Original Article

Assessment and Analysis of the Data from the Program "Basic Interventions of Non-Communicable Diseases in Iran's Primary Health Care System in Urmia City, Iran, 2023

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Abstract

Background: Cardiovascular diseases are among the leading causes of death and disability worldwide, including in Iran. Identifying their risk factors is essential for implementing cost-effective preventive interventions. This study aimed to determine the prevalence of behavioral risk factors for non-communicable diseases and their relationship with of cardiovascular diseases risk level in Urmia City, Iran. **Materials and Methods:** This cross-sectional study involved 10,000 individuals aged 30 years and older who underwent risk assessment in 2023. Participants were selected through multi-stage cluster sampling. Data were collected using a researcher-designed checklist within the Integrated Health System and analyzed using, employing independent t-tests and Chi-square tests. **Results:** The prevalence of risk factors was: history of diabetes (12.22%), hypertension (17.24%), high cholesterol (14.93%), family history of diabetes (4.25%), pre-diabetes (7.19%), and pre-hypertension (29.33%). The distribution of risk levels was as follows: 91.15% of participants was classified as having a risk level below 10%, 8.24% between 10 and 20%, 0.33% between 20 and 30%, and 0.28% above 30%. There was a significant positive correlation between risk level and fasting blood sugar, cholesterol, systolic and diastolic blood pressure, age, body mass index (BMI), and waist circumference. **Conclusions:** The implementation of the risk assessment program and the identification of risk factors at early stages will help in the regular follow-up of high-risk individuals, provide them with necessary health care, and lead to the prevention or early diagnosis of disease.

Keywords: *Cardiovascular diseases, Iran, primary health care, risk assessment, risk Factors*

Introduction

Non-Communicable Diseases (NCDs) are currently recognized as a major global challenge, and forecasts indicate that they will remain the leading cause of mortality by 2030. Annually, 41 million individuals worldwide die due to NCDs, accounting for 71% of all deaths; 15 million of these occur in the 30–69 age group, with 85% in low and middle income nations.[1,2] In Iran, cardiovascular Diseases (CVDs) are the leading cause of death among individuals over the age of 35.[3] In recent decades, risk factors for CVDs have increased rapidly due to social and economic changes and lifestyle shifts.[4] In 2019, the leading risk factors contributing to mortality and disability in Iran included high blood pressure, elevated body mass index, increased fasting blood glucose, tobacco use, and unhealthy dietary habits.[5]

Effective management of health behaviors and risk factors, such as physical activity, smoking, body mass index, blood pressure, total cholesterol, and blood sugar, plays a crucial role in reducing the risk of CVDs.[6] A study by Pettee *et al*.[7] found that even a slight increase in blood pressure is associated with a substantial rise in cardiovascular mortality. Similarly, elevated blood glucose levels are a major contributor to CVDs globally.[8] Moreover, a meta-analysis conducted in 2019 by Lestra revealed that quitting smoking can reduce mortality due to CVDs by 35%, increasing physical activity by 35%, and modifying dietary habits by 45%. In response to the global burden of NCDs, the World Health Organization (WHO) introduced the "Essential Package of Interventions for Non-Communicable Diseases" (PEN) to reduce mortality and enhance disease management.[9,10] PEN

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is a set of cost-effective interventions implemented at both community and individual levels, including health education, promotion of healthy behaviors, and early detection of CVDs and associated risk factors. It employs low-cost technologies and medication for the prevention and treatment of CVDs, stroke, diabetes, hypertension, cancer, and asthma.[11] Following this global initiative, numerous countries, particularly those with low and middle incomes, have implemented PEN interventions focusing on screening, diagnosis, prevention, management, and early treatment of NCDs at the primary healthcare level. Countries such as Myanmar, Nepal, Bhutan, South Korea, Uzbekistan, and Moldova have adapted these interventions.[12] Research conducted by Fasero M demonstrated that the introduction of PEN interventions resulted in a significant decrease in the population at risk of CVDs over a 10-year period.[13] Similarly, a study conducted in 2018 assessing the implementation of the PEN program in 20 cities in Myanmar highlighted the program's effectiveness in real-world settings, its delivery through non-physician health workers, and its accessibility.[11]

The IRAPEN program was launched in Iran in 2015 as part of the national health reform plan. Initially piloted in four cities: Naqadeh, Baft, Maragheh, and Shahreza—it was expanded across all provinces of Iran in 2018 following positive results.[14] IRAPEN uses the risk assessment model to estimate individuals' 10-year risk of developing CVDs, based on factors such as age, sex, blood pressure, smoking and alcohol use, diabetes status, and blood cholesterol levels. The program targets individuals over the age of 30, with health data entered the Integrated Health System (SIB). The system calculates a risk score indicating the likelihood of heart attacks or strokes in the next decade. Based on these results, individuals receive tailored follow-up, treatment, or referral to address specific risk factors.[15] The present study aimed to analyze data from the IRAPEN program in Urmia City, Iran, to determine the prevalence of behavioral risk factors for NCDs and their relationship with the risk level of CVDs. By identifying the distribution and associations of these risk factors, this study seeks to provide evidence to support the development of targeted, data-driven strategies for the prevention, early detection, and management of CVDs and other NCDs within the primary healthcare system.

Materials and Methods

This analytical cross-sectional study, conducted during 2022–2023 with both descriptive and inferential approaches, involved 10,000 individuals over the age of 30 from Urmia City. Participants were selected from a pool of 214,000 people registered in the country's health network system (SIB system) using a multi-stage cluster sampling method. In the first stage, the study area was stratified into urban and rural clusters based on administrative divisions. In the second stage, health centers were randomly selected from each cluster using probability proportional to size (PPS) sampling. In the third stage, eligible individuals were randomly selected from each center's registry using simple random sampling techniques. According to the IRAPEN program guidelines and the WHO's intervention package for NCDs, individuals aged 30 to 40 with risk factors such as a family history of diabetes, early cardiovascular events in first-degree relatives, kidney failure in first-degree relatives, systolic blood pressure over 140 mmHg, waist circumference over 90 cm, smoking, and a history of diabetes or hypertension were included. Those with a history of heart attack, angiography, coronary artery transplant, stroke, or peripheral vascular disease were excluded.

Data were collected using a researcher-designed checklist that included demographic information (age, gender, marital status, education, place of residence, occupation, insurance status, family history of diabetes and hypertension, smoking, and alcohol consumption). Additional data included height, weight, body mass index (BMI), cholesterol level, blood sugar level, blood pressure, waist circumference, and 10-year risk level. Venous blood samples (5 ml) were taken from all participants to measure total cholesterol and fasting blood glucose, with participants required to fast for 12 to 14 hours prior to sampling. Blood pressure was measured by trained staff and classified as norma (<120/80 mm Hg), pre-hypertension (120–139/80–89 mmHg), Stage I hypertension (140–159/90–99 mmHg) and Stage II hypertension (≥160/100 mmHg). Fasting Blood Sugar was measured using the glucose oxidase method and categorized as normal (<100 mg/dL), pre-diabetes (100–125 mg/dL), and diabetes (≥126 mg/dL).[16] High Cholesterol: Individuals with total cholesterol levels ≥200 mg/dL at the initial assessment were classified as having hypercholesterolemia.[16] A waist Circumference ≥90 cm in both genders was considered abnormal.[16] BMI was calculated as weight (kg) divided by height squared (m^2), and categorized as underweight (<18.5), normal (18.5–24.9), overweight (25–29.9), and obese (≥30).[16] The ten-year risk of heart and brain diseases was estimated and classified into four groups: <10%, 10% −19.9%, 20% −29.9%, and ≥30% risk.[16]

Statistical analyses were performed using SPSS version 22. Data normality was assessed using the Kolmogorov-Smirnov test. Variables were reported as mean ± SD, frequency, and percentage. Chi-square and Pearson correlation tests were applied, with p values <0.05 considered statistically significant.

Ethical considerations

The study was approved by the Ethics Committee of Urmia University of Medical Sciences (IR.UMSU.REC.1402.10; Approval Date: 2023-07-17). Confidentiality of participants' information was maintained.

Results

The mean (SD) age of the participants was 49.19 (13.21) years. Of the total, 5407 (54.07%) were male, 9098 (90,98%) were married, and 6301 (63,01%) lived in urban areas. Additionally, 2113 (21.13%) were illiterate, 2673 (26.73%) primary or secondary education, and 9719 (97.19%) had health insurance. Regarding occupation, 4687 (46.87%) were self-employed. Among the participants, 1724 (17.24%) had hypertension, and 1222 (12.22%) had diabetes. Smoking and alcohol consumption rates were 828 (8.28%) and 261 (2.61%), respectively. A family history of kidney disease was reported by 54 (0.54%), and a family history of diabetes by 452 (4.52%). Additionally, 719 (7.19%) were pre-diabetic, and 2933 (29.33%) were pre-hypertensive [Table 1].

The analysis of CVDs risk levels showed that 9115 (91.15%) of participants had a risk level below 10%, 824 (8.24%) had a risk level between 10-20%, 33 (0.33%) had a risk level between 20–30%, and 28 (0.28%) had a risk level above 30% [Table 1].

The relationship between hypertension and demographic variables [Table 2] indicated that among hypertensive individuals, 960 (55.68%) were women, 1068 (61.94%) lived in urban areas, 1530 (88.74%) were married, 644 (37.35%) were illiterate, 1696 (98.37%) had insurance, and 869 (50.40%) were housewives. Additionally, 165 (9.57%) reported a history of smoking. The Chi-square test indicated a statistically significant association between hypertension and all demographic variables except place of residence ($p < 0.05$).

The analysis of diabetes and demographic variables [Table 3] showed that among diabetic participants, 663 (54.25%) ($n = 663$) were women, 663 (54.22%) ($n = 663$) lived in urban areas, 868 (71,09%) ($n = 868$) were married, 452 (36.95%) ($n = 452$) were illiterate, 1202 (98.36%) ($n = 1202$) had insurance, and 608 (49.75%) ($n = 608$) were housewives. Additionally, 119 (9.73%) ($n = 119$) reported history of smoking. The Chi-square test indicated a statistically significant association between diabetes and all the demographic variables ($p < 0.05$).

Finally, the analysis of risk level and associated variables [Table 4] showed significant relationships between cardiovascular risk and diabetes, place of residence, gender, marital status, literacy level, occupation, smoking, hypertension, family history of diabetes, and prehypertension.

Table 1: Distribution of frequency and percentage of demographic characteristics and risk assessment levels of the participants

Variables		Frequency
Gender	Man	5407 (54.07%)
	Female	4593 (45.93%)
Address	City	6301 (63.01%)
	Village	3698 (36.98%)
Marital status	Single	902 (9.02%)
	married	9098 (90.98%)
Education	illiterate	2113 (21.13%)
	emergency	2673 (26.73%)
	guidance	1777 (17.77%)
	High school	2399 (23.99%)
	university	1038 (10.38%)
Insurance status	yes	9719 (97.19%)
	no	274 (2.74%)
Job	housewife	4115 (41.15%)
	Employee	1037 (10.37%)
	free	4687 (46.87%)
	Unemployed	161 (1.61%)
A patient with high blood pressure	Yes	1724 (17.24%)
	no	8276 (82.76%)
A patient with diabetes	Yes	1222 (12.22%)
	no	8778 (87.78%)
Smoking	Yes	828 (8.28%)
	no	9172 (91.72%)
Alcohol consumption	Yes	261 (2.61%)
	no	9739 (97.39%)
Family history of kidney disease	Yes	54 (0.54%)
	no	9946 (99.46%)
Family history of diabetes	Yes	452 (4.52%)
	no	9548 (95.48%)
Prediabetic	Yes	719 (7.19%)
	no	9281 (92.81%)
Prehypertension	Yes	2933 (29.33%)
	no	7067 (70.67%)
Age distribution	<40	2658 (26.58%)
	40-49	3093 (30.93%)
	50-59	1817 (18.17%)
	<40	2658 (26.58%)
Risk level	<10%	9115 (91.15%)
	10-20%	824 (8.24%)
	20-30%	33 (0.33%)
	Above 30%	28 (0.28%)

Discussion

This study aimed to identify the risk factors and levels of CVD among individuals over 30 years of age visiting health centers in Urmia City, Iran. The findings revealed that most participants had a CVD risk level below 10%, which is consistent with the results of Derakhshan *et al*.[5] Therefore, it is likely fewer than 10% of individuals attending Urmia health centers will develop CVD within the next decade. This outcome reflects the positive impact of primary and secondary preventive interventions and health promotion programs have been implemented across Iran, including Urmia.[17]

Nationwide initiatives in Iran have demonstrated the effectiveness of public health education, regular screenings, and health promotion campaigns in preventing diabetes and CVD. For example, programs in Tehran increased awareness, facilitated early detection, and reduced the incidence of CVD by promoting healthier lifestyles and improving access to

Table 2: Relationship between high blood pressure and the studied variables

Variables		Number (Percentage)		*p*
		High blood pressure	Normal blood pressure	
Gender	Man	764 (44.32%)	4643 (56.10%)	<0.001
	Female	960 (55.68%)	3633 (43.90%)	
Address Residence	City	1068 (61.95%)	5233 (63.24%)	0.324
	Village	656 (38.05%)	3042 (36.76%)	
Marital status	Single	194 (11.25%)	708 (8.55%)	<0.001
	Married	1530 (88.75%)	7568 (91.45%)	
Education	Illiterate	644 (37.35%)	1469 (17.75%)	<0.001
	Emergency	350 (20.30%)	2323 (28.07%)	
	Guidance	222 (12.88%)	1555 (18.79%)	
	High school	349 (20.24%)	2050 (24.77%)	
	University	159 (9.22%)	879 (10.62%)	
Insurance status	Yes	1696 (98.4%)	8023 (96.95%)	0.001
	No	28 (1.62%)	246 (2.97%)	
Job	Housewife	869 (50.41%)	3246 (39.22%)	<0.001
	Employee	237 (13.75%)	800 (9.67%)	
	Free	585 (33.93%)	4102 (49.57%)	
	Unemployed	33 (1.91%)	128 (1.55%)	
Smoking	Yes	165 (9.57%)	663 (8.01%)	0/020
	No	1559 (90.43%)	7613 (91.99%)	

Table 3: The relationship between diabetes and the studied demographic variables

Variables		Number (percentage)		*p*
		Diabetic	Non diabetic	
Address	City	868 (71.09%)	5433 (61.89%)	<0.001
	Village	353 (28.91%)	3345 (38.11%)	
Gender	Man	559 (45.74%)	4848 (55.23%)	<0.001
	Female	663 (54.26%)	3930 (44,77%)	
Marital status	Single	148 (12.11%)	754 (8.59%)	<0.001
	Married	1074 (87.89%)	8024 (91.41%)	
Education	Illiterate	452 (36.99%)	1661 (18.92%)	<0.001
	Emergency	232 (18.99%)	2441 (27.81%)	
	Guidance	159 (13.01%)	1618 (18.43%)	
	High school	278 (22.75%)	2121 (24.16%)	
	University	101 (8.27%)	937 (10.67%)	
Insurance status	Yes	1202 (98.49%)	8517 (97.18%)	0.003
	No	19 (1.56%)	255 (2.91%)	
Job	Housewife	608 (49.75%)	3507 (39.95%)	<0.001
	Employee	156 (12.77%)	881 (10.04%)	
	Free	443 (36.25%)	4244 (48.35%)	
	Unemployed	15 (1.23%)	146 (1.66%)	
Smoking	Yes	119 (9.74%)	709 (8.08%)	0.029
	No	1103 (90.26%)	8069 (91.92%)	

medical consultation.[18] Globally, the Framingham Heart Study has played a pivotal role in identifying risk factors for CVD and has developing the widely used Framingham Risk Score.[19] Such structured programs illustrate the opportunities available within Iran's health network to strengthen preventive care and promote cardiovascular health.[20]

Our study also found significant positive correlations between CVD risk level and fasting blood sugar, cholesterol, systolic and diastolic blood pressure, age, BMI, and waist circumference. While some studies did not confirm the relationship between systolic blood pressure and risk of heart diseases.[21] Our findings are consistent with other research supporting this association.[22-24] The relationship between high blood pressure and increased incidence of heart diseases has been scientifically proven.[23] Hypertension is a well-established risk factor for angina pectoris, myocardial infarction and sudden death.[25] Similarly, obesity and hyperglycemia are strongly associated with elevated cardiovascular risk due to their effects on vascular function and related comorbidities.[5,26]

Age also emerged as a critical determinant of CVD risk, in line with existing evidence.[5,27-29] For instance, Sezavar *et al.*[30] reported a mean age of 59 years for first myocardial infarction patients, and Ahmadi *et al.*[31] documented a national average of 61.2 years. The protective role of estrogen in premenopausal delays onset compared to men, but risk increases substantially after menopause.[5] Our findings largely consistent with both national and international literature, although some variations (e.g., gender differences) likely reflect demographic, cultural, and methodological differences across study populations.

We also observed significant associations between CVD risk and sociodemographic factors such as residence, gender, marital status, education level, occupation, and smoking. These results are consistent with studies from Iran,[15,27] Turkey,[32] and India[33] which emphasize the importance of contextual and socioeconomic influences on cardiovascular health.[34,35] While Derakhshan *et al.*[5] reported higher CVD risk in women, our findings showed men to be more vulnerable, which is consistent with other studies.[36-38]

Table 4: The results of the Chi-square test to check the risk level and the studied variables

Variables		Number (percentage)				*p*
		<10%	10-20%	20-30%	>30%	
Address	City	518 (87.58%)	747 (11.88%)	22 (0.32%)	14 (0.22%)	<0.001
	Village	3597 (97.21%)	76 (2.07%)	11 (0.2%)	14 (0.4%)	
Gender	Male	4966 (91.84%)	411 (7.06%)	11 (0.2%)	19 (0.2%)	0/003
	Female	4149 (90.33%)	413 (8.99%)	22 (0.48%)	9 (0.19%)	
Marital status	Single	788 (87.36%)	106 (11.75%)	3 (0.32%)	5 (0.55%)	<0.001
	Married	8327 (91.53%)	718 (7.89%)	30 (0.33%)	23 (0.25%)	
Education	Illiterate	1738 (82.25%)	335 (15.85%)	26 (1.22%)	14 (0.71%)	<0.001
	Emergency	2519 (94.24%)	141 (5.27%)	3 (0.11%)	10 (0.41%)	
	Guidance	1642 (92.40%)	131 (7.37%)	2 (0.11%)	2 (0.11%)	
	High school	2225 (92.74%)	170 (7.13%)	2 (0.08%)	2 (0.08%)	
	University	989 (95.38%)	45 (4.43%)	2 (0.19%)	2 (0.19%)	
Insurance status	Yes	8852 (9107%)	808 (8.31%)	32 (0.32%)	26 (0.26%)	<0.164
	No	256 (93.43%)	16 (5.84%)	1 (0.01%)	2 (0.72%)	
Job	Housewife	3690 (89.67%)	395 (9.59%)	21 (0.1%)	9 (0.21%)	<0.001
	Employee	900 (83.87%)	135 (12.58%)	1 (0.09%)	1 (0.09%)	
	Free	4394 (93.74%)	270 (5.77%)	8 (0.17%)	15 (0.32%)	
	Unemployed	130 (80.74%)	24 (14.90%)	4 (2.48%)	3 (1.86%)	
A patient with high blood pressure	Yes	1167 (67.33%)	512 (29.54%)	28 (1.61%)	17 (0.98%)	<0.001
	No	7948 (96,03%)	312 (3.76%)	5 (0.06%)	11 (0.13%)	
A patient with diabetes	Yes	670 (54.82%)	516 (42.22%)	24 (1.96%)	12 (0.98%)	<0.001
	No	8445 (96.20%)	308 (3.50%)	9 (0.10%)	16 (0.18%)	
Smoking	Yes	679 (82%)	139 (16.78%)	4 (0.48%)	6 (0.72%)	<0.001
	No	8436 (91.97%)	685 (7.44%)	29 (0.31%)	22 (0.23%)	
Family history of diabetes	Yes	399 (88.27%)	48 (10.61%)	4 (0.88%)	1 (0.22%)	<0.001
	No	8716 (91.28%)	775 (8.11%)	29 (0.30%)	28 (0.29%)	
Prediabetic	Yes	664 (92.35%)	52 (7.23%)	2 (0.27%)	1 (0.13%)	0/3
	No	8451 (91.05%)	771 (8.30%)	31 (0.33%)	28 (0.30%)	
Prehypertension	Yes	2757 (93,99%)	168 (5.61%)	2 (0.06%)	6 (0.20%)	<0.001
	No	6358 (89,96%)	656 (9.28%)	31 (0.43%)	22 (0.31%)	

In the present study, most individuals with a CVD risk level of 10%–20% and 20%–30% resided in urban areas, whereas those with a risk level above 30% were equally distributed between urban and rural settings. The sedentary lifestyle commonly observed in cities, coupled with limited access to healthcare services and inadequate health literacy in rural areas, may may explain these differences. Jahani *et al*.[15] similarly reported significant urban-rural disparities, finding that while urban residents generally had a lower average risk level, 7.3% still exhibited high or very high risk compared to 33.7% of rural residents.

Our findings also showed that housewives were at higher risk of CVD compared to employed women. Occupation is an important determinant of cardiovascular health, and Sadeghi *et al*.[39] demonstrated that employed women were less likely to develop chronic diseases than housewives.

The CVD risk assessment program in Iran is largely carried out by trained non-physician staff of health centers. This approach has expanded screening services, reduced delays in seeking hospital care, and ultimately contributed to lowering the incidence of CVD complications and mortality. One of the strengths of our study is that data were collected directly from urban and rural health centers, which represent the first point of contact for most individuals within the health system. As such, our findings reflect real-world evidence and underscore the value of early identification of risk factors, regular follow-up, and equitable access to healthcare resources.[40]

In Brazil, the Family Health Program has been instrumental in improving cardiovascular health outcomes through community-based health services. The program offers preventive care, health education, and screenings, especially for high-risk populations in remote areas. Its effectiveness in reducing CVD risk among high-risk populations has been well documented.[41]

Nevertheless, our study would benefit from including additional lifestyle-related factors such as diet and physical activity, which are well-established contributors to cardiovascular risk. Cicero AFG *et al*. (2018)[42] found that healthier dietary patterns rich in fruits and vegetables and regular exercise significantly reduced cardiovascular risk in Chinese populations. Similarly, the global INTERHEART study identified diet and exercise as critical modifiable factors accounting for a large share of the myocardial infarction burden.[43] Incorporating these variables

into future research could enable a more comprehensive assessment of cardiovascular risk and inform more targeted prevention strategies.

International experiences also illustrate challenges. For instance, in South Africa, a government-led CVD prevention program failed to achieve its intended outcomes due to poor adherence to treatment, inadequate public health infrastructure, and limited cultural adaptation to local needs.[44] In contrast, the Atherosclerosis Risk in Communities (ARIC) Study, which tracked over 15,000 adults for several decades, clearly demonstrated how changes in risk factors such as blood pressure and cholesterol levels over time influenced the development of CVD.[45] Such longitudinal data provide stronger evidence for causal relationships compared to cross-sectional designs.

Several limitations should be acknowledged. First, this study relied only on date variable in the SIB system, which excluded other potentially important determinants of CVD. were investigated and their relationship with the risk level of cardiovascular diseases was investigated, Future research should include a wider range of clinical and lifestyle variables. Additionally, the cross-sectional design precludes drawing causal inferences between risk factors and cardiovascular outcomes. Longitudinal studies are needed to strengthen causal interpretations.

Conclusion

This study highlights the high prevalence of diabetes and hypertension among adults over 30 years old and demonstrates a strong association between these conditions and other factors, such as fasting blood sugar, cholesterol, blood pressure, BMI, and waist circumference, with increased CVD risk. These findings emphasize the urgent need to expand cardiovascular risk assessment programs, ideally initiating them before the age of thirty. Targeted interventions on modifiable risk factors, such as obesity, sedentary lifestyle, and smoking, remain a critical component of national prevention strategies.

Moreover, integrating smart technologies into primary healthcare systems, especially within nursing and community health services, holds great potential for early detection and long-term monitoring of cardiovascular risk. However, ethical concerns such as patient data privacy, digital consent, and algorithmic transparency must be addressed to ensure equitable and culturally appropriate implementation.[46,47] In addition, active involvement of insurance providers, non-governmental organizations (NGOs), and other stakeholders is vital to support the somatization of nursing through financial, logistical, and policy-based contributions.[48]

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Conflicts of interest

Nothing to declare.

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