Title: Applying Theory of Planned Behaviour in Heart Disease Prevention: An Educational Intervention Study

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Abstract

Background: Most of the burden of morbidity and mortality from cardiovascular disease is related to modifiable risk factors. Healthy lifestyle behaviour to be consistent and directed can be helped by implementing the theory of planned behaviour (TPB). This study aimed to determine the effects of an educational intervention based on the TPB on coronary heart disease preventive behaviours and knowledge.

Methods: This non-randomized controlled trial with a pretest-posttest design was conducted on 46 participants with risk factors of coronary heart disease at Banyuanyar and Nusukan Primary Health Centers, Surakarta City, Central Java, Indonesia, from June to October 2024. Participants were non-randomly assigned to intervention (n=23) and control (n=23) groups. The educational intervention based on the TPB included risk screening, health education via electronic module, focus group discussion, and three individual counseling sessions via WhatsApp, which were implemented over a four-week period. Data were collected using the TPB questionnaire and the Heart Disease Fact Questionnaire (HDFQ) before intervention and at the end of forth week. Data analysis was conducted using paired t-test, independent t-test, Wilcoxon, and Mann–Whitney U tests with a significance level of < 0.05 in IBM SPPS Statistic version 26.

Results: All core components of the TPB construct including "attitude" (Mann–Whitney = 0.000, $p < 0.001$), "perceived behavioural control" (Mann–Whitney = 106.00, $p < 0.001$), "subjective norm" (Mann–Whitney = 141.500, $p < 0.006$), and "behavioral intention" ($t = 6.527$, $p < 0.001$), showed higher post-test scores for respondents in the intervention group than in the control group.

Conclusion: This study suggests that a TPB-based educational intervention delivered by nurses is an effective strategy for improving knowledge and promoting heart disease preventive behaviours among high-risk individuals.

Keywords: Attitude to health, Cardiovascular disease, Health education, Risk reduction behavior, Theory of planned behaviour

Highlights

- Most cardiovascular disease morbidity and mortality is associated with high-risk populations, including those with diabetes mellitus and hypertension.
- This study examined the impact of an intervention based on the theory of planned behaviour (TPB) on coronary heart disease preventive behaviours.
- The results revealed that a training program based on the TPB, is an effective approach for enhancing knowledge and encouraging heart disease preventative practices among high-risk population.

Plain Language Summary

The majority of cardiovascular disease-related illness and death are found in high-risk groups, such as people with diabetes mellitus and high blood pressure. The goal of this study was to determine the effects of an educational intervention based on the theory of planned behaviour (TPB) on coronary heart disease preventive behaviours and knowledge. The results showed that a TPB-based training program is a good way to improve the skills of high risk individuals and get them to do things that keep them away from heart disease.

Introduction

Coronary heart disease (CHD) remains a major global health challenge, contributing significantly to morbidity and mortality worldwide. The burden of cardiovascular diseases (CVDs) has increased substantially over the past decades, with estimated deaths rising from approximately 12.1 million in 1990 to 18.6 million in 2019, affecting 9.6 million men and 8.9 million women (Lindstrom *et al.*, 2022). Projections by the World Health Organization (WHO), an estimated 19.8 million people died from cardiovascular diseases (CVDs) in 2022, representing 32% of all global deaths. This substantial burden highlights the critical importance of implementing effective prevention and management strategies (WHO, 2025).

In Indonesia, CHD continues to be a significant public health concern. Although its overall prevalence has not exhibited a drastic increase, the rising trends of key risk factors—such as metabolic syndrome, hypertension, and low level of high-density lipoprotein (HDL) suggest a heightened future burden of the disease (Hussain *et al.*, 2016; Amalia and Kismiantini, 2022). Recent epidemiological data indicate that the incidence of CHD in Indonesia is approximately 2.72%, with an incidence rate of 34 per 100,000 person-years. Major risk factors, including smoking, hypertension, and hypercholesterolemia, have been identified as primary predictors of CHD in the Indonesian population (Ramadhaniah *et al.*, 2022). The high prevalence of these modifiable risk factors signals a potential increase in CHD incidence and other disease, necessitating evidence-based interventions to mitigate its progression (Nugroho *et al.*, 2022).

In Central Java Province, Indonesia, CHD prevalence is strongly influenced by well-established risk factors. A study conducted at a national referral hospital identified age, dyslipidemia, hypertension, and diabetes mellitus as the primary determinants of CHD (Risdahidayanti *et al.*, 2020). Individuals over the age of 40 with a history of these conditions are at a significantly higher risk of developing CHD. Notably, diabetes mellitus

and hypertension exacerbate cardiovascular risk by adversely affecting glucose metabolism, lipid profiles, and blood pressure regulation. Given these findings, targeted preventive interventions for high-risk populations are imperative to delay the onset and progression of CHD. Effective management of modifiable risk factors—such as hyperglycaemia, dyslipidaemia, and hypertension—through lifestyle modifications and optimized medical therapy has been shown to substantially reduce cardiovascular risk (Hong *et al.*, 2017). Preventive measures, particularly those initiated early and sustained over time, are essential for promoting long-term cardiovascular health. Research indicates that comprehensive lifestyle interventions, encompassing regular physical activity and dietary modifications, can delay or even prevent the onset of type 2 diabetes mellitus and improve cardiovascular outcomes (Pomeroy and Palacios, 2012; Sartika *et al*., 2023). Preventive efforts targeting individuals at risk of cardiovascular disease are essential to reduce disease burden and improve population health outcomes (Yuliawan and Hanoum, 2025). Furthermore, behaviour-focused strategies, such as motivational interviewing and behavioural counselling, have demonstrated efficacy in facilitating sustainable lifestyle changes, improved quality of life and mitigating cardiovascular risk factors (Lakerveld *et al.*, 2008; Yuniartika and Hidayati, 2021; Kristinawati *et al*., 2024).

One promising theoretical framework for guiding behavioural interventions in CHD prevention is the Theory of Planned Behaviour (TPB). TPB posits that human behaviour is primarily guided by behavioural intention, which in turn is influenced by three core cognitive determinants: attitude toward the behaviour**,** subjective norms**,** and perceived behavioural control (Ajzen, 1991; Steinmetz et al., 2016). Attitude reflects an individual's evaluation of the outcomes of performing a behaviour—such as perceiving healthy eating or regular exercise as beneficial for heart health. Subjective norms involve perceived social pressure or expectations from significant others, including family, peers, or healthcare providers, to

engage in preventive actions. Perceived behavioural control denotes one's confidence in their ability to perform the behaviour, often shaped by prior experiences, self-efficacy, and available resources (Steinmetz et al., 2016).

In the context of CHD prevention, TPB offers a comprehensive framework to understand why individuals at risk—such as those with hypertension or diabetes—may or may not engage in preventive behaviours like maintaining a balanced diet, adhering to medication, or engaging in physical activity. By identifying and addressing specific cognitive determinants, TPB allows interventions to be precisely tailored: for instance, by strengthening positive attitudes toward lifestyle modification, enhancing perceived social support for heart-healthy behaviours, and improving individuals' confidence and skills to overcome perceived barriers. Moreover, TPB's predictive validity has been consistently demonstrated in cardiovascular health studies, where interventions targeting its constructs have led to significant improvements in behavioural intention, lifestyle adherence, and self-regulatory practices (Khani Jeihooni et al., 2021; Wang et al., 2023). Therefore, TPB not only provides a conceptual explanation of behavioural change but also serves as a practical foundation for designing structured, theory-driven educational programs that promote sustainable heart disease prevention behaviours.

Previous studies have demonstrated the effectiveness of TPB-based interventions in promoting physical activity, improving dietary habits, and enhancing medication adherence—factors critical for reducing cardiovascular risk among populations with diabetes and hypertension (Jalali Javaran *et al.*, 2020; Mirahmadizadeh *et al.*, 2020; Kim and Hur, 2021). A meta-analysis study has highlighted the significant impact of TPB-based strategies in behavioural modification across various health domains (Steinmetz *et al.*, 2016). Notably, TPB-driven interventions have successfully influenced dietary behaviours, such as increasing

fibber intake and reducing body mass index in adolescent populations (Mazloomy-Mahmoodabad *et al.*, 2017).

Given the established benefits of TPB in shaping health behaviors, this study aims to implement an educational intervention based on this theory to enhance CHD prevention behaviors in at-risk populations. By leveraging a structured behavioral framework, this approach seeks to facilitate sustainable lifestyle modifications, ultimately contributing to the reduction of CHD incidence and its associated health burden. This research aims to analyze the effectiveness of a TPB based educational intervention on heart disease preventive behaviours in at-risk individuals.

Material and Methods

Design, setting, and sample

This study was a non-randomized, controlled clinical trial with a pretest and posttest design. The TREND (Transparent Reporting of Evaluations with Non-randomized Designs) 2010 checklist guidelines guided this report (Haynes et al., 2021).

This research was conducted at community health centers located in the Central Java region of Indonesia. The research sample consists of patients with diabetes mellitus and hypertension who are part of a group called PROLANIS (Chronic disease management programme in Indonesia). Participants were first recruited based on the inclusion criteria: PROLANIS participants with risk factors for coronary heart disease (including diabetes mellitus and hypertension), who had never received education on heart disease prevention, and who were under 65 years of age. Participants with other heart diseases, cognitive impairments, dementia, and those who do not comply with the research protocol were excluded.

The sample size in this study was calculated using G*power software (version 3.1.9.6), considering an effect size assumption of 0.80, 80% power, and a significance level of 0.05

(Khani Jeihooni *et al.*, 2021). The total sample required was 42 based on the calculations, which increased to 46 participants after accounting for 10% attrition, and 23 samples were considered for each group. The participants were assigned non-randomly into the groups. In the first stage, the eligibility of participants in the intervention group was determined, and 23 participants were selected. The same procedure was carried out for the control group, resulting in 23 participants who met the research criteria.

Instruments and data collection

The data collection tool comprised three questionnaires. The first section gathered demographic information, including age, gender, main risk factors, marital status, and smoking history.

The Cardiovascular disease prevention behaviour was measured using a questionnaire developed based on the Theory of Planned Behaviour (TPB) by Fishbein and Ajzen (2010) in Predicting and Changing Behavior: The Reasoned Action Approach. The instrument was designed to assess four key TPB constructs: attitude, subjective norms, perceived behavioural control, and behavioural intention. A previous cross-cultural adaptation and psychometric evaluation of the Indonesian version of the TPB questionnaire was conducted by Utami *et al.*, (2022) among mothers of children with hearing loss. The study confirmed the validity of all TPB constructs ($p < .05$), with satisfactory internal consistency (Cronbach's $\alpha = 0.773$) and excellent test–retest reliability (ICC = 0.903), indicating that the TPB framework is applicable within the Indonesian cultural context.

Building upon these findings, the present study further adapted and validated the instrument to fit the context of cardiovascular disease prevention. The modified version consisted of 21 items distributed across four domains: attitude (6 items), subjective norms (5 items), perceived behavioural control (5 items), and behavioural intention (5 items). A 5-point Likert scale (1 = strongly disagree to 5 = strongly agree, with higher scores indicative of better

cardiovascular disease prevention behaviour) was used to enhance clarity and cultural appropriateness. Content validity was evaluated by three experts in behavioural science and health promotion, yielding a Content Validity Index (CVI) of 0.87. The internal consistency test produced a Cronbach's alpha coefficient of 0.74, demonstrates that the modified TPB-based questionnaire was valid and reliable for assessing behavioural constructs related to cardiovascular disease prevention in this population.

Respondents' knowledge was measured using the Heart Disease Fact Questionnaire (HDFQ) (Wagner *et al.*, 2005). This questionnaire measured knowledge of coronary artery disease (CAD) risk factors, the relationship between diabetes and CAD, and preventive measures to reduce CAD risk. The HDFQ questionnaire consisted of 25 items that were rated using the Gottman scale, in which responses were categorized as "true", "false", or "don't know". Six items were reverse-scored. Each correct response received a score of 1, while incorrect responses and "I do not know" answers received a score of 0. The total score was calculated by multiplying the number of correct responses by four, resulting in a range of 0 to 100. In this study, the HDFQ was translated from English into the Indonesian language through a standardized forward and backward translation process conducted by bilingual experts. The translated version was reviewed by a panel of nursing and cardiology experts to ensure content validity. The content validity index (CVI) of the translated instrument was 0.92, indicating excellent validity. Reliability testing using Cronbach's alpha yielded a coefficient of 0.81, confirming the internal consistency of the adapted version used in this study.

Education based on Theory of Planned Behavior

The intervention model was developed by the principal investigator (PI) based on the TPB and a comprehensive literature review. The intervention consisted of four sequential stages:

risk screening, health education, focus group discussion, and individual counselling (see Table 1).

Table 1. Description of the Intervention Stages Based on the Theory of Planned Behaviour (TPB)

Time	Stage	Objective	Activities
Day 1	Risk screening	To identify participants' level of CHD risk and raise awareness about their health condition.	screening conducted using the *Systematic Coronary Risk Evaluation (SCORE)* guidelines
Day 3	Health education	To improve knowledge and shape positive attitudes toward CHD prevention behaviours.	Educational materials delivered through the e-module *e-healthcare*
Day 5	Focus group discussion	To strengthen subjective norms and motivation for preventive behaviour.	Group discussions emphasized that CHD is preventable and highlighted the importance of self-care and social support from peers and family. Participants shared experiences and reflected on their health behaviours.
Week 2-4	Individual counselling	To strengthen perceived behavioural control and facilitate behaviour change.	Three personalized counselling sessions conducted via WhatsApp, focusing on overcoming barriers, providing tailored advice, and evaluating participants' behavioural progress.

Procedure

The intervention was implemented over a total duration of four weeks, consisting of three face-to-face sessions in the first week followed by three chat-based counselling sessions during the subsequent three weeks.

Heart disease risk screening was conducted using the Systematic Coronary Risk Evaluation (SCORE) guidelines (Graham *et al.*, 2021). Participants were categorized into four risk levels: very high risk (SCORE risk ≥ 10%), high risk (SCORE 5%–9%), medium risk (SCORE 1%–4%), and low risk (SCORE < 1%). At this stage, participants were also provided with information regarding their specific risk factors and their potential health consequences.

The experimental group received TPB -based education from the PI in addition to routine care, while the control group received only routine care.

During the health education stage for the intervention group, an E-Module called e-healthcare (https://e-healthcare.id/) was used to deliver information about coronary heart disease (CHD), including its definition, risk factors, signs and symptoms, and preventive strategies, particularly for individuals with hypertension and diabetes mellitus.

The focus group discussions were designed to enhance participants' awareness that CHD is preventable and to strengthen their attitudes and intentions toward adopting heart disease preventive behaviours. The final stage involved individual counselling, conducted through three personalized sessions via WhatsApp, which addressed participants' barriers to behaviour change, monitored progress, and evaluated their preventive practices.

Prior to the intervention, participants completed a pre-test questionnaire assessing their knowledge and preventive behaviours related to heart disease. Then, at the end of this period, they were required to complete the post-test questionnaire via a Google Form available on the website.

In the control group, nurses provided education on heart disease prevention, covering the same components as the intervention group. Additionally, participants were given informational leaflets to take home. The control group was required to complete a questionnaire in the first week before receiving the education as a pre-test assessment. They were then asked to complete the questionnaire again in the fourth week as a post-test assessment. Two research assistants, who were qualified nursing professionals trained in data collection, assisted the PI throughout the study.

Data Analysis

Data were analyzed using descriptive statistics, including frequency distributions, percentages, means, and standard deviations. The chi-square test, Fisher's exact test, and independent t-test were used to compare baseline demographic characteristics between the

intervention and control groups. The normality of continuous data was tested using the Shapiro–Wilk test, as the number of participants in each group was fewer than 50. Variables with a p-value greater than 0.05 were considered normally distributed. Normally distributed data were analyzed using the paired t-test (within-group comparisons) and the independent t-test (between-group comparisons). For data that were not normally distributed ($p < 0.05$), the Wilcoxon signed-rank test and Mann–Whitney U test were applied to compare pre- and post-intervention scores of knowledge and cardiovascular disease prevention behaviour within and between groups, respectively.

Results

The total number of participants was 46, and there was no attrition in any of the groups. The findings revealed no significant difference between the two group regarding demographic characteristic and health condition prior the study (See **Table 2**).

Table 2. Comparison of demographic characteristics of intervention and control groups

Characteristic	Category	Intervention Group			Control Group			P- *value*
		(n)	(%)	Mean (SD)	(n)	(%)	Mean (SD)	
Age (years)				65 ± 6.083			62.96 ± 7.94	0.333***
Gender	Male	3	13		7	30.4		0.284**
	Female	20	87		16	69.6		
History of Regularly Health Medical Check-up	Yes	21	91.3		21	91.3		1.000**
	No	2	8.7		2	8.7		
Smoking history	Yes	1	4.3		2	8.7		1.000**
	No	22	95.7		21	91.3		
Main risk factor	Hypertension	16	69.6		11	47.8		0.134*****
	Diabetes Mellites	7	30.4		12	52.2		
Length of the main risk factor (year)				4.52 ± 3.62			5.26 ± 4.05	0.517***

Note. *Chi-square, **Fisher's exact test, ***Independent t-test

Effectiveness of TPB based Education

Before the intervention, there were no significant differences in TPB constructs and average knowledge scores between the groups (**Table 3**). Nonetheless, the mean post-test scores of

the TPB constructs in the intervention group were significantly higher than those of the control group (Mann–Whitney = 13.500, p = 0.001). Additionally, all core components of the TPB construct, including "attitude" (Mann–Whitney = 0.000, p < 0.001), "perceived behavioural control" (Mann–Whitney = 106.00, p < 0.001), "subjective norm" (Mann–Whitney = 141.500, p < 0.006), and "behavioral intention" (t = 6.527, p < 0.001), showed higher post-test scores for respondents in the intervention group than the control group. Within group comparisons showed that all of the TPB core components have improved after intervention in the experimental group, while only the subjective norm component showed an increase in the control group (Wilcoxon = -2.43, p = 0.015). Furthermore, the experimental group's mean score on cardiovascular disease prevention knowledge increased significantly at the end of the intervention compared to before (t = -9.436, p < 0.001), while the control group also showed a significant increase, although not as much as the intervention group (t = 2.598, p = 0.016) (**Table 3**).

Table 3. Within and between groups comparisons of knowledge, TPB core components and total TPB score

Variables	Group	Experimental group mean (SD) / Median (IQR)	Control group mean (SD)/ Median (IQR)	*Between group (p)*
Knowledge	Baseline	71.09 ± 13.48	68.70 ± 18.6	0.62*
	Follow-up	87.39 ± 8.10	70.65 ± 16.6	0.001*
Within group (p)		0.001**	0.016**	
Attitude	Baseline	20.13 ± 1.55/ 20 (18-24)	19.87 ± 1.46/ 20(19-21)	0.574****
	Follow-up	26.13 ± 1.49/ 26(24-29)	18.79 ± 0.74/ 19(18-19)	0.001****
Within group (p)		0.001**	0.003***	
Subjective Norms	Baseline	18.43 ± 1.88/ 19(18-20)	18.91 ± 1.78/ 17(19-20)	0.849****
	Follow-up	20.65 ± 1.58/ 21(20-22)	19.35 ± 1.47/ 19(18-20)	0.006****
Within group (p)		0.001***	0.015***	
Perceived	Baseline	17.78 ± 1.95	17.61 ± 1.73/ 18(16-19)	0.75*
Behavioural	Follow-up	20.48 ± 2.23/ 21 (17-24)	18.09 ± 1.38/ 18(17-19)	0.001****
Control				
Within group (p)		0.001**	0.058***	
Behavioural	Baseline	18.52 ± 1.86/ 18(15_21)	18.65 ± 2.04/ 19(16-23)	0.947****
intention	Follow-up	21.61 ± 1.78	18.39 ± 1.56	0.001*
Within group (p)		0.001**	0.228**	
Total Score TPB	Baseline	74.87 ± 6.00/ 75(71-80)	75.04 ± 6.87/ 74(70-80)	0.928*
	Follow-up	88.87 ± 5.64/ 90(85-93)	74.61 ± 4.09/ 74(72-77)	0.001****
Within group (p)		0.001***	0.702***	

Note. *Independent t-test, **Paired t-test, ***Wilcoxon rank test, ****Mann-Whitney U test

Discussion

The findings of this study demonstrated that education based on the TPB was effective in improving knowledge and preventive behaviours related to heart disease among high-risk individuals, especially those with diabetes mellitus and hypertension. These results are consistent with previous TPB-based interventions in cardiovascular contexts. Khani Jeihooni *et al.* (2021) found that an educational program grounded in TPB significantly improved nutritional behaviours associated with cardiovascular disease, particularly through enhancing attitudes, subjective norms, and perceived behavioural control. Similarly, Wang *et al.* (2023) integrated TPB with the Temporal Self-Regulation Theory to predict physical activity behaviour among patients with coronary heart disease, showing that attitude and perceived behavioural control were key determinants of intention and subsequent behavioural change.

Increased knowledge in the current study likely strengthened participants' awareness of risk factors and facilitated more informed decision-making regarding their health. This aligns with TPB's assumption that behavioural change is driven by cognitive factors shaping individual intentions to act (Ajzen, 2010). Improvements in preventive behaviours observed in this study suggest that TPB-based education effectively targeted these determinants, leading to a higher likelihood of adopting and maintaining heart-healthy behaviours.

Moreover, the present findings reinforce the importance of focusing on behavioural intention as a critical mediator between cognition and action. Consistent with previous studies, attitude, subjective norms, and perceived behavioural control remain core components influencing behavioural outcomes in patients with or at risk of cardiovascular disease (Khani Jeihooni *et al.,* 2021; Wang *et al.,* 2023). Similar evidence has also been reported in TPB-based programs addressing heart disease prevention and lifestyle modification, highlighting their role in enhancing adherence to diet, medication, and physical activity recommendations (Izadpanah *et al.,* 2023). Collectively, these findings strengthen the argument that TPB-based

education can serve as an effective behavioural framework for promoting cardiovascular health.

The application of TPB has also proven effective in modifying health behaviours, particularly through the three main constructs of the theory: attitudes, subjective norms, and perceived behavioural control. Prior research has shown that TPB-based interventions can improve patient adherence to treatment regimens and lifestyle modifications—factors that are essential for managing chronic conditions (Paul *et al.*, 2022a; Teng *et al.*, 2023). Accordingly, it can be concluded that behavioural intention is the most influential factor driving behaviour change (Steele Gray *et al.*, 2018; Paul *et al.*, 2022b; Barbosa *et al.*, 2021; Zeidi *et al.*, 2021).

One of the primary mechanisms underlying the success of TPB interventions is the enhancement of perceived behavioural control, which increases patients' confidence in performing preventive actions. Interventions that incorporate skills training, personalized feedback, and goal-setting have been shown to improve patient adherence to recommended health practices. Evidence suggests that the reduction of perceived barriers and the increase in an individual's sense of control significantly enhance the likelihood of sustaining health behaviours over time (Barbosa *et al.*, 2021; Esferjani *et al.*, 2024). This is further supported by (Pourmand *et al.*, 2020), who emphasized that patients' perceptions of control over self-care behaviour are critical determinants of their engagement in such behaviours.

In addition to perceived behavioural control, positive attitudes toward health behaviours are fundamental in fostering the adoption and maintenance of healthy habits. TPB-based interventions aim to shift patient attitudes by delivering evidence-based information on the benefits of preventive actions and the risks associated with unhealthy behaviours. Research indicates that positive attitude changes, such as recognizing the long-term benefits of physical activity or understanding the dangers of smoking, are closely associated with

sustained behaviour change (Miller-Rosales *et al.,* 2017). Furthermore, strategies that employ emotional appeals, patient testimonials, and real-life success stories have been shown to be particularly effective in reshaping individuals' health perceptions (Siegenthaler, et al., 2021; Dudley et al., 2023).

Subjective norms, which represent the social influences on health-related decision-making, also contribute to the effectiveness of TPB-based interventions. Prior studies highlight the importance of social support from family, friends, and healthcare professionals in enhancing adherence to positive health behaviours (Okube *et al.,* 2023). Additionally, community- and culturally-based interventions have been found to exert a stronger influence on creating supportive environments that foster behaviour change. The findings of this study reinforce the notion that TPB-based educational interventions are a valuable strategy for improving knowledge and heart disease preventive behaviours.

While this study demonstrated the effectiveness of TPB-based education in enhancing knowledge and preventive behaviors, several limitations should be acknowledged. The relatively short follow-up period and the absence of long-term evaluation restricted the ability to assess sustained behavioral changes. Additionally, the small sample size and the lack of randomization may have limited the generalizability of the findings. Future research should consider increasing the sample size, employing more rigorous sampling methods, and implementing extended follow-up assessments to evaluate the long-term impact of the intervention.

Conclusions

The findings of this study suggest that a TPB-based educational intervention delivered by nurses is an effective strategy for improving knowledge and promoting heart disease preventive behaviours among high-risk individuals. This approach holds significant potential for strengthening cardiovascular disease prevention efforts, particularly in resource-limited

settings. Nurses can play a pivotal role in delivering educational interventions and facilitating behavioural change, ultimately contributing to a reduction in the burden of cardiovascular disease.

Ethical Considerations

Compliance with ethical guidelines

This research has been approved by the Health Research Ethics Committee of Dr. Moewardi General Hospital, Surakarta, Central Java, Indonesia (Number: 371/ II/ HREC/ 2024). Prior to the study, all participants received a written explanation of the research procedures, benefits, objectives, risks, and the participant's right to withdraw from the study at any time without affecting their healthcare services and an informed written consent was received. Participant information will be kept confidential and stored in a secure location accessible only to the researchers, and the data will be destroyed at the end of the research period.

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Authors' Contributions

Conceptualization, research, and supervision: DH; Data gathering: EF, DH; Data analysis: AS, DH; Consultation: MM, FNR; Initial draft preparation: DH, EF, AS, IM; Final approval: All authors.

Conflict of interest

The authors declared no conflict of interests.

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