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Analysis of the Results of Cardiovascular Disease Risk Assessment Program

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ABSTRACT

BACKGROUND AND OBJECTIVE: Risk assessment is one of the most important strategies in estimating the risk of cardiovascular disease and controlling the risk factors. In Iran, half of all deaths and 79% of deaths due to non-communicable diseases are attributed to cardiovascular diseases. The aim of this study was to analyze the results of cardiovascular disease risk assessment program in Mazandaran province.

METHODS: This cross-sectional study was performed in 2019 on 600 patients referred to comprehensive health centers of Noor and Mahmoudabad cities in Mazandaran province. The data collection tool was a checklist containing the risk factors studied in the SIB system. Descriptive statistics such as mean, standard deviation, frequency and percentage as well as analytical statistical tests such as chi-square, regression and analysis of variance were used using SPSS software version 19.

FINDINGS: The prevalence of risk factors for cardiovascular disease including history of diabetes, history of hypertension, obesity, high cholesterol, family history of diabetes and heart disease were 36.5%, 45.5%, 42.3%, 34.8%, 23.5% and 10%, respectively. The four variables of age, history of diabetes and hypertension, and blood cholesterol levels were significantly associated with the 10-year risk of cardiovascular disease. With increasing one year of age, the 10-year risk level increased by 15% ($p<0.001$), and by seven times in people with a history of diabetes ($p<0.001$) and increased by 83% in people with a history of high blood pressure compared to others individuals ($p=0.022$).

CONCLUSION: The results of the study showed that in Mazandaran province, four variables of age, history of diabetes and hypertension and cholesterol levels are the most common factors that are associated with 10-year risk of cardiovascular disease.

KEY WORDS: *Risk Assessment, Patients, Cardiovascular Diseases.*

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Introduction

Non-communicable diseases are responsible for more than 71% of all deaths worldwide, with more than a quarter of these deaths occurring in low- and middle-income countries (1). These diseases are currently the leading cause of death in all parts of the world except Africa and are projected to be the leading cause of death in all countries by 2030. In addition, the economic costs imposed on countries due to the four cardiovascular diseases, cancer, diabetes and chronic respiratory diseases are estimated to be around $ 30 billion between 2011 and 2030 (2).

In Iran, half of all deaths and 79% of deaths due to non-communicable diseases are attributed to cardiovascular diseases. On the other hand, more than 76% of the total burden of diseases and the first cause of catastrophic health expenditures in Iran is related to these diseases (3, 4). According to the Global Burden of Disease Report in 2015, Iran is one of the countries with the highest rate of disease prevalence with more than 9,000 cases of cardiovascular disease per 100,000 people (5).

Cardiovascular diseases, cancers, chronic respiratory diseases and diabetes account for 80% of deaths from non-communicable diseases (6). These four diseases are mainly caused by the four modifiable risk factors of smoking, unhealthy diet, physical inactivity and alcohol consumption. Therefore, the basis of prevention of non-communicable diseases is to identify the main risk factors and control them (1). For this reason, the World Health Organization has set the control of these diseases and their underlying factors as the main goal for reducing 25% of deaths due to non-communicable diseases by 2025. The organization considers the integration of interventions in primary health care as the best model, which in addition to low cost, has also brought justice in access to services (7, 8).

In this regard, the package of essential non-communicable (PEN) diseases interventions has been proposed by the World Health Organization. One of the most important interventions in this package is the 10-year risk assessment of cardiovascular events (9). Cardiovascular risk assessment is a suitable approach to calculate the probability of these events occurring in the next ten years. Using this approach and integrated care of non-communicable diseases, limited resources can be directed to the most needy sections of the population (10). So far, several well-known risk assessment models and charts have been introduced. These include the Framingham risk score, the integrated general equations recommended by the American Heart College, and the SCORE, ASSIGN, Q-Risk, and Globorisk risk prediction models (11). These models are used for general risk classification and disease management in primary health care.

In Iran, the 10-year risk assessment model of myocardial infarction is used according to the WHO / ISH table in the Eastern Mediterranean region B. Indicators such as age, gender, blood pressure, smoking and alcohol use, diabetes and blood cholesterol are used to determine the risk. In Iran, the target group of the program includes people aged 30 years and older. After the health care providers enter the required information in the integrated health system (SIB), this tool determines a risk score as a risk factor for heart attacks and strokes in the next ten years. Then, based on the results of this evaluation, integrated care is performed with the participation and coordination of different levels of the network system (10).

Using risk assessment tools is an effective approach to disease management. This approach is economically viable and minimizes over-treatment, and it provides specific guidelines for disease management that can be used to evaluate interventions (12, 13). The results of various studies have shown the positive effect of risk assessment program on reducing the prevalence of risk factors in patients (14-16). However, this program, like all health system interventions, needs assessment studies and results analysis to improve. In addition, recognizing the common risk factors in each area improves the focus on interventions on effective prevention and treatment measures and contributes to adopting evidence-aware policies to reduce these risk factors. Therefore, this study was conducted to analyze the results of cardiovascular disease risk assessment program in comprehensive health service centers in Mazandaran province.

Methods

This cross-sectional study was conducted in 2019 after approval by the Ethics Committee of Islamic Azad University, Chalus Branch with the code IR.IAU.CHALUS.REC.1397.026. The two cities of Noor and Mahmoudabad were randomly selected and clients of comprehensive health service centers in these cities were included in the study. The total number of clients in 2018 and 2019 in these two cities was 60,000 people and the sample size of 600 people was selected

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using systematic sampling method. Data were collected using a researcher-made checklist including risk factors assessed in the cardiovascular disease risk assessment program (such as location, gender, age, height, weight, body mass index, cholesterol level, blood sugar, blood pressure, waist circumference, family history of diabetes and hypertension, diabetes and hypertension and 10-year risk level) entered by health care providers in the SIB system.

After entering the data in the SIB system, which based on risk factors determines the risk of cardiovascular stroke in the next ten years, people were classified in 4 high-risk groups of low-risk (10-year risk rate less than 10%), average (10-20%), high (20-30%) and very high (more than 30%) (10). Data were analyzed using SPSS 19 software and statistical tests of X^2, one-way ANOVA and regression. For logistic regression, percentage more than 10% was considered as risky and for regression analysis, the effects were reported by adjusting other variables and $p<0.05$ was considered significant.

Ethical considerations and submission of letters of introduction to Mazandaran University of Medical Sciences and health centers of the studied cities, maintaining the confidentiality of information and impartiality of researchers were observed in all stages of the research.

Results

The mean age of the subjects was 59.18±15.95 years. Most participants in the study were women (365 subjects, 60.8%), 459 had no family history of diabetes (76.5%) and 540 had heart disease (90%). 219 subjects (36.5%) had diabetes and 273 (45.5%) had high blood pressure. Furthermore, more than 371 (61.8%) subjects had a risk level of less than 10% and 23 (3.8%) subjects had a risk level above 30% (Table 1). The results of this study showed that the mean age of individuals with a risk level of less than 10% (group one) was significantly lower than the mean age of individuals in other groups ($p<0.001$).

Moreover, blood cholesterol levels were significantly different between groups and the lowest and highest blood cholesterol levels were in people with a risk level of less than 10% (group one) and people with a risk level of more than 30% (group four), respectively. In other words, as people's blood cholesterol levels rise, so does their risk. This relationship was also present in the mean fasting blood sugar and with its increase, the risk level also increased ($p=0.001$). The highest mean fasting blood sugar was in people with a risk level greater than 30% (183) and the lowest was in people with a risk level less than 10% (116.9). More than 30% of those with a history of diabetes had a high or very high risk level, compared with about 7% of those without a history of diabetes. Also, about a quarter of people with a history of high blood pressure had a high and very high risk level, while this rate was 7.3% in people without a history. In other words, people with a history of diabetes ($p<0.001$) or high blood pressure ($p<0.001$) were at significantly higher risk.

Table 1. Frequency distribution and percentage of demographic characteristics and background factors of participants.

Underlying factor	Number(%)
Gender	
female	365(60.8)
male	235(39.2)
Family history of diabetes	
no	459(76.5)
yes	141(23.5)
Having diabetes	
no	381(63.5)
yes	219(36.5)
Cholesterol levels	
Less than 200	391(65.2)
More than 200	209(34.8)
Level of risk	
Group one (less than 10%)	371(61.8)
Group one (less than 10-20 %)	136(22.7)
Group one (less than 20-30 %)	70(11.7)
Group four (more than 30%)	23(3.8)
Location	
City	300(50)
Village	300(50)
Family history of heart disease	
no	540(90)
yes	60(10)
Having high blood pressure	
no	327(54.5)
yes	273(45.5)
waist circumference	
Less than 90	226(37.7)
More than 90	374(62.3)
Body Mass Index	
Less than 19	9(1.5)
19-25	109(18.2)
25-30	228(38)
More than 30	254(42.3)

Among the participants with a family history of diabetes, 17.7% had a high and very high risk level, while the rate of participants without a family history of diabetes was 14.8%. People with a family history of diabetes had a significantly higher risk level ($p=0.050$). Also, the level of risk was significantly different between urban and rural residents and urban residents had a lower average risk level ($p<0.001$). While 7.3% of urban residents had a high and very high level of risk, this percentage was 23.7% in rural residents. Finally,

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women were significantly more at risk than men (p=0.007). While less than 10% of men had high and very high risk levels, about 20% of women had this risk level (Table 2). Based on the results of multiple logistic regression, the relationship between four variables of age, history of diabetes, history of hypertension and blood cholesterol level with a ten-year risk level of cardiovascular disease is significant; with one year increase of age, the ten-year risk level of cardiovascular disease increases by 15% (p<0.001), in people with a history of diabetes, the level of 10-year risk of cardiovascular disease increases by 6 times compared to other people (p<0.001), in people with a history of high blood pressure, this rate increases by 83% compared to other people (p=0.022) and in people with high blood cholesterol, the ten-year risk level of cardiovascular disease increases by 6.37 times compared to other people (p<0.001). The predictive power of this model in predicting changes in cardiovascular risk factors was 62% (Table 3).

Table 2. Relationship between contextual variables in cardiovascular disease risk assessment and risk assessment levels

Variable	Cardiovascular disease risk level				p-value
	Less than 10%	10-20%	20-30%	More than 30%	
Mean age	50.9±13.84	74±7.16	71±9.13	69±9.63	<0.001
Mean MBI	30.5±5.94	29.3±5.21	28.5±5.23	30.4±6.60	0.141
Mean waist circumference	96±12.69	90.1±14.53	96.3±14.09	102.2±14.04	0.012
Mean cholesterol levels	183.4±40.48	195.1±41.11	218.6±50.50	269±89.38	<0.001
Mean fasting blood sugar	116.9±66.75	156.6±54.39	172.7±70.61	183±90.50	0.001
Gender					
Female	210(57.6%)	84(23%)	53(14.6%)	18(5%)	0.007
Male	161(68.5%)	52(22.1%)	17(7.2%)	5(2.1%)	
Family history of diabetes					
Yes	93(66%)	23(16.3%)	22(15.6%)	3(2.1%)	0.050
No	278(60.6%)	113(24.6%)	48(10.4%)	20(4.4%)	
Family history of heart disease					
Yes	32(53.3%)	21(35%)	7(11.7%)	0(0%)	0.060
No	339(62.8%)	115(21.3%)	63(11.7%)	23(4.3%)	
History of diabetes					
Yes	74(33.8%)	79(36%)	52(23.7%)	14(6.4%)	<0.001
No	297(78%)	57(15%)	18(4.7%)	9(2.4%)	
History of high blood pressure					
Yes	120(44%)	85(31.1%)	51(18.7%)	17(6.2%)	<0.001
No	251(77%)	52(15.9%)	18(5.5%)	6(1.8%)	
Location					
City	191(63.7%)	87(29%)	19(6.3%)	3(1%)	<0.001
Village	180(60%)	49(16.3%)	51(17%)	20(6.7%)	

*To evaluate the relationship between class variables and quantitative variables and the risk level of cardiovascular disease, chi-square and one-way ANOVA tests were used, respectively.

Table 3. Determining the relationship between underlying and demographic factors on the ten-year risk of cardiovascular disease using multiple logistic regression

Variable	Standard Error (S.E)	p-value	Odds ratio (Exp (β))	Confidence interval-odds ratio
The first model				
Gender	0.29	0.642	1.14	(0.2-64.05)
Age	0.01	<0.001	1.15	(1.1-12.18)
Family history of diabetes	0.35	0.867	0.94	(0.1-46.89)
Family history of heart disease	0.46	0.642	1.23	(0.3-50.05)
Having diabetes	0.28	<0.001	7.15	(4.12-12.41)
Having high blood pressure	0.27	<0.017	1.92	(1.3-12.29)
Waist circumference	0.30	0.773	0.91	(1.1-50.65)
Blood cholesterol levels	0.44	<0.001	7.37	(3.16-21.92)
Body mass index	0.30	0.616	0.85	(0.1-46.56)
The second model				
Age	0.01	<0.001	1.15	(1.1-12.18)
Having diabetes	0.27	<0.001	7.02	(4.12-10.02)
Having high blood pressure	0.26	0.022	1.83	(1.3-09.08)
Blood cholesterol levels	0.42	<0.001	7.37	(3.16-21.92)

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Discussion

The results of the study showed that more than 61% of participants were at low risk level, 22.7% were at medium risk level and 11.7% were at high risk level. Moreover, 3.8% of people had a very high risk of cardiovascular disease in the next ten years. In a 2020 study that used the SCORE tool to assess the 10-year risk of cardiovascular disease, it was found that among the studied female participants, 53.8% were at low risk level, 24.6% at medium risk level and 21.6% at high risk level. This rate was 36.6%, 28.4% and 35% in men, respectively (17). The results of this study are somewhat similar to the present study. However, due to the different evaluation tools and also the different prevalence of risk factors in different societies, the differences seem natural.

The results of this study indicate a relatively high prevalence of cardiovascular disease risk factors in the studied population. In the study of Eslami et al., which was performed longitudinally and evaluated the prevalence of risk factors for cardiovascular disease in the population over 60 years of age between 2002 and 2014, the prevalence of all risk factors increased during this period. The prevalence of diabetes, hypertension and obesity at the end of the period was 35%, 56% and 61% in men and 42%, 71% and 74% in women, respectively. Physical activity was decreasing in women and increasing in men (18).

Since the prevalence of cardiovascular disease risk factors increases with age (19, 20), the higher prevalence of risk factors in this study can be related to the older age of the participants. Moreover, Sarrafzadegan et al. in a review article found the prevalence of hypertension, diabetes, high cholesterol, obesity and smoking in the population over 40 years equal to 42.2%, 18.7%, 65.4%, 26.4% and 13%, respectively (5). In this research, the results of published studies in Isfahan in 2007 have been used. Therefore, considering the increasing trend of risk factors in the Iranian population in recent years, the difference between the results of this study and the present study seems natural considering the time interval.

The results of regression test showed that the variables of age, blood cholesterol level, history of diabetes and history of hypertension were significantly associated with the 10-year risk level of cardiovascular disease. In this study, it was shown that the mean age in low-risk individuals was significantly lower than the mean age in other individuals. Other studies have shown that the risk of cardiovascular disease increases with age (19, 21). Although age is an unchanging risk factor, health care providers play an important role in changing the lifestyle of older people and reducing their chances of developing cardiovascular disease (21). Diabetes and hypertension are other risk factors that in this study showed a significant relationship with the 10-year risk level of cardiovascular disease. The association between diabetes and cardiovascular disease has been reported in many studies (22-24). Van Der Aalst et al. showed that diabetes and high blood pressure put people at higher risk (17). Accordingly, in Iran, according to the IraPEN guidelines and in the form of referral system, patients with diabetes and hypertension are identified and comprehensive care, referral to higher levels and tests are performed for them (10, 25).

By comparing the frequency of family history of diabetes in groups with different levels of risk of cardiovascular disease, it was shown that people with a family history of diabetes had a significantly higher mean risk level. Family history, in addition to the effect of genetic predisposition to cardiovascular disease, is very influential in the transmission of unhealthy lifestyles. Research has shown that the prevalence of obesity, smoking and unhealthy diet in people with a family history of diabetes is higher than other people in the community (26, 27). Therefore, it is necessary for educational care interventions to be used by health care providers to change the lifestyle of these people.

Research has shown that conducting studies aimed at analyzing the results of risk assessment in different populations helps to identify the most important regional risk factors and long-term planning and application of intervention measures for disease management (28). Iran is committed to a 25% reduction in the risk of premature death from cardiovascular disease in the National Non-Communicable Diseases Document. Hence, the use of multi-sectoral participation and an integrated approach is essential for a coherent and comprehensive response (29, 30).

Despite the success of the IraPEN program in the country, this program still has challenges such as lack of cross-sectoral coordination, non-compliance of the network system with the needs of patients, lack of integrated information system and instability of financial resources (31). Moreover, despite the positive performance of the program in risk assessment, care and follow-up after it is difficult. In one study, it was shown that only 32% of people with diabetes and 41% of people with high blood pressure receive full follow-up and care (32).

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One of the limitations of this study is the effect of certain variables available in the system on the level of risk of cardiovascular disease. However, several other variables may affect the risk of these diseases, which have not been considered in this study.

Overall, the results of this study indicate the relatively high prevalence of cardiovascular disease risk factors in Mazandaran province. Continuation of risk assessment program and focus of necessary interventions on the most common risk factors in the province has an important role in the management of cardiovascular disease. Due to the high prevalence of obesity, diabetes and high blood pressure in this province, it is recommended to implement intervention and educational programs to improve lifestyle. Risk assessment in people over the age of 18 can also help identify people at risk early. Given the effectiveness of care and follow-up of people at high risk, the adoption of this approach should be on the agenda of managers and policy makers. Also, it is suggested that the impact of variables such as economic and social factors be examined in other studies and similar studies be conducted in the country to obtain integrated information on the most common risk factors for cardiovascular disease.

Conflict of interest: The authors have stated that they have not had any conflict of interest.

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