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Original article

Predictors of behavioral risk factors associated with myocardial infarction and stroke based on protection motivation theory in middle-aged adults of Southern Iran: Threat appraisal or coping appraisal?

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Abstract: *Background* — Among noncommunicable diseases, myocardial infarction (MI) and stroke are the most common global cause of death and the most important cause of disability. However, they are also regarded as the most preventable chronic noncommunicable diseases in humans. The goal of our study was to investigate the predictors of behavioral risk factors associated with MI and stroke based on the protection motivation theory (PMT) in the middle-aged adults of southern Iran.
Methods — We conducted a cross-sectional descriptive analytical study. The study population included 383 middle-aged individuals from southern Iran. Data collection instruments included demographic questions, PMT questionnaire, and questions on preventive behaviors for MI and stroke. Descriptive and inferential statistics were calculated after data collection.
Results — The mean age of the study subjects was 41.26±8.32 years. The results of this study showed that the construct of self-efficacy has the highest predictive power of protection motivation. In our study, the most important predictors of preventive behaviors against the risk of MI and stroke were perceived severity, perceived vulnerability, self-efficacy, protection motivation, risk level, gender, and literacy level.
Conclusions — Our results confirmed that PMT is a suitable theory for preventive behaviors for MI and stroke. In this context, it is suggested to initially provide positive coping messages, especially to the middle-aged population, to increase patients' self-confidence regarding preventive behavior, especially diet and regular physical activity.

Keywords: Behavioral risk factors, myocardial infarction, stroke, protection motivation theory, middle age.

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Introduction

Cardiovascular diseases (CVD) are a major public health problem worldwide, posing significant morbidity and mortality. They are the leading global cause of death responsible for 17.9 million deaths each year. Among CVD, coronary artery disease (CAD) has the highest mortality rate [1-3]. In addition, more than four out of five CVD deaths are caused by myocardial infarction (MI) and stroke, and one-third of these deaths occur prematurely in people under 70 years of age [4].

Given the importance of this problem, the World Health Organization (WHO) warned two decades ago that CAD should be a health priority in developing countries [2]. According to the reports of the Ministry of Health, Disease Treatment and Medical Education, CVD is the leading cause of death in Iran and is responsible for one million disability-adjusted life years (DALY). CAD and stroke are the first and second leading causes of death and DALY in Iran, respectively [5]. Therefore, there is a need to have a comprehensive action plan to identify, prevent and control risk factors and occurrence of heart disease and stroke [6].

One of the comprehensive action plans compiled and developed by the WHO is the *World Health Organization Package of Essential Noncommunicable Disease Interventions* (WHO-PEN). It is used to assess the capacity of primary health care (PHC) centers to prevent and control noncommunicable diseases [7]. In this package, evidence-based interventions are structured in simple flowcharts with clear referral criteria in clinical protocols and a cardiovascular risk prediction tool, allowing health workers to target those at highest risk of MI, stroke, amputation, and kidney failure. This integrated multifactorial approach to risk is cost-effective and improves outcomes [8].

Since social and environmental causes play an important role in the incidence and prevalence of MI and stroke, it is necessary to formulate and implement high-risk group solutions and population-based solutions in society to prevent and treat MI and stroke. Important actions include addressing behavioral risk factors for MI and stroke [9]. The most important behavioral risk factors for these conditions are unhealthy diet, inactivity, smoking, and excessive alcohol consumption. The effects of behavioral risk factors can manifest themselves in individuals in the form of

elevated blood pressure, elevated concentrations of blood glucose and blood lipids, overweight, and obesity [4]. Given the public health importance of CVD, and especially MI and stroke, and their association with lifestyle behaviors, it is necessary to implement community-based health education interventions to control CVD [10].

Health education and health promotion theories and models should be used to ensure the effectiveness of health education interventions. Health education has optimal effects when combined with the use of health education theories and models, which can help identifying multiple factors that influence the behavior of individuals and communities and act as an evidence-based framework and roadmap for the program. Previous evidence suggests that planning, implementing, and evaluating health education interventions that are associated with the adoption of appropriate theories and models are effective [11]. Moreover, it has been suggested that perceptions and beliefs about disease susceptibility may play a significant role in health behavior models such as the protection motivation theory (PMT) [12].

PMT is a core framework in health psychology and health education and a social cognitive model based on research regarding the appeal of fear in determining protective health behaviors that explains the cognitively mediated process of behavioral changes in terms of threat appraisal and coping (*Figure* 1). PMT hypothesizes that motivation (intention) is to protect oneself from danger [13, 14]. When an individual faces health threats, the two processes (threat appraisal and coping appraisal) determine protective motivation (intention to perform the behavior) and, ultimately, the behavior. Threat appraisal includes perceived threats (perceived vulnerability and severity) and perceived rewards. Coping appraisal includes perceived efficacy (self-efficacy and response efficacy) and perceived response costs [15, 16].

To date, PMT has been used in complementary and alternative medicine among people with CAD [17], attitudes related to self-care behaviors in overweight/obesity [18], and the acceptance of electronic personal health records in patients with chronic diseases [19]. However, only a few studies have investigated the predictors of MI and stroke preventive behaviors using medical education theories, especially PMT; there is limited correspondence between the actual and perceived risk in people with CVD, and this risk mismatch is likely to hinder the adoption of risk-reducing behaviors [20]. Hence, we aimed to investigate the predictors of MI and stroke-related behavioral risk factors based on PMT in middle-aged people of southern Iran.

Material and Methods

Study design and sampling methods

In this cross-sectional descriptive analytical study, 383 middle-aged individuals (aged 30-60 years) from the city of Jiroft in southern Iran were recruited in 2022 using a multistage sampling method (a combination of cluster sampling, simple random sampling and systematic random sampling). First, with the cluster sampling method, each PHC center was considered as a cluster, and four centers were selected using the simple random sampling method, while a list of middle-aged individuals who underwent cardiovascular risk assessment was extracted from each center.

Inclusion and exclusion criteria

The inclusion criteria in our study were: age exceeding 30 years, ability to read and write, consent to participate in the study, and residency in Jiroft. The exclusion criteria were as follows: severe mental illness, inability to speak clearly (according to the information in the Sib system), and unwillingness to cooperate and participate in the research process.

Data collection procedure

After the prospective study population was identified, the participants were invited to participate by telephone; the purpose of the study was explained to them, and they were assured that their information would remain confidential. Demographic data, the investigator's questionnaire on PMT and behavioral factors preventing MI and stroke were collected in a safe environment. Patient risk level was extracted from the Sib system.

Data collection instrument

The data collection instrument included a three-part questionnaire (*Supplement* 1): (1) demographic questions and risk level status, (2) questions on PMT and (3) questions on preventive behavior against MI and stroke. The demographic questions included age, gender, and literacy level according to the WHO-PEN program in the Sib system in 4-grade classification of cardiovascular risk level (< 10%, 10% to 20%, 20 to 30%, and above 30%) [21].

The PMT questionnaire included 7 questions on perceived severity, 5 on perceived vulnerability, 4 on perceived rewards, 2 on perceived costs, 5 on fear, 6 on response efficacy, 6 on self-efficacy, and 1 question on protection motivation. The responses were scored on a 5-point Likert scale. The most appropriate option was scored as 5 pts, and the least appropriate option was rated as 1 pt.

The scoring of the perceived rewards and perceived costs constructs was opposite to the other constructs. The questions on MI and stroke preventive behavior included 17 questions on a 5-point Likert scale with response options ranging from '*never*' to '*always*' with the following five dimensions:

(1) *Diet* with 7 questions including consumption of unhealthy fats, intake of low-fat foods and salty foods, consumption of red meat during the week, white meat intake (fish, etc.), consumption of fast food, and sufficient fruit and vegetable intake the daily diet;

(2) *Physical activity* with 2 questions, including short-distance walking and regular physical activity;

(3) *Tobacco and drugs* with 2 questions (tobacco use, drug use);

(4) *Health management* with 4 questions, including blood pressure monitoring, routine tests, referral for risk assessment and medical care to PHC centers, and timely visits to the doctor;

(5) *Stress management* with 2 questions (the ability to control annoyance, harmful thoughts, and emotional state; the ability to control oneself in stressful situations).

In total, the questions on the behavioral factors preventing MI and stroke were scored from 17 to 85 pts.

To determine the status of the PMT constructs and preventive behavior against MI and stroke, obtaining a score above 75% of the achievable score was considered favorable, obtaining a score between 50% and 75% of the achievable score was considered

moderate, and obtaining a score below 50% was considered weak [22].

The validity of the questions was confirmed and the reliability of the questions was assessed using the Cronbach's alpha method after completing 30 questionnaires and for all constructs. We detected Cronbach's alpha scores exceeding 0.70.

Statistical analyses

The data were processed using SPSS v. 21 software and analyzed using descriptive statistics including count, percentage, median, interquartile range (IQR), minimum and maximum. Kruskal-Wallis test was employed to compare means of several populations, while Mann-Whitney test was used to compare means of two groups. Spearman correlation and linear regression analysis were used as well. The statistical significance for all tests was assumed at $p<0.05$.

Results

This study was conducted to identify the predictors of behavioral risk factors related to MI and stroke based on the PMT in the middle-aged individuals of Jiroft city.

Accordingly, *Table 1* shows the demographic parameters of the middle-aged people under investigation. Their mean age was 41.18±8.4 years. In terms of the risk level, most of 383 study participants (51.4%) had the risk level between 10% and 20% In relation to the difference in preventive behaviors in terms of demographic variables, we revealed a statistically significant difference between gender (p=0.003) and risk level (p=0.007) of preventive behaviors for MI and stroke (*Table 1*).

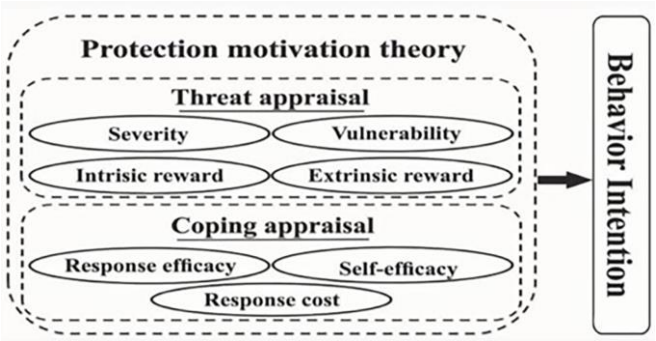

Figure 1. Protection motivation theory (adopted from the reference [15]).

Table 1. Demographic variables, risk level, mean and standard deviation of preventive behaviors for myocardial infarction and stroke in middle-aged individuals (n=383)

Variables		*Number*	*Percent*	*Median*	*IQR**	*Min*	*Max*	*P-value*
Age, years:	30-40	202	52.7	51	9.25	17	70	0.378**
	40-50	107	27.9	49	12	31	70	
	50-60	74	19.3	51	11.25	17	68	
Gender:	Male	168	43.9	49	12.	17	70	0.003***
	Female	215	56.1	52	9	17	70	
Literacy level:	Illiterate	46	12	49	12.25	17	68	0.161**
	Guidance	59	15.4	51	11	33	66	
	Secondary school diploma	89	23.2	51	11.50	17	68	
	Associate degree	43	11.2	49	7	33	66	
	Bachelor's degree	126	32.9	51.50	11	17	70	
	Master's degree	17	4.4	53	11	17	70	
	PhD degree	3	0.8	49	6	45	70	
Risk level	Under 10%	167	42.6	49	11	17	70	0.007**
	10-20%	197	51.4	51	11.50	31	70	
	20-30%	15	3.9	57	7	40	66	
	Above 30%	4	1	53	12.75	42	59	

*Interquartile range; ** Kruskal-Wallis test was used to compare several populations means; *** Mann-Whitney test used to compare the means of two groups.

Table 2. Determining the mean score of the PMT constructs and preventive behaviors in middle-aged adults

Variable	*Mean*	*SD*	*Achievable score range*	*Obtained score range*	*Percent of obtained score from the achievable score*
Perceived severity	27.93	4.75	7-35	12-35	79.8`
Perceived vulnerability	14.09	4.61	5-25	5-25	56.34
Perceived rewards	12.57	4.20	4-20	4-20	62.58
perceived costs	6.71	1.86	2-10	2-10	67.1
Fear	18.54	3.43	5-25	8-25	74.16
Self-efficacy	22.40	3.39	6-30	10-29	74.66
Response efficacy	24.50	3.54	6-30	9.30	81.66
Protection motivation	2.76	1.27	1-5	1-5	54.2
Preventive behaviors	50.06	9.69	17.85	17-72	58.89
Diet	19.73	3.97	7.35	7-27	56.37
Physical activity	4.06	2.52	2-10	2-10	40.60
Tobacco and drugs	5.91	1.94	2-10	2-10	59.1
Follow-up health monitoring	13.73	2.69	4-20	4-19	68.65
Stress management	6.44	1.58	2-10	2-9	64.4

Table 3. Pearson correlation coefficient matrix of PMT constructs in relation to preventive behaviors for myocardial infarction and stroke in middle-aged people (Spearman correlation test)

Variable	*Perceived severity*	*Perceived vulnerability*	*Perceived rewards*	*Perceived costs*	*Fear*	*Self-efficacy*	*Response efficacy*	*Protection motivation*	*Risk level*	*Preventive behaviors*
Perceived severity	1									
Perceived vulnerability	0.162**	1								
Perceived rewards	-0.091	0.052	1							
Perceived costs	-0.070	0.056	0.274**	1						
Fear	0.389**	0.204**	-0.087	-0.096	1					
Self-efficacy	0.340**	0.210**	-0.117*	-0.030	0.196**	1				
Response efficacy	0.391**	-0.003*	-0.194**	0.021	0.183**	0.466**	1			
Protection motivation	0.349**	0.142**	-0.157**	-0.179**	0.409**	0.179**	0.179**	1		
Risk level	0.335**	0.103*	-0.104*	-0.188**	0.287**	0.137**	0.114*	0.384**	1	
Preventive behaviors	0.450**	0.323**	-0.088	-0.095	0.277**	0.485**	0.271**	0.409**	0.333**	1

*P-value<0.05; **P-value<0.01.

Table 4. Predictors of preventive behaviors for myocardial infarction and stroke in middle-aged people

Variables	*B*	*SE*	*Beta*	*P*	*F*	R^2
Constant (a)	2.945	2.546		0.248	62.77	53.1
Perceived severity	0.380	0.074	0.209	0.000		
Perceived vulnerability	0.344	0.069	0.184	0.000		
Self-efficacy	0.916	0.099	0.360	0.000		
Protection motivation	1.493	0.557	0.106	0.008		
Risk level	1.546	0.271	0.228	0.000		
Gender	1.799	0.614	0.103	0.004		
Literacy	0.460	0.203	0.081	0.024		

The mean, standard deviation and range of the achievable score, as well as the percentage of the obtained score from the achievable score of the PMT constructs, are presented in *Table 2*.

Spearman's correlation coefficient matrix of PMT constructs for MI and stroke preventive behaviors in middle-aged individuals is shown in *Table 3*. Our results implied that there was a statistically significant correlation between the risk level and perceived vulnerability, perceived severity, fear, self-efficacy and protection motivation ($p<0.01$ in all cases), as well as between the risk level and response efficacy ($p<0.05$).

Also, we revealed an inverse statistically significant correlation between the risk level of and perceived rewards ($p<0.05$). There was a significant correlation between preventive behaviors against the risk of MI and stroke and all PMT constructs, except for perceived rewards and perceived costs, which exhibited an inverse statistically significant correlation with preventive behaviors ($p>0.05$), ($p<0.01$ except for two instances).

Table 4 specifies the predictors of preventive behaviors for MI and stroke. According to the results of linear regression, the most important predictors of the kind are perceived severity, perceived vulnerability, self-efficacy, protection motivation, risk level, gender, and literacy level. In total, in our study, these variables predicted 53.1% of preventive behaviors for MI and stroke. Among the above variables, self-efficacy, risk level, perceived severity and perceived vulnerability with higher beta coefficient values played a more important role in predicting preventive behaviors for myocardial infarction and stroke.

Discussion

Our results showed that 43.6% of the participants were at a risk level of less than 10%, while 51.4% were at a risk level between 10% and 20%. However, in the study by Mirzaei et al., 7.8% were at an intermediate risk level, and 86% were at a low risk level (less than 10%) [23]. Similarly, a 2020 study that used the SCORE tool to estimate the 10-year risk of developing CVD showed that among female participants, 53.8% were at a low risk level and 24.6% were at an intermediate risk level, while in 24.6%, the risk level was high [24]. In the study by Kharqani et al., 100% of people over 30 years of age had a risk level below 10% [25]. It appears that such difference in results may be due to the use of different assessment tools and the prevalence of risk factors in different societies, age groups, and genders.

In the present study, significant correlations (all $p<0.01$) were observed between MI and stroke preventive behaviors and all constructs of PMT except perceived rewards and perceived costs (for those, $p>0.05$). Perceived costs and rewards were inversely statistically significantly correlated with preventive behaviors. In addition, according to the linear regression results, the most important predictors of MI and stroke risk preventive behaviors were perceived severity, perceived vulnerability, self-efficacy, protection motivation, risk level, gender, and literacy level. Among the above variables, self-efficacy, risk level, perceived severity and perceived vulnerability with higher values of beta (β) coefficients played a more important role in predicting preventive behaviors for MI and stroke.

In the publication by Plotnikoff et al. (1995), a direct statistically significant relationship was found between self-efficacy and response efficacy for a low-fat diet, while there was no significant correlation between vulnerability and perceived severity [3]. In a path analysis, Calder et al. (2011) showed that the coping appraisal component (self-efficacy, response efficacy, and perceived costs) was significantly associated with behavioral intention to consume omega-3 fatty acids [26]. Contrariwise, in the study by Chamroonsawasdi et al. (2021), the strongest predictor of behavioral intention in eating behavior was response efficacy, while self-efficacy was the strongest factor for physical activity to prevent diabetes [27]. Results by Plotnikoff et al. (2002) showed that overall self-efficacy and response efficacy had a stronger direct statistically significant relationship with exercise behavior in the prevention of CAD than perceived vulnerability and severity.

In the aforementioned studies, just as in our research, self-efficacy was an effective factor in predicting low-fat diet intake [3], omega-3 fatty acid consumption [27], physical activity, and exercise behavior [27] for the prevention of CVD. Self-efficacy is described as a cognitive process in which individuals, through environmental and social influences, learn new behavioral patterns that influence their ability to improve future events. Therefore, self-efficacy can be viewed as an individual's belief in

his or her ability to perform successful activities that can change an individual's behavior [28, 29].

In Blanchard et al. (2011), the authors showed that intention (protection motivation) was a key predictor of physical activity during home-based CVD rehabilitation [30]. In Brouwer-Goossensen et al. (2016), self-efficacy, fear, and response efficacy were determinants of intention to change health-related behavior after transient ischemic attack or stroke [31]. In the study by Blanchard et al. (2009), coping appraisal variables (response efficacy and self-efficacy) potentially explain exercise behavior during home-based cardiac rehabilitation [32]. In the above-mentioned studies, self-efficacy was considered as a general predictor of physical activity intention and behavior [30, 33] and health-related behaviors [31] in both patients and healthy individuals. Response efficacy was also an effective factor for preventive behaviors aimed at preventing disease aggravation or recurrence in patients [31, 32].

It seems that when a risk factor is potentially harmful and dangerous, or people's perception of the adverse consequences of the risk factor is high, such as tsunami [34] or earthquake [35], the threat appraisal includes perceived threats (perceived vulnerability and severity) and in some cases perceived rewards are the most important determinants of protection motivation and preventive behaviors. However, when threats are perceived as having only moderate risk in the short-term or medium-term, or the individual's risk perception is not high, such as when following a low-fat diet [3] and consuming omega-3 fatty acids [26] for the prevention of CVD, coping appraisal includes perceived efficacy (self-efficacy and response efficacy) and perceived costs as determinants of protection motivation (intention to perform the behavior) and preventive behavior.

When a person perceives a risk factor to be physically far away or to occur in the medium-term or longer-term rather than immediately, it is possible that a combination of threat appraisal and coping appraisal constructs determine protection motivation and preventive behaviors. E.g., in the case of the COVID-19 pandemic, higher general anxiety (higher perceived vulnerability and severity) with better adherence to disease preventive behavior was associated with greater disease severity [36].

Results from Tulloch et al. (2009) supported PMT for short-term (six months or less) but not long-term (one year or more) exercise behavior among patients with CAD [33]. In the study by Reid et al. (2007), regression analysis of pre-active stages between the onset of hospitalization for CAD and 6-month follow-up showed increased perceived susceptibility to a future CAD-related event, lower willingness to exercise, lower self-efficacy, and greater barriers to exercise [37]. Fear of physical activity and exercise after CAD may be a barrier to physical failure in patients. Indeed, in the study by Bäck et al., high levels of kinesiophobia were observed in 20% of patients with CAD [37]. In the study by Zhang et al., 54.8% of patients with heart failure experienced fear of movement [39], while in the study by Shen et al., 75.7% of patients experienced it [39]. This is an example of how important a healthy lifestyle is for preventing CAD [41].

Study limitations

Among the limitations of the present study, it should be noted that the study process was lengthy due to the lack of timely referral of people who wanted to participate in the study to the PHC center to complete the questionnaire. In addition, the cross-sectional nature of the study precludes causal inference.

Conclusion

In our study, the most important predictors of preventive behaviors against the risk of MI and stroke were perceived severity, perceived vulnerability, self-efficacy, protective motivation, risk level, gender, and education level. In addition, among the above variables, self-efficacy, risk level, perceived severity, and perceived vulnerability played a more important role in predicting preventive behaviors for MI and stroke. According to our results, educational interventions related to preventive behaviors against the risk of MI and stroke may need to provide positive coping messages, especially to middle-aged adults, in order to improve their self-confidence in preventive behaviors, particularly diet and regular physical activity. We advocate that future analytical or intervention studies should examine a variety of illnesses and conditions of varying severity over the short, medium, and long term. We also suggest that educational interventions based on protection motivation theory should be properly assessed.

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Author contributions

RF, EM and AMS were involved in all aspects of study concept and design; data collection, analysis and interpretation; draft manuscript [reparation, and critical revision of the manuscript for intellectually important content. CC helped with the general design of the study, data analysis and interpretation of results, co-authoring, and editing the entire manuscript. All the authors have read and approved the final version of the manuscript and agreed to be accountable for all aspects of the work.

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Availability of data and materials

The raw data and materials from this study are available from the corresponding author upon reasonable request. The data presented in this study are openly available in one of the repositories or will be available on request from the corresponding author by this journal representative at any time during submission or after publication. Otherwise, all consequences of possible withdrawal or future retraction will be with the corresponding author.

Ethical approval and consent to participate

All participants were informed that studies involving human participants complied with the ethical standards of the Institutional Research Committee and the 1964 Declaration of Helsinki and its latest amendment. All study participants signed informed consent forms before participating in the study. This article is based on the doctoral dissertation in general medicine, which was completed with the financial support of the Vice-Chancellor for Research and Technology of Jiroft University of Medical Sciences and approved by the ethics code IR.JMU.REC.1401.046 in the Ethics Committee of the Iran Ministry of Health. We, the authors of this article, also confirm that we did not used artificial intelligence or artificial intelligence technology while preparing this manuscript.

Consent for publication

Not applicable.

Competing interests

The authors declare no competing interests.

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Supplement 1.

Predictors of behavioral risk factors associated with myocardial infarction and stroke based on protection motivation theory in middle-aged adults of southern Iran: Threat appraisal or coping appraisal?

A) Demographic variables:

Age, years 30-40
40-50
50-60
Gender Male
Female
Literacy level Illiterate
Guidance
Secondary school diploma
Associate degree
Bachelor's degree
Master's degree
PhD degree
Risk level <10%
10-20%
20-30%
>30%

B) Protection motivation theory questionnaire:

Choose the most relevant response to the following questions:

##	*Perceived severity*	*Not at all*	*A little*	*To some extent*	*A lot*	*Too much*
1	How dangerous do you think heart attacks and strokes are?					
2	To what extent do you think a stroke can cause paralysis?					
3	To what extent do you think a heart attack can disrupt your daily routine?					
4	To what extent do you think having a heart attack or stroke can cause you and the people around you to lose their lives?					
5	Is the damage caused by a heart attack or stroke irreparable?					
6	Can having a heart attack or stroke cause serious physical damage?					
7	To what extent do you think having a heart attack or stroke can cause psychological distress?					
-	*Perceived vulnerability*	*Not at all*	*A little*	*To some extent*	*A lot*	*Too much*
1	How likely are you to be at risk for heart attacks and strokes right now?					
2	I am not at risk for heart attacks and strokes because I am weak					
3	Like others, I am susceptible to injuries caused by heart attack and stroke					
4	I am not at risk for heart attacks and strokes because I adhere to a healthy diet					
5	Because I live away from stressful environment, I am not at risk for heart attack and stroke					

Specify your level of agreement or disagreement with the following statements:

##	*Perceived rewards:* When I do not implement protective behaviors against heart attack and stroke, ...	*Totally disagree*	*Disagree*	*Not sure*	*Agree*	*Totally agree*
1	… my expenses are saved					
2	… my time is saved					
3	… my time is saved					
4	… I have no worries or concerns about the possibility of heart attack or stroke.					
5	… I feel more secure					
-	*Perceived costs*	*Totally disagree*	*Disagree*	*Not sure*	*Agree*	*Totally agree*
1	Activities such as regular exercise take up a lot of time					
2	Because preventive measures against heart attack and stroke are expensive, I do not undertake them					
-	*Self-efficacy*	*Totally disagree*	*Disagree*	*Not sure*	*Agree*	*Totally agree*
1	I can eat a healthy diet to reduce my risk of having a heart attack or stroke, even if people around me tell me otherwise					
2	I can exercise regularly on a daily basis, even if I have to spend time doing this					
3	I can take steps to prevent heart attack and stroke, even if I have to pay for it					
4	I can learn the necessary information to prevent heart attack and stroke					
5	I can learn basic first aid to help someone having a heart attack or stroke					
6	I have learned preventive measures in accordance with the health expert's opinion on the level of risk in the cardiovascular risk assessment					

Specify your level of agreement or disagreement with the following statements:

##	*Response efficacy:* *By taking the necessary steps to combat heart attack and stroke, …*	*Totally disagree*	*Disagree*	*Not sure*	*Agree*	*Totally agree*
1	… I prevent complications of cardiovascular diseases					
2	… I have more peace of mind					
3	… I can live longer					
4	… the serious consequences of heart attack and stroke will be prevented					
5	Taking preventive measures against heart attack and stroke will improve the physical and mental health of me and my family					
6	When I take the necessary steps to prevent cardiovascular diseases (daily exercise, proper diet, etc.), my family and people around me support me more					
-	*Fear*	*Totally disagree*	*Disagree*	*Not sure*	*Agree*	*Totally agree*
1	When I think about having heart attack and stroke, I become anxious and worried					
2	When I think about having a heart attack or stroke, I cannot sleep or have disturbing dreams					
3	When I think about having a heart attack or stroke, I cannot sleep or have disturbing dreams					
4	I get very scared when I think about the day I might lose my loved ones to heart attacks or strokes.					
5	I get anxious when I think about complications from a heart attack or stroke					

Specify your level of agreement or disagreement with the following statements:

##	*Protection motivation:* *Are you thinking about being prepared to cope with heart attack and stroke?*	*Totally disagree*	*Disagree*	*Not sure*	*Agree*	*Totally agree*
1	A Yes, I have been taking the necessary measures to prevent heart attacks and stroke for more than 6 months					
2	B Yes, I have been taking the necessary measures to prevent heart attacks and stroke for less than 6 months					
3	C No, but next month I will finally make up my mind to take the necessary measures to prevent heart attacks and stroke					
4	D No, but in the next six months I will finally make up my mind to take the necessary measures to prevent heart attacks and stroke					
5	E No, in the next six months I will not make up my mind to take preventive measures against heart attacks and stroke.					

C) Questions on behaviors to prevent heart attack and stroke

##	*Statement*	*Never*	*Rarely*	*Sometimes*	*Often*	*Always*
1	I eat fats and oils such as beef tallow, lard, animal fats, vegetable oils					
2	I eat low-fat foods					
3	I eat salty foods					
4	I eat red meat often during the week					
5	I eat white meat (fish, etc.) often during the week					
6	I eat fast food					
7	I eat enough fruits and vegetables every day					
8	I walk short distances					
9	I exercise regularly during the week					
10	I smoke					
11	I use drugs					
12	I monitor my blood pressure regularly					
13	I get regular check-ups to know my health					
14	I see my doctor regularly for risk assessment					
15	I see my doctor regularly to monitor my health and control my risk factors for heart attack and stroke					
16	I can control anxious thoughts and feelings					
17	I can control myself in stressful situations					

Description:

Dimensions, number of questions and how to calculate the score, validity and reliability

The data collection instrument includs a three-part questionnaire: (1) demographic questions and risk level status, (2) questions on protection motivation theory (PMT) and (3) questions on preventive behavior for myocardial infarction (MI) and stroke. The demographic questions include age, gender, and literacy level according to the WHO-PEN program in the Sib system in 4-grade classification of cardiovascular risk level (< 10%, 10% to 20%, 20 to 30%, and above 30%).

The PMT questionnaire includes 7 questions on perceived severity, 5 on perceived vulnerability, 4 on perceived rewards, 2 on perceived costs, 5 on fear, 6 on response efficacy, 6 on self-efficacy, and 1 question on protection motivation. The responses were scored on a 5-point Likert scale. The most appropriate option was scored as 5 pts, and the least appropriate option was rated as 1 pt.

The scoring of the perceived rewards and perceived costs constructs is opposite to the other constructs. The questions on MI and stroke preventive behavior include 17 questions on a 5-point Likert scale with response options ranging from '*never*' to '*always*' with the following five dimensions:

(1) Diet with 7 questions including consumption of unhealthy fats, intake of low-fat foods and salty foods, consumption of red meat during the week, white meat intake (fish, etc.), consumption of fast food, and sufficient fruit and vegetable intake the daily diet;

(2) Physical activity with 2 questions, including short-distance walking and regular physical activity;

(3) Tobacco and drugs with 2 questions (tobacco and drug use);

(4) Health management with 4 questions, including blood pressure monitoring, routine tests, referral for risk assessment and medical care to primary health care centers, and timely visits to the doctor;

(5) Stress management with 2 questions (the ability to control annoyance, harmful thoughts, and emotional state; the ability to control oneself in stressful situations). In total, the questions on the behavioral factors preventing MI and stroke can be scored from 17 to 85 pts.

To determine the status of the PMT constructs and preventive behavior against MI and stroke, obtaining a score above 75% of the achievable score is considered favorable, obtaining a score between 50% and 75% of the achievable score is considered moderate, and obtaining a score below 50% is considered weak.

The validity of the questions was confirmed and the reliability of the questions was assessed using the Cronbach's alpha method after completing 30 questionnaires and for all constructs. We detected Cronbach's alpha scores exceeding 0.70.