

Assessment of Cardiovascular Risk in the Adult Population in the Central Region of the Russian Federation

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Abstract

The aim of the study was to analyze the risk of cardiovascular complications development in the adult population in the Vladimir region of the Russian Federation.

Material and methods: The cross-sectional population-based study included 1,350 men and women aged 30-69 years from 5 cities in the Vladimir region (Vladimir, Kovrov, Murom, Yuryev-Polsky and Vyazniki). The response to the study was 87%. The study was completed with 1174 people (424 men -36.1% and 750 women -63.9%). The risk of the fatal cardiovascular complications was assessed using the classic European SCORE scale. Depending on the total score, the risk was assessed as follows: low risk <1%, moderate risk-from 1% to 5%, high risk - from 5% to 9% and very high risk-10-14%.

Results: In the surveyed unorganized population, the high and very high risk of cardiovascular complications among men was 32%, while in women the risk was 2 times lower (15.5%). Low and moderate risk was more prevalent in females (66.3%), being 1.5 times more common than in males (43.6%). With comparable rates of hypertension (41.5% in men and 39.9% in women) and hypercholesterolemia (57.8% in men and 55.7% in women), male gender and smoking status (38.4% in men and 9.3% in women) contributed to the total cardiovascular risk. The frequency of very high risk of cardiovascular complications among men in certain cities of the Vladimir region was 2.5-4 times higher compared to women.

Conclusion: In a single region in the central part of the Russian Federation, one in three men was at high and very high cardiovascular risk because of the high prevalence of smoking, hypercholesterolemia and hypertension. Among women, high and very high cardiovascular risk was 2 times lower (15.5%), while a high incidence of hypercholesterolemia and hypertension was also observed among them. There was a variability in the very high risk of cardiovascular complications in different cities of Vladimir region.

Keywords: Prevalence; Population; Cardiovascular risk; SCORE scale

Key Points: Every third man in the Vladimir region had a high and very high cardiovascular risk, which is due to the prevalence of smoking, hypercholesterolemia and hypertension. Among women, high and very high cardiovascular risk was 2 times lower (15.5%), while a high incidence of hypercholesterolemia and hypertension was also observed. There is variability in the very high risk of cardiovascular complications in different cities of the Vladimir region.

Abbreviations: AH: Arterial Hypertension; CHD: Coronary Heart Disease; CVD: Cardiovascular Diseases; NCD: Non-Communicable Chronic Diseases; ECG: Electrocardiogram

Introduction

According to international experts, Russia, along with the countries of Eastern Europe and the Commonwealth of Independent States, belongs to a group of high risk for the development of cardiovascular complications [1,2]. Taking into account the improved medical care, including improved screening of the cardiovascular system in adults with identification of a high-risk group and provision of high-tech methods of care for patients with various Cardiovascular Diseases (CVD), positive dynamics in the incidence and development of

complications are noted [3]. It is obvious that primary prevention of cardiovascular complications should be one of the top priorities of modern medicine. Without reducing morbidity, the fight against CVD complications will not be successful [4,5].

Therefore, the timely identification of CVD risk factors at the population level and their correction is an urgent problem [1]. From this point of view, regular screening and large studies make it possible to determine the prevalence as well as gender and age characteristics of the main risk factors [6]. These results allow us to predict the cumulative risk of developing CVD complications. There is also variability in these indicators in different regions of the Russian Federation [7]. The aim of this study is to analyze the risk of cardiovascular complications in an unorganized population of men and women in the Vladimir region, part of the Central District of the Russian Federation.

Material and Methods

A cross-sectional population study was conducted from May 2018 to March 2020 in 5 cities of the Vladimir region (Vladimir, Kovrov, Murom, Yuryev-Polsky and Vyazniki). From six outpatient clinics, 9 therapeutic areas were selected, then, according to the lists of the assigned population aged 30-69 years, respondents from each area were invited to the study; on average, every tenth of the 1500 people in the attached population (1500:10=150; a total of 150 respondents per site). Thus, 1350 people were included in the study. The response to the study was 87%.

In total, 1174 people completed the study. Of these, 424 were men (36.1%) and 750 women (63.9%). The distribution of the population in 5 cities, taking gender into account, is presented in Table 1. At the first stage, respondents were surveyed using a standard questionnaire prepared at the National Medical Research Center for Therapeutic and Preventive Medicine, including social status, family history, smoking status, alcohol consumption, other risk factors and concomitant diseases and taking medications. All participants underwent the measurement of blood pressure, resting heart rate, anthropometric indicators (height, weight, body mass index, waist circumference) and biochemical tests, including the levels of total cholesterol, low-density lipoprotein cholesterol, fasting glucose, and creatinine.

Table 1: Population size distributed by city and gender.

Cities	Total, n	Men, n	Women, n
Vladimir	282	102	180
Vyazniki	62	13	49
Kovrov	195	60	135
Murom	315	128	187
Yuriev-Polsky	150	43	107
All cities	1004	346	658

Office blood pressure and heart rate measurement

Blood pressure was measured with a mechanical sphygmomanometer to an accuracy of 2mmHg twice at 5-minute

intervals in a seated position at rest. The average of the two measurements was used for analysis. The questionnaire included one minute of heart rate data. Arterial Hypertension (AH) was diagnosed when systolic blood pressure was ≥ 140 mm Hg and/or diastolic blood pressure was ≥ 90 mm Hg.

All patients underwent ECG recording at rest in 12 leads using a 6-channel Schiller electrocardiograph (Switzerland). Two ECG criteria were used to diagnose left ventricular hypertrophy:

A. Sokolov-Lyon Index. Left ventricular hypertrophy according to this criterion is determined if $SV1+RV5(V6) > 3.5$ mV and/or $RaVL > 1.1$ mV and/or $RI > 1.5$ mV and/or $RII > 2.0$ mV and/or $RIII > 2.0$ mV.

B. Cornell Voltage Index. Left ventricular hypertrophy according to this criterion is determined if $RaVL+SV3 > 2.8$ mV.

Laboratory studies

Were carried out centrally. Fasting blood from the antecubital vein was taken in the morning. The concentration of total cholesterol and triglycerides (mmol/l) in serum was determined using enzyme kits from the «Human» company by an autoanalyzer «ALCYON 160». HDL cholesterol (mmol/l) was determined by the same method as cholesterol, after precipitation of low-density lipoproteins and very low-density lipoproteins from serum with sodium phosphotungstate and $MgCl_2$. Hypercholesterolemia was diagnosed when total cholesterol in the blood exceeded > 5 mmol/l, hypertriglyceridemia-when the triglycerides concentration was > 1.7 mmol/l, low HDL cholesterol - for men < 1.1 mmol/l and for women < 1.3 mmol /l. The fasting glucose concentration (mmol/l) in venous blood plasma was determined using a photo electro colorimeter using the glucose oxidase method. According to WHO criteria (1999-2013), a fasting glucose concentration in venous blood plasma $> 6,1 < 7,0$ mmol/l was assessed as prediabetes and with a glucose concentration ≥ 7.0 mmol/l as type 2 diabetes mellitus.

The risk of developing fatal cardiovascular complications was assessed for persons aged 40 years and older using the European SCORE scale (in the absence of verified CVD). The following data were used for the calculation: age, gender, smoking status, systolic blood pressure and total cholesterol levels. Depending on the total score, the risk was assessed as follows: low risk $< 1\%$, moderate risk - from 1% to 5%, high risk -from 5% to 9% and very high risk-10-14% [8].

Control of material collection and the training of researchers

The collection of material was carried out with the participation of primary care physicians in the Vladimir region. Training was conducted on the protocol and filling out the questionnaire and the questionnaires were randomly checked by independent experts. The results were processed centrally: at Vladimir State University and at the National Medical Research Center for Therapy and Preventive Medicine.

Statistical Analysis

Data entry was carried out in the Excel system of the MS Office package. Statistical analysis was performed in IBM SPSS 20.0 statistical analysis system. Qualitative parameters were described by relative frequencies in percentages. Quantitative parameters were described by means and errors of means ($M \pm m$). Assessment of differences between two independent samples for continuous parameters was performed using Welch's t-test. Comparison of prevalences was performed using the test for equality of fractions. Frequency analysis was performed by ANOVA. Differences were considered significant at $p < 0.05$.

Results

Table 2 presents the prevalence of the three main risk factors among men and women in the sample that were used to calculate the risk of cardiovascular events using the SCORE scale. In general, the average age of men and women was comparable. AH has been detected in about 40% of adults from the unorganized population; its frequency also did not have gender differences. Men smoked 4 times more often than women; that difference was statistically significant ($p < 0.001$). Among women, every tenth was a smoker. There was a high prevalence of hypercholesterolemia in the population as a whole. Thus, approximately 60% of men and

women had elevated levels of total cholesterol (Table 2).

Table 2: Gender characteristics of risk factor prevalence.

Risk factors	Men n=424, %	Women n=750, %	p-value
Age, years	52,5±9,5	53,8±9,8	0,924
AH, n (%)	176 (41,5%)	299 (39,9%)	0,582
Smoking, n (%)	163 (38,4%)	70 (9,3%)	0,001
Hypercholesterolemia, n (%)	245 (57,8%)	418 (55,7%)	0,496

There were differences in the frequency of gradations of risk of cardiovascular complications between men and women (Table 3). Low risk of cardiovascular complications was found in one in three women, whereas the frequency of low risk was twice as low in men ($p = 0.00001$). The proportion of women with a moderate risk of cardiovascular complications was comparable to the frequency of low risk. Moderate risk of cardiovascular complications was found in one in four men, which was significantly lower than in women ($p = 0.0395$). The frequency of high and very high risk in men was 2-2.5 times more prevalent than in women. One in five men and one in ten women were at high risk of cardiovascular complications ($p = 0.00001$). Very high risk of cardiovascular complications was observed in 11% of men and 4% of women ($p = 0.00001$) (Table 3).

Table 3: Assessment of cardiovascular risk in a random sample of men and women in the Vladimir region.

Cardiovascular Risk Values According to the Score Scale	Men n=424	Women n=750	p-value
Low (less than 1%)	72 (17%)	254 (33,9%)	0,00001
Moderate (>1% to 5%)	113 (26,6%)	243 (32,4%)	0,0395
High (>5% to 10%)	90 (21,2%)	86 (11,5%)	0,00001
Very high (>10%)	46 (10,8%)	30 (4%)	0,00001

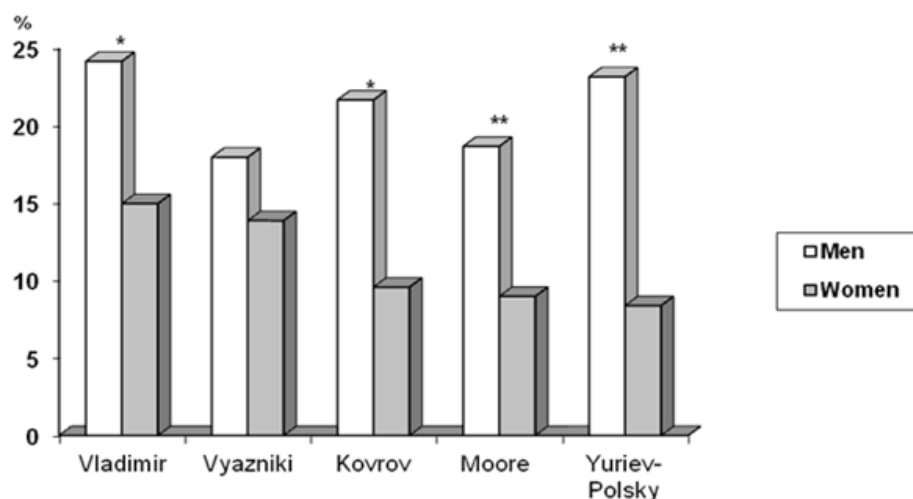


Figure 1: Frequency of high risk of cardiovascular complications in the studied population. * $p < 0.05$, ** $p < 0.01$ statistically significant difference between the groups of men and women.

The study also examined the frequency of high and very high risk of cardiovascular complications in individual cities of the Vladimir region. In 4 cities, the frequency of high risk of cardiovascular complications among men was 1.5-2.5 higher than in women, which was statistically significant (Figure 1). In Vladimir

and Yuryev-Polsky, every fourth man was found to have a high risk of cardiovascular complications. In Vyazniki, the high risk of cardiovascular complications between men and women turned out to be comparable (Figure 1). The frequency of very high risk of cardiovascular complications among men was high in three cities

(Vladimir, Kovrov and Yuryev-Polsky), averaging 13% (Figure 2). Among women, the frequency of very high risk of cardiovascular complications was about 5% in two cities (Vladimir and Vyazniki),

and about 3% in three other cities. Thus, the frequency of very high risk of cardiovascular complications among men in certain cities was 2.5-4 times higher compared to women.

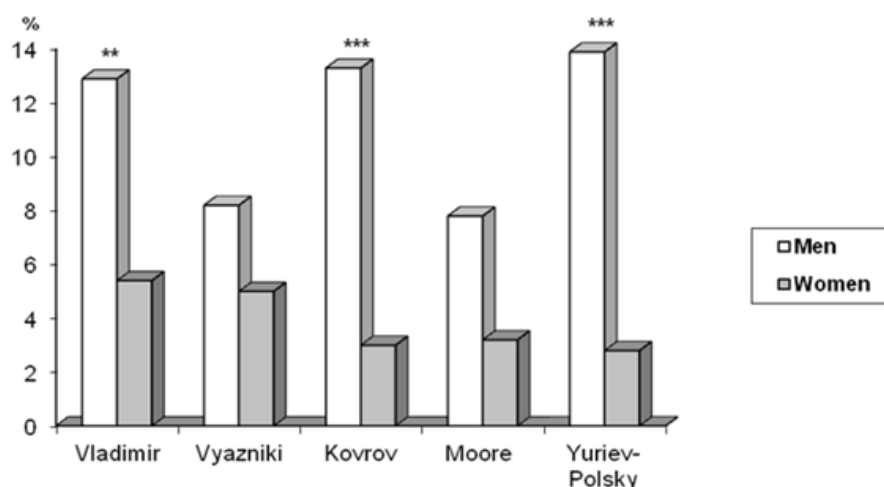


Figure 2: Identification of the very high risk of cardiovascular complications in the unorganized population of the Vladimir region.

** $p < 0.01$, *** $p < 0.001$ statistically significant difference between the groups of men and women.

Discussion

The Central Federal District of the Russian Federation is the leader in the prevalence of Non-Communicable Chronic Diseases (NCDs) and their complications. Despite the fact that in recent years the all-cause mortality rate of the population in this district has decreased by 1/5, the Central Federal District ranks second among the 8 federal districts in terms of adult mortality from chronic NCDs [9]. It is obvious that comprehensive screening is required among the population in order to implement a population-based prevention strategy and a high-risk strategy for the development of NCDs and their complications.

Population-based studies to assess the risk of cardiovascular complications are carried out in various countries around the world. In a Brazilian study among adults, 18.9% of the population were found to be at high risk of cardiovascular disease using the Framingham risk scale. Moreover, in men it was 2.5 times higher than in women. It should also be emphasized that among people engaged in physical labor, the cardiovascular risk was 3 times lower compared to the group of people engaged in intellectual work [10]. In a Vietnamese cross-sectional population-based study (participants aged 40-69 years) using the WHO/ISH scale, the incidence of moderate and high cardiovascular risk was the same (5.1%). At the same time, elevated blood pressure levels were associated with higher cardiovascular risk. Among men, the risk was 2 times higher compared to women (18.3% and 8.5%, $p < 0.001$). The authors concluded that male gender, smoking, ethnic minority status, hypertension and diabetes were associated with an increased risk of cardiovascular disease [11].

The Russian national study ESSE RF demonstrated that the majority of the population has low and moderate cardiovascular risk. However, in men, high risk ($\geq 5\%$) is 6 times more common

than in women (40.5% vs 7.4%), indicating a marked gender difference [7]. In the present study, the high and very high risk of cardiovascular complications among men was 32%; among women this value was 2 times lower (15.5%). Thus, the majority of women had low and moderate risk (66.3%), which is 50% more than men (43.6%). With the same frequency of hypertension and hypercholesterolemia (the quantitative values of these disorders also depend on the gender), male gender and smoking status contributed to the total cardiovascular risk values.

In a Polish 8-year prospective study, independent predictors of cardiovascular mortality in men were age, glucose level, systolic blood pressure and smoking status. In women, independent predictors were age, smoking status and diabetes. The SCORE scale for assessing cardiovascular risk in the Polish adult population has demonstrated high predictive value [12]. In the Russian national population-based ESSE study, variability in the risk of cardiovascular events was observed across regions. A ranked analysis of the regions showed that in Vologda, Voronezh and Tomsk more than a quarter of the population has high and very high cardiovascular risk. A low incidence of cardiovascular risk (10-15%) was detected in Vladikavkaz and Samara [7]. The present study showed the variability in the frequency of very high cardiovascular risk in 5 cities of the Vladimir region. According to experts, in addition to traditional factors, social and environmental factors also play an important role in the development of the risk of cardiovascular complications. In a Russian prospective cohort study (3856 people), an analysis of deaths from CVD was carried out over 7 years (Tyumen region). The relative risk of cardiovascular death in the study cohort, depending on occupation, had a stepwise increasing pattern in the following order: managers, retired and disabled workers, light manual workers, specialists, medium manual workers, heavy manual workers [13]. Therefore,

when developing prevention programs, it is necessary to take into account not only the traditional risk factors, but also a wide range of socio-demographic indicators [14].

Conclusion

Thus, in a single region in the central part of the Russian Federation, one in three men of working age had a high and very high cardiovascular risk due to the high prevalence of smoking, hypercholesterolemia and hypertension. Among women, high and very high cardiovascular risk was 2 times lower, with a frequency of hypercholesterolemia and hypertension comparable to that of men. The variability of very high risk of cardiovascular complications in different cities of Vladimir region was notable. When developing a strategy of CVD prevention, in addition to the correction of traditional risk factors, it is recommended to take into account socio-demographic parameters and gender characteristics of the population.

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