with type-2 diabetes: Results from the Rio de Janeiro type-2 diabetes cohort study. *Journal of Diabetes Research, 2018*, 1-8. https://doi:10.1155/2018/8970196

Mogre, V., Johnson, N.A., Tzelepis, F., Shaw, J.E., & Paul, C. (2019). A systematic review of adherence to diabetes self-care behaviours: Evidence from low-and middle-income countries. *Journal of Advanced Nursing, 75* (12), 3374-3389.

Mohebi, S., Parham, M., Sharifirad, G., Gharlipour, Z., Mohammadbeigi, A., & Rajati, F. (2018). Relationship between perceived social support and self-care behavior in type-2 diabetics: A cross-sectional study. *Journal of Education and Health Promotion, 7*, 1-6. https://doi:10.4103/jehp.jehp_73_17

Morisky, D.E., Ang, A., Krousel-Wood, M., & Ward, H.J. (2008). Predictive validity of a medication-adherence measure in an outpatient setting. *The Journal of Clinical Hypertension, 10* (5), 348-354. https://doi:10.1111/j.1751-7176.2008.07572.x

Morisky, D.E., Green, L.W., & Levine, D.M. (1986). Concurrent and predictive validity of a self-reported measure of medication adherence. *Medical Care, 24* (1), 67-74.

Mukhtar, Y., Galalain, A., & Yunusa, U. (2020). A modern overview on diabetes mellitus: A chronic endocrine disorder. *European Journal of Biology*, *5* (2), 1-14.

Mutyambizi, C., Pavlova, M., Hongoro, C., & Groot, W. (2020). Inequalities and factors associated with adherence to diabetes self-care practices amongst patients at two public hospitals in Gauteng, South Africa. *BMC Endocrine Disorders, 20* (1), 1-10. https://doi:10.1186/s12902-020-0492-y

Nejaddadgar, N., Solhi, M., Jegarghosheh, S., Abolfathi, M., & Ashtarian, H. (2017). Self-care and related factors in patients with type-2 diabetes. *Asian Journal of Biomedical and Pharmaceutical Sciences, 7* (61), 6-10.

Ong-Artborirak, P., Seangpraw, K., Boonyathee, S., Auttama, N., & Winaiprasert, P. (2023). Health literacy, self-efficacy, self-care behaviors, and glycemic control among older adults with type-2 diabetes mellitus: A cross-sectional study in Thai communities. *BMC Geriatrics, 23* (1), 297.

Paleeratana, W. (2019). Predicting diabetic self-care management based on the theory of planned behavior among elderly with type-2 diabetes in Thailand. *Сахарный диабет, 22* (4), 367-376. https://doi.org/10.14341/DM10290

Parajuli, J., Saleh, F., Thapa, N., & Ali, L. (2014). Factors associated with non-adherence to diet and physical activity among Nepalese type-2 diabetes patients: A cross sectional study. *BMC Research Notes, 7* (1), 758. https://doi:10.1186/1756-0500-7-758

Prabawati, D., & Natalia, L. (2020). The effectiveness of self-care model on diabetes self-management behaviour. *Indonesian Nursing Journal of Education and Clinic*, *5* (1), 1-7.

Rahmati-Najarkolaei, F., Pakpour, A.H., Saffari, M., Hosseini, M.S., Hajizadeh, F., Chen, H., & Yekanineja, M.S. (2017). Determinants of lifestyle behavior in Iranian adults with prediabetes: Applying the theory of planned behavior. *Archives of Iranian Medicine, 20* (4), 198-204. URL: http://ijdo.ssu.ac.ir/article-1-532-en.html

Rajkumar, E., Kruthika, G.T., Padiri, R.A., Lakshmi, R., Daniel, M., John, R., & Abraham, J. (2023). Understanding self-care behaviours among type-II diabetes patients: A behaviour-change models' perspective. *Current Diabetes Reviews*, *19* (4), 107-119.

Sankar, U.V., Lipska, K., Mini, G.K., Sarma, P.S., & Thankappan, K.R. (2015). The adherence to medications in diabetic patients in rural Kerala, India. *Asia Pacific Journal of Public Health, 27* (2), NP513-NP523. https://doi:10.1177/1010539513475651

Shettigar, S., Shivaraj, K., & Shettigar, S. (2019). A study to assess the factors affecting adherence to exercise in the Indian population. *Cureus, 11* (11), e6062. https://doi:10.7759/cureus.6062

Simpson, S.H., Lin, M., & Eurich, D.T. (2016). Medication-adherence affects risk of new diabetes complications: A cohort study. *Annals of Pharmacotherapy, 50* (9), 741-746. https://doi:10.1177/1060028016653609

Toobert, D.J., Hampson, S.E., & Glasgow, R.E. (2000). The summary of diabetes self-care activities measure: Results from 7 studies and a revised scale. *Diabetes Care*, *23* (7), 943-950.

World Health Organization. (2012). *Global physical-activity questionnaire (GPAQ) analysis guide*. Geneva.

Wu, P., & Liu, N. (2016). Association between patients' beliefs and oral antidiabetic medication adherence in a Chinese type-2 diabetic population. *Patient Preference and Adherence, 10*, 1161-1167. https://doi:10.2147/PPA.S105600

Yang, S., Su, Y., Wang, W., & Hua, K. (2019). Research on developers' green procurement behavior based on the theory of planned behavior. *Sustainability*, *11* (10), 2949.

Yashkin, A.P., & Sloan, F. (2018). Adherence to guidelines for screening and medication use: Mortality and onset of major macrovascular complications in elderly persons with diabetes mellitus. *Journal of Aging and Health, 30* (4), 503-520. https://doi:10.1177/0898264316684270