JURNAL ILMIAH MEDICAMENTO

Vol.12 No.1 (March 2026)
page 38-47
https://doi.org/10.36733/medicamento.v12i1.12680
e-ISSN: 2356-4814

Original Article

Determinants of Medication Adherence Intention in Type 2 Diabetes Patients: A Theory of Planned Behavior in Javanese Society

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Submitted : 02-10-2025
Revised : 11-02-2026
Accepted : 05-03-2026

Keywords: determinants, medication adherence, medication, Javanese society, type 2 diabetes mellitus.

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Abstract

Background: Diabetes mellitus (DM) requires long-term therapy, which may reduce patients' adherence to medication and ultimately lead to treatment failure.
Objective: This study aimed to analyze factors influencing medication adherence intention among patients with type 2 diabetes mellitus (T2DM) based on the Theory of Planned Behavior (TPB).
Methods: An analytical observational study with a cross-sectional design was conducted among patients diagnosed with T2DM in Purworejo Regency, Central Java. Data was collected using a structured questionnaire and analyzed using binary logistic regression in SPSS version 25. A total of 382 respondents were included in the analysis.
Results: Most participants were female, aged 55–65 years, employed, and had an elementary school education or equivalent. The proportion of respondents with high medication adherence intention was 85.9%. Attitude, subjective norm, and perceived behavioral control jointly explained 53.6% of the variance in medication adherence intention. Among these variables, subjective norm demonstrated the strongest association with adherence intention (OR = 197.019; $p < 0.001$).
Conclusion: These findings suggest that social influence, particularly encouragement and support from family members and healthcare providers, plays a dominant role in shaping medication adherence intention within a collectivist socio-cultural setting. Integrating culturally sensitive, family-centered approaches into diabetes management programs may therefore strengthen adherence intention and improve long-term treatment outcomes among patients with T2DM.

How to Cite: (*citation style* AMA 11th Ed.)
Pratiwi FI, Widayati A, Dewi PEN. Exploring the Determinants of Medication Adherence Intention in Patients with Type 2 Diabetes Mellitus: A Study Based on the Theory of Planned Behavior in Javanese Society. *J. Ilm. Medicam.*, 2026;12(2): 38-47. https://doi.org/10.36733/medicamento.v12i1.12680

INTRODUCTION

Diabetes mellitus (DM) is a chronic metabolic disease that requires long-term medical management to prevent complications and premature mortality. The global burden of DM continues to rise, and Indonesia is among the countries most affected. In 2019, Indonesia ranked sixth worldwide in the number of adults aged 20–79 years diagnosed with DM, with approximately 10.3 million cases, and DM-related complications contributed to 4.2 million deaths globally.[1] National data indicate that the prevalence of DM among Indonesians aged ≥15 years reached 10.9%, representing an increase of 1.6% compared to 2018.[2]

The management of DM should follow evidence-based therapeutic guidelines while considering individual preferences, prognosis, and comorbidities.[3] In patients with type 2 diabetes mellitus (T2DM), long-term treatment involves a combination of pharmacological therapy and behavioral modifications aimed at controlling blood glucose levels, managing comorbidities, preventing complications, and maintaining quality of life.[4–7] However, prolonged treatment duration often leads to decreased medication adherence, which may result in suboptimal glycemic control, increased complications, and higher mortality.[8] Patients with T2DM who fail to adhere to prescribed treatment regimens have been reported to experience a mortality rate nearly twice that of adherent patients.[4–7]

Medication adherence refers to the extent to which patients take their medications as prescribed by healthcare providers, including correct timing, dosage, and duration.[11,12] Adequate medication adherence plays a critical role in reducing morbidity, mortality, and healthcare costs among patients with T2DM.[13] Previous studies have demonstrated that

adherence behavior is closely associated with patients' intention to follow treatment recommendations, which is influenced by psychological and social factors such as attitudes, subjective norms, and perceived behavioral control.[14]

The Theory of Planned Behavior (TPB) provides a comprehensive framework for understanding health-related behaviors by explaining how intention is shaped by attitudes, subjective norms, and perceived behavioral control.[15] When applied to T2DM management, TPB offers valuable insights into patients' medication-taking behavior and self-care practices.[15–19] In culturally collectivist societies such as the Javanese community, social influence and interpersonal relationships play a prominent role in health-related decision-making.[16–18] Cultural beliefs, including preferences for traditional medicine and misconceptions regarding diabetes treatment, may influence patients' adherence behavior and contribute to fatalistic attitudes toward the disease.[17]

Several studies have applied TPB to examine medication adherence intention among patients with T2DM, demonstrating varying contributions of TPB constructs across different settings.[23,24] Research conducted in East Java and Brazil reported that attitudes, subjective norms, and perceived behavioral control significantly influenced adherence intention.[23,24] However, cultural and behavioral differences between regions—particularly between East Java and Central Java—may result in different patterns of health behavior due to historical, geographical, and socio-economic factors.[18,25] Despite the growing burden of T2DM, behavioral theory–based studies examining medication adherence intention in Central Java remain limited.[26]

Central Java therefore provides a relevant setting for this study due to its strong Javanese cultural values, where family members and healthcare providers exert substantial influence on health-related decision-making. This socio-cultural context is particularly suitable for applying TPB, especially the subjective norm construct, to explore medication adherence intention among patients with T2DM.[27] Therefore, this study aimed to analyze the factors influencing medication adherence intention among patients with T2DM based on the Theory of Planned Behavior within the Javanese population in Central Java.

METHODS

Study Design

This study was conducted as an analytical observational study using a cross-sectional design to examine patients' medication adherence intention, including attitudes, subjective norms, and perceived behavioral control. The population consisted of patients with type 2 diabetes mellitus registered at primary healthcare centers and hospitals in Purworejo Regency, Central Java, based on medical records and patient registries in 2021.

The minimum sample size was calculated using the Slovin formula based on the estimated population of patients with T2DM in the study area, resulting in a minimum required sample of 378 respondents. During data collection, a total of 382 respondents met the inclusion criteria and were included in the final analysis. Sample selection was conducted using a non-random purposive sampling method. Although purposive sampling may introduce potential selection bias and limit the generalizability of the findings, this approach was considered appropriate to ensure the inclusion of patients who met specific clinical and contextual criteria relevant to the study objectives.

The sampling sites were selected purposively based on several considerations, including the availability of routine diabetes mellitus management services, a sufficient number of registered patients with type 2 diabetes mellitus, and the feasibility of data collection. The selected primary healthcare centers and hospitals also represented both urban and semi-rural healthcare settings in Purworejo Regency, Central Java, to capture a diverse patient population receiving diabetes care at different levels of healthcare services.

Javanese ethnicity was determined based on the study setting and respondent characteristics. All participants were recruited from primary healthcare centers and hospitals located in Purworejo Regency, Central Java, an area predominantly inhabited by individuals of Javanese ethnicity. In addition, respondents were required to have lived in Central Java for an extended period and used Indonesian or Javanese as their primary language in daily communication. This approach allowed the study findings to be interpreted within the context of Javanese socio-cultural characteristics.

The inclusion criteria were adult patients (≥18 years) diagnosed with T2DM for at least one year and receiving oral hypoglycemic agents and/or insulin therapy. Pregnant patients were excluded from the study. Ethical approval was obtained from the Health Research Ethics Committee of Universitas Respati Yogyakarta (No.198.3/FIKES/PL/VIII/2021).

Table 1. Characteristics of Respondents to the Study of Medication Adherence Intention in Patients with Type 2 Diabetes Mellitus Based on the Concept of the Theory of Planned Behavior

No.	Respondent Characteristics	Number of Respondents (N=382)	Percentage (%)
1.	**Gender**		
	Female	286	74.9
	Male	96	25.1
2.	**Age**		
	45-54 years	102	26.7
	55-65 years	181	47.4
	66-74 years	86	22.5
	>74 years	13	3.4
3.	**Job-status**		
	Employed	224	58.6
	Unemployed	158	41.4
4.	**Last education**		
	Elementary school/equivalent	143	37.4
	Junior high school/equivalent	95	24.9
	Senior/Vocational high school/equivalent	114	29.8
	Diploma 1/2/D	13	3.4
	Bachelor/Master/Doctoral	17	4.5
5.	**Diagnosis of T2DM disease**		
	No complications	225	58.9
	With complications	157	41.1
6.	**Duration of suffering**		
	1-5 years	280	73.3
	>5 years	102	26.7
7.	**Amount of medication**		
	≤ 2 kinds of medicine	242	63.4
	> 2 kinds of medicine	140	36.6
8.	**Blood glucose levels**		
	Abnormal (GDP/GDS)	232	60.7
	Normal (GDP/GDS)	150	39.3

Data Collection

Data collection was performed from October 18 to November 13, 2021, using a questionnaire referring to theoretical concepts from the Theory of Planned Behavior (TPB). The TPB concept contains three constructs, namely attitude, subjective norm, and perceived behavioral control (PBC). The questionnaire consisted of 31 items measuring attitude, subjective norm, perceived behavioral control, and intention. Responses were measured using a five-point Likert scale ranging from strongly disagree to strongly agree. For attitude, subjective norm, perceived behavioral control, and intention items, responses were scored from 1 to 5. Outcome evaluation items were scored on a scale ranging from –2 (very negative) to +2 (very positive).

For attitude-related items, belief strength scores were multiplied by their corresponding outcome evaluation scores to obtain a composite attitude score. The resulting product scores were then summed up and averaged to obtain a mean construct score for each respondent. For subjective norm and perceived behavioral control constructs, item scores were summed and averaged to obtain mean scores. Intention scores were dichotomized into “high” and “low” categories using the overall mean score as the cut-off point. Respondents with scores above the mean were classified as having high medication adherence intention, while those with scores equal to or below the mean were classified as having low intention. The positive value signifies the positive score derived from multiplying each construct by the result evaluation. The negative value signifies the negative score derived from multiplying each construct by the result evaluation. Scores at zero indicate neutral positions. The validity test of the questionnaire was carried out using an expert judgment approach, which consisted of 3 social pharmacists, and all items in the questionnaire were declared valid. These experts independently evaluated each item for its relevance, clarity, and alignment with the TPB theoretical constructs related to medication adherence in patients with T2DM. The experts assessed whether each item accurately reflected the intended construction and was appropriate for the target population. Only items unanimously deemed valid by the experts were retained for the final instrument, ensuring comprehensive and culturally relevant content validity. Reliability testing was conducted by distributing questionnaires to 50 people with characteristics similar to those of the research respondents. Following that, the reliability test results employed internal consistency with a

Cronbach's alpha value of 0.830. Whereas Cronbach's alpha values for each construct were 0.804 – 0.852 for attitude, 0.804 – 0.828 for subjective norm, 0.802 – 0.847 for PBC, and 0.832 for intention. In addition, the language comprehension test involved five respondents with characteristics similar to the research respondents.

Statistical Analysis

Data analysis was performed using SPSS software version 25. Descriptive analysis was conducted to summarize respondent characteristics and study variables. Bivariate analysis was performed using the Chi-square test to examine the association between independent variables and medication adherence intention. Multivariate analysis was conducted using binary logistic regression to identify the contribution of attitudes, subjective norms, and perceived behavioral control to medication adherence intention among patients with type 2 diabetes mellitus. The strength of association was expressed as odds ratios (ORs) with a 95% confidence interval, and the model fit was assessed using Nagelkerke's R^2. Intention scores were dichotomized into high and low categories to facilitate binary logistic regression analysis and to provide clearer interpretation of predictors associated with higher adherence intention. Dichotomization allowed the identification of factors significantly associated with increased likelihood of high medication adherence intention.

RESULT

Description of Intentions, Attitudes, Subjective Norms, and Perceived Behavioral Control of Medication Adherence in Patients with Type 2 Diabetes Mellitus

As many as 85.9% of patients with T2DM had a high intention to use their medication according to the instructions for use. A positive attitude score was indicated by 94.2% of respondents who supported adherence to medication use. A positive subjective norm score among 92.1% of respondents presented that there was support from the immediate environment and significant others to adhere to medication use. Then, a positive perceived behavioral control score was observed in 95.8% of respondents who felt in control of themselves to adhere while using T2DM medication (**Table 2**).

Table 2. Description of Intentions, Attitudes, Subjective Norms, and Perceived Behavioral Control in a Study of Medication Adherence Intention in Patients with Type 2 Diabetes Mellitus Based on the Theory of Planned Behavior

No.	TPB construct	Frequency (N=382)	Percentage (%)
1.	**Intention**		
	High	328	85.9
	Low	54	14.1
2.	**Attitude**		
	Positive	360	94.2
	Neutral	5	1.3
	Negative	17	4.5
3.	**Subjective Norms**		
	Positive	352	92.1
	Neutral	8	2.1
	Negative	22	5.8
4.	**Perceived Behavioral Control**		
	Positive	366	95.8
	Neutral	2	0.5
	Negative	14	3.7

Relationship between Respondent Characteristics and Medication Adherence Intention in Patients with Type 2 Diabetes Mellitus

Table 3 showed that medication adherence intention was significantly high among T2DM patients without complications (55.5%; $p < 0.001$) and received 2 kinds of drugs or less (58.4%; $p<0.001$). The data showed that two factors were strongly connected to the intention to adhere with T2DM drug therapy, the number of drugs used, and whether the patients had any complications. People with T2DM who had complications could get more drugs than people with DM who did not have complications because they needed more drugs to treat the problems.

Table 3. Description of Intentions in Research on Medication Adherence in Patients with Type 2 Diabetes Mellitus Based on the Theory of Planned Behavior

Respondent Characteristics		Intention to Use Drugs in Patients with T2DM N=382 in %		*Asymp. Sig.* (*2-sided*)
		Low	High	
Diagnosis	T2DM without complications	3.4	55.5	<0.001
	T2DM with complications	10.7	30.4	
Number of Drugs	≤ 2 kinds of medicine	5	58.4	<0.001
	> 2 kinds of medicine	9.2	27.5	
Gender	Female	12.0	62.8	0.059
	Male	2.1	23.1	
Age	< 55 years	4.2	22.5	0.601
	≥ 55 years	10.0	63.3	
Job-status	Unemployed	8.9	49.7	0.486
	Employed	5.2	36.2	
Last education	Elementary/junior high school	9.1	53.2	0.497
	Senior high school/higher education	5.0	32.7	
Duration of suffering	≤ 5 years	11.5	61.8	0.142
	> 5 years	2.6	24.1	

Analysis of the Relationship between Attitudes, Subjective Norms, and Perceived Behavioral Control on Medication Adherence Intentions in Patients with Type 2 Diabetes Mellitus

From **Table 4**, it can be seen that attitudes, subjective norms, and perceived behavioral control had a relationship with the intention to use drugs (p <0.001). As many as 84.8% of respondents had a positive attitude and high intentions, and the contingency coefficient value for attitudes towards intentions was 0.451. Respondents with positive subjective norms and high intentions to use drugs were 84.3%, and the contingency coefficient value was 0.508. As many as 84.6% of respondents had positive behavioral control and high intention with a contingency coefficient value of 0.340.

Table 4. Analysis of the Relationship between Attitudes, Subjective Norms, and Perceived Behavioral Control on Intentions in Research on Medication Adherence Intentions in Patients with Type 2 Diabetes Mellitus Based on the Theory of Planned Behavior

Variable	Category	Intention to Use Drugs (N=382) in %		*Pearson Chi-Square p-value*	*Contingency Coefficient*
		Low	High		
Attitude	Positive	9.4	84.8	<0.001	0.451
	Neutral	0.5	0.8		
	Negative	4.2	0.3		
Subjective norms	Positive	7.8	84.3	<0.001	0.508
	Neutral	0.8	1.3		
	Negative	5.5	0.3		
Perceived behavioral control	Positive	11.2	84.6	<0.001	0.340
	Neutral	0.0	0.5		
	Negative	2.9	0.8		

Contribution of Attitudes, Subjective Norms, and Perceived Behavioral Control to Medication Adherence Intentions in Patients with Type 2 Diabetes Mellitus

Based on **Table 5**, the odds ratio (OR) value for the attitude variable was 51.993, for the subjective norm variable was 197.019, and for the perceived behavioral control variable, it was 33,000. Therefore, the value of contributed factors from regression analysis was obtained with an R-square value of 0.536.

Table 5. Logistic Regression Test in Research on Intention to Use Drugs in Patients with Type 2 Diabetes Mellitus Based on the Theory of Planned Behavior

Variable	B	Sig.	Exp. B	95% C.I. for EXP(B)	
				Lower	*Upper*
Attitude	3.951	0.001	51.993	5.378	502.647
Subjective norms	5.283	<0.001	197.019	24.459	1586.990
Perceived behavioral control	3.497	<0.001	33.000	7.758	140.378

DISCUSSION

Type 2 diabetes mellitus (T2DM) comprises approximately 90% of the total number of diabetes cases.[29] In T2DM, there is a reduced reaction to insulin, which is referred to as insulin resistance. During this phase, insulin becomes inefficient and is initially compensated by an upsurge in insulin synthesis to regulate glucose balance. However, as time progresses, insulin production declines, leading to the development of T2DM.[28] As this study found that T2DM mostly suffered by patients ages 45-65 (**Table 1**), a previous study also confirmed that T2DM was predominantly observed in individuals who are 45 years of age or due to degenerative factors that influence the function of pancreatic β cells in producing insulin.[29] Moreover, the increasing prevalence in younger people, primarily as a result of escalating rates of obesity, lack of physical activity, and consumption of high-calorie meals.[7]

Treatment for T2DM, which is a lifelong treatment, is undoubtedly susceptible to patient noncompliance. There are factors influencing adherence to using medication, including habits, older age, no perceived side effects of medication, and duration of treatment since being diagnosed with T2DM.[30] Complicated drug regimens, psychological factors, drug safety, tolerability, and low cost are also factors causing poor adherence.[21]Non-adherence to medication can trigger uncontrolled sugar levels.[31] In addition, several determinants related to medication adherence in patients with T2DM encompass knowledge, motivation, age, support from partner and family, intervention by medical personnel, and prevention of complications.[24,32,33] As this study found of more women with T2DM (**Table 1**), a previous study also observed that women are more susceptible to T2DM due to their relatively high body mass index (BMI)[34–36] and in line with this result showed that the most women with lower education level tend not to adhere to taking medication.[37]

The majority of participants reported that they could exert self-control (**Table 2**) to stick to their medication regimen with the assistance of individuals in their social network, including family members, doctors, friends, pharmacists, and nurses. Building on prior research, they also noted that the determinants of treatment adherence intention were encompassed in the subjective norm construct, which included support from spouse, family, and intervention from health workers.[24,38,39] Meanwhile, factors that belong to the construct of perceived behavioral control (PBC) in influencing the intention to adhere with T2DM therapy are drug regimen, number of drugs, treatment duration, high patient activity, drug use, forgetfulness, disease complications, cheap treatment costs, and habits.[26,40] Attitudes reflect patients' beliefs about the advantages and disadvantages of taking medication. Subjective norms represent the perceived social pressure and support from significant others regarding medication adherence. Perceived behavioral control indicates patients' confidence in taking medication as prescribed. These three factors collectively contribute to forming a patient's intention to adhere to medication, predicting actual adherence behavior. By understanding and targeting these three factors, healthcare providers can develop more effective interventions to improve medication adherence among patients with various conditions, including hypertension and diabetes. Knowing the factors that most influence the intention to adhere in using T2DM medication (attitude, subjective norms, or perceived behavioral control) can be used as a basis for intervention to achieve therapeutic success.

According to this study (**Table 3**), the greater number of medication items consumed among T2DM patients with complications were found to have lower intentions to adhere to their medication regimen compared to those without complications. Consistent with the previous study, adherence to medication use increases as the quantity of medication consumed decreases.[41] This is caused by the increasing number of drug items used so that the treatment regimen becomes more complex.[24] Thus, patients may become increasingly reluctant to adhere to medication use.[24,42] The duration of suffering from DM had no relationship with intention (**Table 3**). Both patients with pre-existing and newly T2DM diagnosed were found to be influenced by emotional factors, because they may experience similar emotional states as they both share a desire to avoid the burden of this chronic illness.[31]

Positive attitude was significantly related to the intention to adhere to medication use (**Table 4**). This finding aligns with the TPB concept, i.e., that attitudes are positively correlated with intentions.[14,23]An increasingly positive attitude also leads to stronger intentions.[14] The most prominent belief in the attitude variable in this study was the belief that adherence to medication could control blood sugar levels.[43] A correct understanding of the importance of controlling blood sugar levels will tend to produce a positive attitude.[44]

Positive subjective norms were significantly associated with intention to use drugs in patients with T2DM according to this study (**Table 4**). The more positive the subjective norm is towards a particular behavior, the greater the intention to realize that particular behavior in an action.[18,28]Results concerning positive subjective norms denote that the respondents admitted that encouragement from people around them influenced adherence to medication use.

The presence of supportive people around them created a high intention to adhere to medication use to achieve therapeutic success. Apart from the family, encouragement from the health workers, such as the nurses they meet, will influence the patient's mindset.[22,45]

Perceived behavioral control (PBC) positively and significantly correlated with intention to use drugs in patients with T2DM (**Table 4**). Fundamentally, PBC is influenced by beliefs about one's control or ability to carry out certain behaviors and their perceived power. The more positive a person's self-efficacy, the more positive the perceived behavioral control will be.[14,25] In this study, a positive PBC score means that the respondent felt in control to adhere to medication or insulin injections according to the instructions for use.[21]

Patients with T2DM who demonstrated positive attitudes (OR = 51.993), positive subjective norms (OR = 197.019), and positive perceived behavioral control (OR = 33.000) were significantly more likely to report high intention to adhere to medication compared to those with negative constructs (**Table 5**). Among these variables, subjective norms showed the strongest association with adherence intention, followed by attitude and perceived behavioral control. This finding underscores the important role of social support and healthcare provider influence in shaping patients' treatment intentions. The model explained 53.6% of the variance in medication adherence intention (R^2 = 0.536), indicating that other unmeasured factors may also contribute to intention formation. The exceedingly high odds ratios, particularly for subjective norms, should be interpreted with caution. The high proportion of respondents categorized as having strong adherence intention (85.9%) may have resulted in a skewed distribution, potentially inflating the magnitude of the OR values. The dominant role of subjective norm warrants further reflection. In collectivist cultures such as Javanese society, social expectations, family involvement, and healthcare provider recommendations often exert substantial influence on individual health decisions. In this context, adherence intention may be shaped more by perceived social approval and relational harmony than by purely personal beliefs. However, as the data were obtained through self-reported questionnaires, the possibility of social desirability bias cannot be excluded. Future studies employing longitudinal designs or structural equation modeling may provide a more nuanced understanding of the relative contribution of TPB constructs to medication adherence behavior.

Limitation

This research applies the concept of the TPB. Based on this concept, predictions can be made down to actions or behavior. However, this research only limited predictions to the construct of intention, while several other studies have examined behavior. Nevertheless, the results of this research still have an important contribution in predicting behavior because intentions are the direct, closest, and only antecedent for behavior according to the TPB concept. Furthermore, this study did not use HbA1C data, which shows average sugar levels for the last 3 months. The patient's laboratory test results were limited to non-fasting blood glucose level (non-FBG) or fasting blood glucose level (FBG).

CONCLUSION

This study highlights the prominent role of subjective norms in shaping medication adherence intention among patients with T2DM within the Javanese cultural context. These findings suggest that interventions aimed at improving medication adherence should prioritize strengthening social support systems, particularly through active involvement of family members and healthcare providers. Integrating culturally sensitive, family-centered approaches into diabetes management programs may enhance adherence intention and ultimately improve long-term treatment outcomes. Future research is recommended to explore additional behavioral and contextual factors influencing adherence intention using longitudinal designs.

FUNDING

This research received no specific grant from any funding agency.

ACKNOWLEDGMENTS

Universitas Muhammadiyah Yogyakarta provided support for this publication and access to the sources. The authors would also like to thank the experts from the primary health clinics and hospitals in Purworejo, Central Java, Indonesia, for their assistance in data collection as well as their suggestions for improving the study. The primary health

care facilities engaged were Puskesmas Cangkrep, Bayan, Banyuurip, Kutoarjo, Wirun, Semawung Daleman, Pituruh, and Bruno, while the hospitals were Panti Waluyo, Aisyah, and Amanah Umat.

GENERATIVE AI DISCLOSURE STATEMENT

The authors confirm that no Generative Artificial Intelligence (AI) or AI-assisted technologies were utilized in the writing, data analysis, or preparation of this manuscript.

AUTHOR CONTRIBUTION STATEMENT

Fransiska Indah Pratiwi contributed to Conceptualization, Methodology, and Software. **Aris Widayati** contributed to Data Curation, Investigation, Visualization, and Writing – Original Draft. **Pramitha Esha Nirmala Dewi** contributed to Supervision, Software, Validation, and Writing – Review & Editing.

CONFLICT OF INTEREST

Authors have no conflict of interest to declare.

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