

Implementation of Theory of Planned Behavior on Behavior Change and Outcomes in Type 2 Diabetes Mellitus Patients in Surakarta, Central Java, Indonesia

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ABSTRACT

Background: The Theory of Planned Behavior (TPB) can serve as a conceptual framework for improving healthy behaviors among patients with type 2 diabetes mellitus (T2DM). The application of TPB is essential for predicting both behavioral patterns and health outcomes in individuals with T2DM. This study aimed to assess the implementation of TPB on behavioral change and outcomes in T2DM patients

Subjects and Method: This cross-sectional study was conducted in Surakarta, Indonesia. There was 200 type 2 DM patients selected by purposive sampling. The dependent variables were HbA1c and behavior. The independent variables were behavioral belief, outcome evaluation, normative belief, motivation, control belief, control power, attitude, subjective norm, perceived behavioral control, and intention. Data were collected using a set of questionnaires and analyzed using path analysis.

Results: HbA1c $\geq 6.5\%$ was directly reduced by strong behavior, but it was statistically non significant ($b = -0.22$; 95%CI= -0.15 to 1.08 ; $p = 0.745$). Behavior was directly and significantly increased by strong intention ($b = 1.66$; 95% CI= 1.03 to 2.30 ; $p < 0.001$) and high perceived behavior control ($b = 0.87$; 95% CI= 0.23 to 1.50 ; $p = 0.007$).

Conclusion: The Theory of Planned Behavior can be used to predict healthy behavior among patients with type 2 DM.

Keywords: Theory of Planned Behavior, type 2 diabetes mellitus, HbA1c

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BACKGROUND

The term diabetes mellitus (DM) refers to a group of heterogeneous metabolic disorders characterized primarily by chronic hyperglycemia (Petersmann et al., 2019). Chronic hyperglycemia is a metabolic abnormality resulting from insufficient insulin secretion,

impaired insulin action, or a combination of both (Antar et al, 2023).

Insulin plays a crucial role as an anabolic hormone that regulates the metabolism of carbohydrates, lipids, and proteins. The metabolic disturbances associated with diabetes primarily affect tissues such as

adipose tissue, skeletal muscle, and the liver as a result of insulin resistance. The severity of symptoms may vary depending on the duration and type of diabetes (Antar et al, 2013).

According to the 10th edition of the International Diabetes Federation (IDF) Atlas, published at the end of 2021, diabetes mellitus is one of the fastest-growing global health conditions of the 21st century. More than half a billion people worldwide were living with diabetes in 2021, specifically 537 million individuals. This number is projected to rise to 643 million by 2030 and 783 million by 2045.

Over the past three decades, there has been a shift in the global burden of disease from communicable diseases to non-communicable diseases (NCDs). NCDs account for approximately 41 million deaths annually, representing 74% of all global deaths. Among NCDs, cardiovascular diseases cause the highest mortality, with about 17.9 million deaths each year, followed by cancer (9.3 million deaths), chronic respiratory diseases (4.1 million deaths), and diabetes (2 million deaths, including chronic kidney disease due to diabetes) (Directorate General of Disease Prevention and Control, Ministry of Health of the Republic of Indonesia, 2023).

Maintaining well-being and adopting positive health behaviors are among the most effective strategies for achieving diabetes treatment goals and optimizing quality of life. To accomplish these goals, patients require support and education to manage diabetes independently, including adherence to dietary recommendations, regular physical activity, smoking cessation counseling, behavioral health counseling, and psychosocial support (Elsayed et al., 2023).

Healthy behaviors among patients with diabetes mellitus can prevent or delay

complications. Various behavioral theories can be applied as approaches to promote these behaviors, with the Theory of Planned Behavior (TPB) being one of the most widely used. According to the Theory of Reasoned Action (TRA) proposed by Fishbein and Ajzen (1975), understanding an individual's behavior requires examining their attitudes and the influence of subjective norms, defined as social norms that may affect an individual's behavioral motivation. Ajzen (1985, 1991) later extended TRA by including the construct of perceived behavioral control (PBC), resulting in the development of the Theory of Planned Behavior (TPB). Since then, TPB has been widely applied by researchers and practitioners to better understand the mechanisms underlying intentions and behaviors (Rozenkowska, 2023).

TPB provides a framework for improving treatment adherence and other health behaviors among patients with diabetes, which can also enhance quality of life. Based on this background, the present study was conducted to examine the TPB constructs on behaviors and HbA1c levels.

SUBJECTS AND METHOD

1. Study design

A cross sectional study carried out in Surakarta, Central Java, Indonesia, from May to June 2025.

2. Population and sample

The study population was type 2 diabetes mellitus patients. A sample was selected from 7 community health posts (puskesmas). A sample of 200 type 2 DM patients was selected for this study purposively. The inclusion criteria were: 1) type 2 DM patients aged ≥ 18 years old; 2) self-report DM was confirmed by a medical doctor.

3. Study variables

The dependent variables were behavior and HbA1c. The independent variables were

intention, attitude, perceived behavior control, behavioral belief, outcome evaluation, behavioral belief, motivation, control belief, and control power.

4. Operational definition of variables

HbA1c (Hemoglobin A1c) is a biological indicator that measures the average blood glucose level over a period of 2–3 months. HbA1c is expressed as a percentage (%). Measurements were conducted in a standard laboratory collaborating with the Surakarta Health Office.

Healthy behavior related to type 2 diabetes mellitus refers to a set of actions undertaken by patients to manage their condition in accordance with medical recommendations.

Intention refers to the willingness and subjective plan of patients to engage in healthy behaviors as individuals with type 2 diabetes mellitus.

Attitude refers to the tendency of patients with type 2 diabetes to perform or refrain from specific behaviors related to the management of their condition in accordance with medical recommendations.

Subjective norm is the perception of patients with type 2 diabetes regarding social pressure from their surrounding environment, including significant others such as family, close friends and healthcare professionals.

Perceived behavioral control refers to the patient's subjective perception of the support or barriers to engaging in healthy behaviors as an individual with type 2 diabetes mellitus.

Behavioral belief is the patient's perception and subjective evaluation of the positive or negative consequences of their behavior as a person with type 2 diabetes mellitus.

Outcome evaluation refers to the patient's subjective assessment of the importance of the potential consequences resulting

from their behavior as a person with type 2 diabetes mellitus.

Normative belief is the patient's perception of the expectations or support from individuals considered important in their life regarding their behavior as a person with type 2 diabetes mellitus.

Motivation to comply refers to the level of desire and willingness of patients with type 2 diabetes to follow the expectations or recommendations of important others regarding their behavior.

Control belief is the individual's perception of factors that may facilitate or impede their engagement in healthy behaviors as a person with type 2 diabetes mellitus.

Control power refers to the extent to which internal or external factors influence the facilitation or obstruction of healthy behaviors in patients with type 2 diabetes mellitus.

5. Study instrument

The instrument used in this study was a questionnaire comprising the constructs of the Theory of Planned Behavior (TPB) and HbA1c measurements.

6. Data analysis

Univariate analysis was conducted to describe the characteristics of the study participants. Bivariate analysis was performed using simple logistic regression. Multivariate analysis was carried out using path analysis to simultaneously examine the constructs of the TPB as applied to patients with type 2 diabetes mellitus.

7. Research Ethics

All study participants were provided with informed consent forms to voluntarily agree or decline participation in the study. Ethical approval for this research was obtained from the Institutional Ethical Clearance Committee of Muwardi Hospital, Surakarta, with approval number 704/III/HREC/2025.

RESULTS

1. Sample characteristics

The characteristics of the study participants are presented in Tables 1 and 2. Table 1 presents the characteristics of respondents in terms of age, duration of type 2 diabetes mellitus (T2DM), and HbA1c scores. The

mean age of the respondents was 62.14 years (SD= 8.90), ranging from 37 to 82 years. The average duration of T2DM was 7.02 years (SD= 5.79), with a minimum of 1 year and a maximum of 32 years. The mean HbA1c score was 8.06 (SD = 2.05), ranging from 4.9 to 15.

Table 1. Characteristics of participants by age, duration of illness, and hba1c levels

Variables	Mean	SD	Min.	Max.
Age (years)	62.14	8.90	37	82
Length of disease (year)	7.02	5.79	1	32
HbA1c (%)	8.06	2.05	4.9	15.9

Table 2 presents the characteristics of respondents based on gender and type of treatment. Male respondents accounted for 27%, while female respondents accounted

for 63%. Regarding treatment type, 89.5% of respondents used oral medication, 3.5% used insulin, and 7% received a combination of both.

Table 2. Characteristics of study participants by gender and type of treatment

Variabel	Category	n	%
Sex	Male	54	27
	Female	146	63
Type of medication	Oral	179	89.5
	Insulin	7	3.5
	Combine	14	7

2. Univariate analysis

The results of the univariate analysis are presented in Table 3. Table 3 shows the distribution of respondents based on the Theory of Planned Behavior constructs, health behavior, and HbA1c levels. Among the respondents, 110 individuals (55%) had high behavioral belief, while 90 (45%) had low behavioral belief. For outcome evaluation, 117 respondents (58.5%) scored high and 83 (41.5%) scored low. Regarding normative belief, 97 respondents (48.5%) had high scores, whereas 103 (51.5%) had low scores. Motivation to comply was high in 106 respondents (53%) and low in 94 (47%).

Control belief was high in 105 respondents (52.5%) and low in 95 (47.5%), while control power was high in 104 respondents (52%) and low in 96 (48%). Attitude scores were high in 109 respondents (54.5%) and low in 91 (45.5%). Subjective norm was high in 113 respondents (56.5%) and low in 87 (43.5%). Perceived behavioral control and intention were both high in 107 respondents (53.5%) and low in 93 (46.5%). Healthy behavior was reported as high in 110 respondents (55%) and low in 90 (45%). Finally, HbA1c levels were high in 190 respondents (95%) and low in 10 respondents (5%).

Tabel 3. Distribusi frekuensi variabel penelitian

Variables	Category	n	%
Behavior belief	High	110	55
	Low	90	45
Outcome evaluation	High	117	58.5

Variables	Category	n	%
Normative belief	Low	83	41.5
	High	103	48.5
Motivation to comply	Low	97	51.5
	High	106	53
Control Belief	Low	94	47
	High	105	52.5
Control power	Low	95	47.5
	High	104	52
Attitude	Low	96	48
	High	109	54.5
Subjective norm	Low	91	45.5
	High	113	56.5
Perceive behaviour control	Low	87	43.5
	High	107	53.5
Intention	Low	93	46.5
	High	107	53.5
Behavior	Low	93	46.5
	High	110	55
HbA1c	Low	90	45
	High	190	95
	Low	10	5

3. Bivariate analysis

The results of the bivariate analysis are presented in Tables 4 and 5. Table 4 showed that behavior belief (OR= 3.33; 95% CI= 1.86 to 5.97; p <0.001), outcome evaluation (OR= 3.19; 95% CI= 1.77 to 5.73 ;p < 0.001), normative belief (OR= 2.77; 95% CI= 1.56 to 4.93 ;p= 0.001), motivation (OR= 3.12; 95% CI= 1.75 to 5.57; p< 0.001), control belief

(OR= 2.52; 95%CI= 1.42 to 4.47; p= 0.002), control power (OR= 2.64; 95% CI= 1.49 to 4.69; p= 0.001), attitude (OR= 2.96; 95% CI= 1.66 to 5.28; p< 0.001), subjective norm (OR= 2.69; 95% CI= 1.51 to 4.78; p= 0.001), perceived behavior control (OR= 3.25; 95% CI= 1.82 to 5.81; p< 0.001), and intention (OR= 6.22; 95%CI= 3.36 to 11.52; p <0.001) significantly increased behavior.

Table 4. Simple logistic regression analysis of the effects of behavioral belief, outcome evaluation, normative belief, motivation to comply, control belief, control power, attitude, subjective norm, perceived behavioral control, and intention on behavior

Variables	Good behavior		Poor behavior		Total		OR	95% CI		P
	N	%	N	%	N	%		Lower limit	Upper limit	
Behavior belief										
High	70	69.31	31	30.69	101	100	3.33	1.86	5.97	<0.001
Low	40	40.40	59	59.60	99	100				
Outcome evaluation										
High	78	67	39	33	117	100	3.19	1.77	5.73	<0.001
Low	32	40	51	60	83	100				
Normative belief										
High	69	66.99	34	33.01	103	100	2.77	1.56	4.93	0.001

Variables	Good behavior		Poor behavior		Total		OR	95% CI		p
	N	%	N	%	N	%		Lower limit	Upper limit	
Motivation										
Low	41	42.27	56	57.73	97	100				
High	72	67.92	34	32.08	106	100	3.12	1.75	5.57	<0.001
Control Belief										
Low	38	40.43	56	59.57	94	100				
High	69	65.71	36	34.29	105	100	2.52	1.42	4.47	0.002
Control power										
Low	41	43.16	54	56.84	95	100				
Strong	69	66.35	35	33.65	104	100	2.64	1.49	4.69	0.001
Attitude										
Low	41	42.71	55	57.29	96	100				
Positive	73	66.97	36	33.03	109	100	2.96	1.66	5.28	<0.001
Subjective norm										
Negative	37	40.66	54	59.34	101	100				
High	74	65.49	39	34.51	113	100	2.69	1.51	4.78	0.001
Perceived behavior control										
Low	36	41.38	51	58.62	87	100				
High	73	68.22	34	31.78	107	100	3.25	1.82	5.81	<0.001
Intention										
Low	37	39.78	56	60.22	93	100				
High	80	74.77	27	25.23	107	100	6.22	3.36	11.52	<0.001
Low	30	32.26	63	67.74	93	100				

Table 5 shows that four participants with low HbA1c levels exhibited low behavioral scores, while 104 participants with high HbA1c levels demonstrated high behavioral scores. The statistical test results indicate a negative association between behavior and

HbA1c, suggesting that better health behavior is associated with lower HbA1c levels. However, this relationship was not statistically significant (OR= 0.81; 95% CI= 0.22 to 2.95; p= 0.745).

Table 5. Simple Logistic Regression Analysis Examining the Effect of Behavior on HbA1c Levels

Variables	HbA1c ≥6.5%		HbA1c <6.5%		Total		OR	95% CI		p
	N	%	N	%	N	%		Lower	Upper	
Behavior										
High	104	94.55	6	5.45	110	100	0.81	0.22	2.95	0.745
Low	86	95.56	4	4.44	90	100				

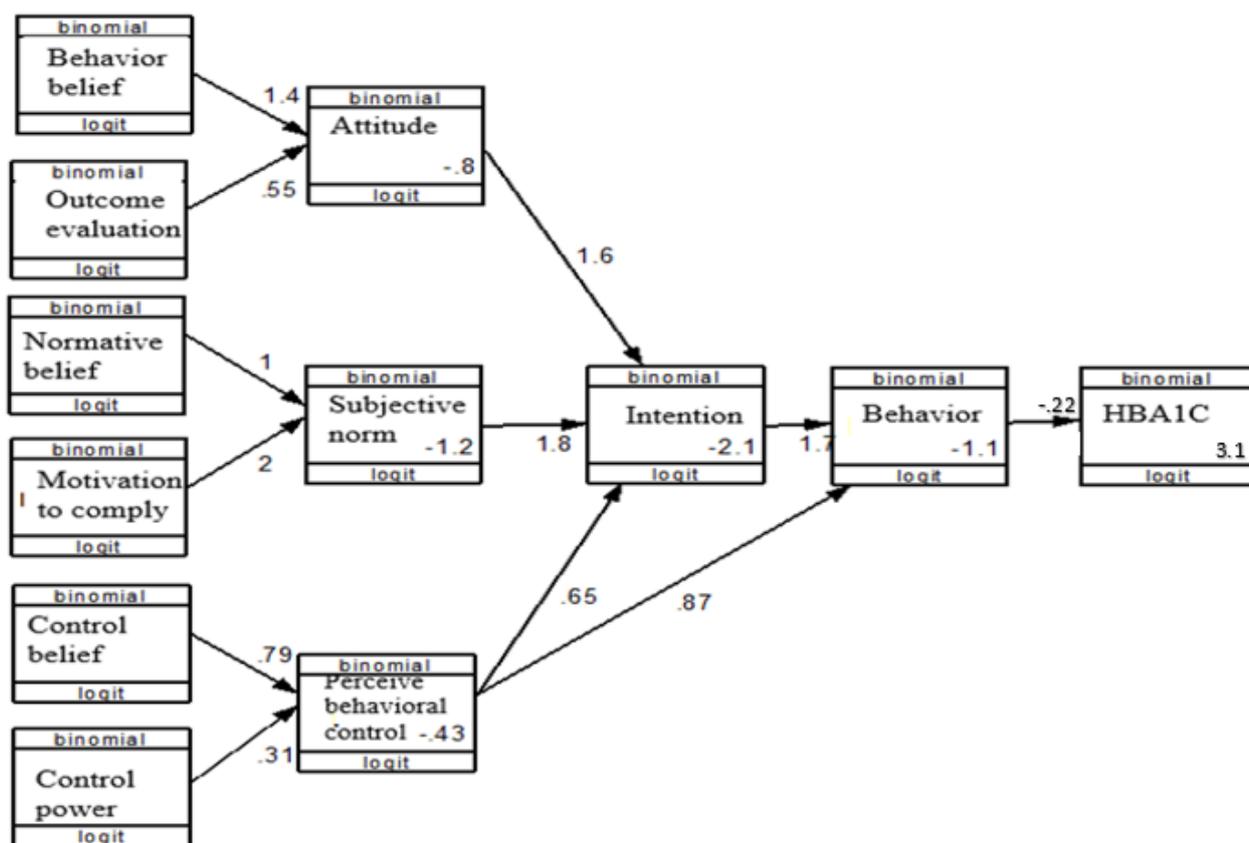


Figure 1. Path analysis of the application of the theory of planned behavior on behavior change and outcomes in patients with type 2 diabetes mellitus

4. Multivariate analysis

Figure 1 presents the path analysis diagram illustrating the relationships between the TPB constructs, behavior, and HbA1c outcomes. Table 6 displays the results of the multivariate analysis using path analysis to examine the effects of behavioral belief, outcome evaluation, normative belief, motivation to comply, control belief, control power, attitude, subjective norm, perceived behavioral control and intention on both behavior and HbA1c.

Table 6 showed that strong behavior directly lowered the likelihood of HbA1c $\geq 6.5\%$, but it was statistically non significant ($b = -0.22$; 95%CI= -0.15 to 1.08; $p = 0.745$). Table 6 showed that strong intention ($b = 1.66$; 95% CI= 1.03 to 2.30; $p < 0.001$) and high perceived behavior control ($b = 0.87$;

95% CI= 0.23 to 1.50; $p = 0.007$) directly increased the likelihood of behavior.

Intention was positively affected by positive attitude ($b = 1.62$; 95% CI= 0.94 to 2.32; $p < 0.001$) and subjective norm ($b = 1.77$; 95% CI= 1.08 to 2.47; $p < 0.001$). Intention increased with perceived behavior control, but it was marginally significant ($b = 0.65$; 95% CI= -0.04 to 1.34; $p = 0.067$). Positive attitude increased with strong behavioral belief ($b = 1.37$; 95% CI= 0.61 to 2.13; $p < 0.001$) and positive outcome evaluation ($b = 0.55$; 95% CI= -0.21 to 1.32; $p = 0.158$). Subjective norm significantly and positively associated with normative belief ($b = 1.01$; 95% CI= 0.16 to 1.86; $p = 0.020$) and strong motivation ($b = 1.95$; 95% CI= 1.10 to 2.81; $p < 0.001$). Perceived behavior control significantly increased with strong

control belief (b= 0.79; 95% CI= 0.10 to 1.49; p= 0.030). Perceived behavior control was increased by control power, but it was

marginally significant (b= 0.31; 95% CI= -0.39 to 1.00; p= 0.055).

Table 6. Path Analysis Results of the Implementation of TPB Constructs on Behavior

Dependent variables	Independent variables	Path coef. (b)	95% CI		p
			Lower	Upper	
Direct effects					
HbA1c ≥6.5%	← Behavior	-0.22	-0.15	1.08	0.745
Behavior	← Intention	1.66	1.03	2.30	<0.001
	← PBC	0.87	0.23	1.50	0.007
Indirect effects					
Intention	← Attitude	1.63	0.94	2.32	<0.001
	← Subjective norm	1.77	1.08	2.47	<0.001
Intention	← PBC	0.65	-0.04	1.34	0.067
Attitude	← Behavior belief	1.37	0.61	2.13	<0.001
	← Outcome evaluation	0.55	-0.21	1.32	0.158
Subjective norm	← Normative belief	1.01	0.16	1.86	0.020
	← Motivation	1.95	1.10	2.81	<0.001
PBC	← Control belief	0.79	0.10	1.49	0.03
	← Control power	0.31	-0.39	1.00	0.055

DISCUSSION

1. Association between intention and behavior

Intention to engage in healthy behaviors among patients with diabetes mellitus was found to have a significant influence on actual health behaviors. The stronger a patient’s intention to perform healthy behaviors, the stronger their corresponding actions. Intention reflects an individual’s readiness to perform a behavior. In the Theory of Planned Behavior (TPB), intention is considered the immediate antecedent of behavior, which is why the theory is also referred to as the Theory of Planned Behavior (Murti, 2018). When intention is strong, behavior is likely to be strong as well, since intention serves as the driving force behind behavioral enactment. This relationship was also observed among patients with diabetes mellitus in the present study.

2. Association between attitude and intention

Attitude toward engaging in healthy behaviors among patients with diabetes mellitus

was found to have a significant influence on their intentions to adopt healthy behaviors. The stronger a patient’s attitude toward healthy behaviors, the stronger their behavioral intention. Attitude is an individual’s subjective evaluation of an attitude object and represents a predisposition to respond cognitively, emotionally, and behaviorally toward a behavioral object (Candrasari et al., 2017). When a patient with diabetes mellitus holds a positive attitude toward healthy behaviors, this reinforces their intention to act in accordance with medical advice.

3. Association between subjective norm and intention

Subjective norm among patients with diabetes mellitus was found to have a significant influence on their intentions to engage in healthy behaviors. The stronger a patient’s subjective norm regarding healthy behaviors, the stronger their behavioral intention. The construct of subjective norm reflects normative beliefs—specifically, what important others think about a behavior to

be performed or avoided, and the extent to which an individual is motivated to seek approval from these significant others. A positive subjective norm occurs when an individual believes that important others approve of a particular behavior and is motivated to obtain their approval (Snelling, 2014). Subjective norms, as represented by the values of close and influential individuals, strongly affect a person's intention to comply with health guidelines, including among patients with diabetes mellitus.

4. Association between perceived behavior control and intention

Perceived behavioral control among patients with diabetes mellitus was found to have a significant influence on their intentions to engage in healthy behaviors. The stronger a patient's perceived behavioral control regarding healthy behaviors, the stronger their behavioral intentions. Perceived behavioral control refers to an individual's evaluation of the ease or difficulty of performing a specific behavior. It is based on the individual's perception of their ability to regulate behavior, including their assessment of the presence of support or barriers in carrying out particular activities (Amanda and Marsasi, 2024). When a patient with diabetes receives substantial support and encounters minimal obstacles, their intention to engage in healthy behaviors is strengthened, as evidenced in the present study.

5. Association between perceived behavior control and behavior

Perceived behavioral control among patients with diabetes mellitus was found to have a direct and significant influence on healthy behaviors. The stronger a patient's perceived behavioral control, the more consistently they engaged in behaviors aligned with health guidelines. The results also indicated that, in addition to influen-

cing behavioral intentions, perceived behavioral control exerted a direct effect on actual health behaviors (Zhao et al, 2023).

6. Association between behavior and HbA1c level

In this study, behavior demonstrated a negative influence on the outcome of patients with type 2 diabetes, specifically HbA1c. The analysis showed that better health behaviors were associated with lower HbA1c levels, although this relationship was not statistically significant.

Diabetes is a condition highly influenced by self-management, where daily decisions affecting health and well-being are made by the patients themselves, it is noteworthy that a large proportion of individuals who report a clear understanding of healthy attitudes and have received professional health advice do not necessarily translate this knowledge into healthy behaviors (Green et al., 2007). In contrast, in the present study, this phenomenon was not observed; positive attitudes were indeed shown to significantly influence the adoption of healthy behaviors as reported by the patients.

Behavior demonstrated a negative influence on HbA1c, indicating that better health behaviors are associated with lower HbA1c levels, which aligns with the theory stated by the American Diabetes Association Professional Practice Committee (2024) that behavioral strategies should be employed to achieve optimal health outcomes. In this study, however, this relationship was not statistically significant. This may be due to the presence of potential confounding variables that were not measured in the study, such as: 1) comorbid conditions, and 2) mental health factors.

Green et al. (2007) conducted a study to assess knowledge, attitudes, and behaviors related to health, diabetes, diet, and exercise among respondents with type 2

diabetes mellitus and those with cardio-metabolic risk factors. The results indicated that respondents with type 2 diabetes reported attitudes and knowledge conducive to good health; however, the majority did not translate these positive attributes into actual healthy behaviors regarding diet, exercise, and weight management. This finding contrasts with the results of the present study, in which attitudes, subjective norms, intentions, and other TPB constructs were significantly translated into actual health behaviors among patients.

Kiçaj et al. (2025) conducted a study aiming to analyze how self-care habits influence quality of life and key health indicators, such as glycated hemoglobin (HbA1c), blood glucose levels, and BMI, among newly diagnosed diabetes patients in Vlorë, Albania. The results demonstrated that sociodemographic and clinical factors significantly impacted the quality of life of patients with type 2 diabetes. Advanced age, lower educational levels, comorbidities, increased BMI and HbA1c levels, as well as inadequate self-care, were associated with reduced quality of life. These findings underscore the need for targeted interventions and policies that promote self-care and provide support for at-risk groups. However, the study provided limited evidence regarding the direct effect of behavioral factors on clinical outcomes, such as HbA1c or other biomarkers.

Kendek et al. (2023) conducted a study to examine the relationship between self-care behaviors and quality of life among patients with type 2 diabetes mellitus in the working area of Tamalanrea Jaya Community Health Center, Makassar, Indonesia. The results indicated that self-care behaviors of patients with type 2 diabetes had a significant influence on their quality of life.

Pan et al. (2022) conducted a study to analyze the significant determinants of self-

management behavior in patients with type 2 diabetes to improve self-care practices. The results demonstrated that attitude ($b=0.161$; $p<0.001$), subjective norm ($b=0.24$; $p<0.001$), and PBC ($b=0.20$; $p<0.001$) were strong predictors of intention. Furthermore, intention ($b=0.23$; $p<0.001$) and PBC ($b=0.26$; $p<0.001$) exerted direct effects on self-management behavior.

Hsu et al. (2023) conducted a study applying the Theory of Planned Behavior (TPB) to shared decision-making in order to understand behavioral intentions among patients with type 2 diabetes regarding injection therapy for blood glucose management. The results indicated that attitude ($\beta=0.43$; $p<0.001$) and PBC ($\beta=0.26$; $p<0.001$) were directly correlated with intention. The TPB model explained 35.2% of the variance in patients' intentions to use injection therapy.

The conclusions of this study are as follows: (1) The application of the Theory of Planned Behavior (TPB) in promoting healthy behaviors among patients with diabetes mellitus demonstrated statistically significant effects; (2) The TPB model also effectively predicted quality of life outcomes; and (3) There remains a limited number of studies that directly link the TPB model to clinical outcomes of diabetes, such as HbA1c or other biomarkers.

These findings highlight opportunities for further research to explore the direct relationship between health behavior and clinical outcomes using the Theory of Planned Behavior or other health behavior theories.

The limitations of this study include its cross-sectional design. A cross-sectional study analyzes independent and dependent variables at a single point in time; therefore, the findings cannot fully establish causal relationships. Another limitation is that the study focused exclusively on patients with

type 2 diabetes mellitus. In addition, behavioral assessment relied solely on self-reported questionnaires. If behavioral data were obtained through triangulation using both questionnaires and direct observation, the results would likely provide more objective and comprehensive insights.

REFERENCES

- Amand TA, Marsasi EG (2024). Exploration of perceived behavioral control and intention to purchase to increase actual behavior. *Image: Management research journal*, 12(1): 14-30.
- Antar SA, Ashour NA, Sharaky M, Khattab M, Ashour NA, Zaid RT, Roh EJ, et al (2023). Diabetes mellitus: Classification, mediators, and complications; A gate to identify potential targets for the development of new effective treatments. *PubMed*. 168: 115734. doi: 10.1016/j.biopha.2023.115734.
- Elsayed NA, Aleppo G, Aroda VR, Bannuru RR, Brown FM, Bruemmer D, Collins BS, et al (2023). Facilitating positive health behaviors and well-being to improve health outcomes: standards of care in diabetes-2023. *Diabetes Care*. 46(1): S68–S96. doi: /10.2337/dc23-S005.
- Petersmann A, Müller-Wieland D, Müller UA, Landgraf R, Nauck M, Freckmann G, Heinemann L, et al. (2019). Definition, Classification and Diagnosis of Diabetes Mellitus. *Exp Clin Endocrinol Diabetes*. 127 (1): S1–S7.
- Murti B (2018). *Theory of Health Promotion and Behavior (in Indonesia)*. Surakarta: Public Health Science Study Program, Postgraduate Program, Universitas Sebelas Maret.
- Green AJ, Bazata DD, Fox KM, Grandy S (2007). Health-related behaviours of people with diabetes and those with cardiometabolic risk factors: results from SHIELD. *Int J Clin Pract*. 61(11): 1791–1797.
- Hsu SH, Tang KP, Lin CH, Chen PC, Wang LH (2023). Applying the theory of planned behavior to investigate type 2 diabetes patients' intention to receive injection therapy. *Front Public Health*. 11. Doi: 10.3389/fpubh.2023.1066633
- Kendek K, Haskas Y, Abrar EA (2023). Association between self care and quality of life in type II diabetes melitus. *Jurnal Sehat Masada*. 18(1).
- Kıçaj E, Saliş A, Çerçizaj R, Prifti V, Qirko S, Rogozia L (2025). Self-care behaviors, health indicators, and quality of life: A comprehensive study in newly diagnosed type 2 diabetes patients. *Nurs Rep*. 15 (6): 201. doi:10.3390/nursrep15060201
- Pan L, Zhang X, Wang S, Zhao N, Zhao R, Ding B, Li Y, et al. (2022). Determinants associated with self-management behavior among type 2 diabetes patients in China: A structural equation model based on the theory of planned behavior. *Int J Clin Health Psychol*. 23: 100332. doi: 10.10-16/j.ijchp.2022.100332.
- Rozenkowska (2023). Theory of planned behavior in consumer behavior research: a systematic literature review. *Int J Consum Stud*. 47: 2670–2700. doi: 10.1111/ijcs.12970.
- Snelling A (2014). *Introduction to Health Promotion*. San Fransisco: Wiley.
- Zhao R, Zhang X, Wang S, Zhao N, Li D, Fan H (2023). Factors affecting T2DM patients' behaviors associated with integrated treatment and prevention services in China. *Int J Equity Health*. 22: 223. doi: 10.1186/s12939-023-02028-9.