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Prevalence of cardiovascular risk factors in a random sample of Russian men and women

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Summary

The aim of the study was to assess the prevalence of cardiovascular risk factors and total cardiovascular risk profiles in a random sample of the adult population of Cheboksary (Russia).

Random sample of 749 men and 1,051 women (n=1,800), aged 30 to 69 years from of the city of Cheboksary (Volga Federal District, Russia). The study was completed by 1,570 people (87.2%). All respondents completed a standardized questionnaire and had a number of examinations, including anthropometric measurement and measurement ofblood pressure (BP), blood lipids, fasting glucose and glucose after a two-hour glucose load.

A high prevalence of traditional risk factors was detected in this random sample of a working age population. Nutritional disturbances, with different degree of manifestation, were revealed in 76.1% of participants, hypercholesterolemia in 62%, sedentary lifestyle in 52.6%, hypertension in 39.2%, and low levels of high-density lipoprotein (HDL) cholesterol in 25%. Tobacco addiction and excess alcohol consumption, leading to physical disorders, was detected in 43% and 27.4% men, respectively. Most common metabolic factors were hypertriglyceridemia (27%) and 42 abdominal obesity (22.1%). One in four participants scored positively for a high level of psychological stress. Low or medium total cardiovascular risk was observed in one in 25% of participants, with high total risk detected in 19% of cases. Risk assessment was performed using the Systematic COronary Risk Evaluation (SCORE) scale. A significant correlation was identified between total cardiovascular risk and metabolic risk factors, and a lack of correlation was detected between tachycardia and chronic anxiety.

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An urban population in Russia is characterized by a high prevalence of traditional risk factors and metabolic risk factors,most of which have a linear association with age but with differences between sexes.

Keywords
Epidemiology, cardiovascular disease, risk factors

Introduction

Cardiovascular disease (CVD) and associated complications, such as myocardial infarction and cerebrovascular accidents (stroke), are the leading cause of high morbidity and mortality among adults in the Russian Federation [1,2]. According to *World Health Organization* (WHO) statistics, the Russian Federation has the highest cardiovascular mortality among European countries [3,6]. One of the main reasons for high CVD prevalence in Russia is poor detection and correction of risk factors [1,4].

Epidemiological studies investigating the prevalence of CVD risk factors were conducted at different times in the USSR and in the Russian Federation. They revealed that hypertension, smoking, alcohol consumption and anxiety are the main risk factors for CVD among adults [5,6,7]. However, over recent years, metabolic risk factors have also become a popular theme for discussion. It should be emphasized that the possibility of developing CVD and associated complications increases two- or threefold, when metabolic risk factors are combined with traditional risk factors [8]. Success in primary prevention of CVD depends on the successful management of risk factors and requires large-scale population-based studies [9].

In recent years, few epidemiological studies have been conducted which explore risk factor prevalence, the combination of risk factors, and the contribution of individual risk factors to total cardiovascular risk, so it is difficult to develop evidence-based prevention strategies and estimate their efficacy [11].

The objective of this study on cardiovascular risk factors in a random sample of adults from the Russian city of Cheboksary is to help optimize approaches to the implementation of prevention programs conducted in the region.

Materials and methods

This study was performed as a part of planned project approved by the National Research Center for Preventive Medicine and the Ministry of Health and Social Development of Chuvashia.

Sampling

Cheboksary is the capital city of the Chuvash region in Western Russia, with a population of 453,721 (2010 Census). Having used a table of random numbers, thirty districts from the city of Cheboksary, each covered by family doctors, were selected from 224 districts, attached to 7 healthcare facilities (k = 224:30 = 7; every seventh district). Then one in every thirty respondents (aged 30–69 years) was selected from each included district with the help of a list of citizens registered in the healthcare facility (1,800:30 = 60; 60 respondents from one district). As a result, 1,800 citizens (men = 749, women = 1,051) were enrolled in the study. The study was completed by 88.7% of those enrolled.

At the first stage of the study, 1,718 participants completed the standardized questionnaire, which included information about family history, heredity, smoking habits, alcohol consumption, physical activity, nutrition habits, information to the Rose questionnaire, psychological and diabetic status, information on the course of hypertension and comorbidities, and drug usage. Later, 148 respondents (8.7%) for various reasons did not take part in the instrumental (BP, heart rate, waist circumference, ECG at rest) and biochemical examinations (total cholesterol, triglycerides, HDL cholesterol, oral glucose tolerance test).

A smoker was defined as a person, who smokes one or more cigarettes a day. Investigators distinguished several smoking statuses: never smoked, smoker in the past, smoker at the present time.

Assessment of alcohol consumption was made in accordance with the following criteria. For men: no alcohol consumption during the previous year; low or intermediate amount of alcohol (<168 g of ethanol per week); high alcohol consumption (≥168 g of ethanol per week). For women: no alcohol consumption during the previous year; low or intermediate amount of alcohol consumption (<84 g of ethanol per week); high alcohol consumption (≥ 84 g of ethanol per week).

Physical activity was considered as normal if it met following criteria: sitting less than 5 hours a day, walking at least 30 minutes a day, and/or doing

physical exercises at least 2 hours per week. Physical activity was considered sedentary if it met following criteria: sitting 5 or more hours a day, walking less than 30 minutes a day, and/or doing physical exercises less than 2 hours per week or walking less than 30 minutes a day and doing physical exercises less than 2 hours per week.

Nutritional assessment was performed using the *WHO* questionnaire, which included questions on the frequency of meals, dietary salt, carbohydrates, animal fats and protein consumption. Excess salt consumption was defined as additional salting of a cooked meal and/or everyday consumption of salty foods. Excess animal fat intake was assessed when sausage products were consumed every day, and/or 4 teaspoon of dairy butter was consumed during a day, and/or at least 3 eggs were consumed per week. Excess consumption of carbohydrates was defined as everyday intake of starchy foods and confectioneries. Nutrition disorders were classified as mild (one type of disorder in carbohydrate, fat and mineral metabolism), moderate (two types of nutritional disorders) and severe (three specified types of nutritional disorders). Healthy nutrition was defined as the absence of all aforementioned nutrition disorders.

Stress level was investigated with a questionnaire based on the Reeder scale, that included 7 questions for evaluating psycho-emotional states in work and private lives. The level of chronic anxiety was classified as severe (1–2 points), moderate (2.01–3 points), and mild (3.01–4 points).

Physical and instrumental examination

Anthropometric examination: body weight was measured to the nearest 0.1 kg. Body mass index (BMI) was defined as the individual's body mass divided by the square of their height (BMI = weight/height^2; weight is measured in kg, and height in meters). According to the *WHO* guidelines waist circumference is measured at a level midway between the lowest rib and the iliac crest to the nearest 0.1 cm. Abdominal obesity was evaluated by using Adult Treatment Panel (ATP) III criteria (men's waist circumference ⩾102 cm; women's waist circumference ⩾88 cm) and the *International Diabetes Federation* (IDF) criteria (men's waist circumference ⩾94 cm; women's waist circumference ⩾80 cm).

BP was measured in a sitting position at rest two times with a 5-minute interval to the nearest 2 mmHg. The average value of these two measurements was used for the analysis. Hypertension was defined as BP ⩾ 140/90 mm Hg and/or antihypertensive drug usage. Awareness — the patient is informed about the presence of hypertension. Treatment — the therapy is administered, but inefficient, i.e. BP is higher than targeted. Efficacy of the treatment — antihypertensive therapy is administered and BP reaches target levels.

All participants were measured using a 12-ead ECG at rest. ECG was interpreted according to a special scheme, which was developed for the study (adapted from Minnesota code, *National Research Center for Preventive Medicine*).

Laboratory assessment

Blood sampling was made from the cubital vein in the morning on an empty stomach after 12 hours of fasting.

The content of total cholesterol (mmol/L) and triglyceride levels in serum were determined using enzyme kits 'Human' and biochemical automatic analyzers, 'ALCYON 160' (serial number 14161416), using a method of endpoint photocalorimetry CHOD — PAP (Reagents Company HUMAN). The same method was used for the evaluation of HDL cholesterol levels after deposition from the serum of low-density lipoproteins (LDL) and very-low-density lipoproteins by sodium phosphotungstate and $MgCl_2$. LDL levels were calculated by the formula, suggested by Friedwald and co-authors: LDL cholesterol (mmol/L) = total cholesterol — (triglycerides (TG)/ 2.2 + HDL cholesterol). Hypercholesterolemia was defined at total cholesterol levels >5 mmol/L. Hypertriglyceridemia was defined, when TG levels were higher than 1.7 mmol/L, low levels of LDL cholesterol for men were defined below 1.1 mmol/L and for women below 1.3 mmol/L.

Oral glucose tolerance test was performed after night fasting of 8–12 hours. After providing blood samples, participants consumed 75 g of glucose, diluted in 250–300 ml of water, in less than 5 minutes. Two hours later a second blood sample was taken. Glucose concentration in venous blood was measured by photoelectric colorimeter KFK-3 using glucose oxidase test. According to the WHO criteria, fasting hyperglycemia was defined when glucose level ⩾6.1 mmol/L; post-load hyperglycemia was defined when glucose level >7.8 mmol/L two hours after glucose load.

Statistical analysis

Data input was performed in regional research center with ACCESS MS OFFICE. Editing and statistical analysis were performed by the National Research Center for Preventive Medicine staff with the help of the Statistical Analysis System (SAS). Descriptive

numerical characteristics of tested variables (mean, frequency ratio, standard deviation, standard error) were analyzed with the help of the following procedures: PROC SUMMARY, PROC UNIVARIATE, PROC FREQ. Authors used standard significance criteria: c-squared, Student-t (two-sample) and Fisher's ratio test.

Results and discussion

Sociodemographic characteristics of the sample are comparable with similar data in other population studies [6,7,14]. In a random sample, the number of women was 50% more than men (Table 1). The age of 65% of participants varied from 40–49 years to 50–59 years. Analysis of the ethnic composition showed that two-third of participants were Chuvash and 30% were Russian. Most respondents were married (76.4%). Divorced participants accounted for 9% of the total, unmarried participants 7.3% and widowers 7.3%. One in four respondents graduated from universities, whereas the majority of participants finished colleges (38.2%) or had secondary education (35%). 64.6% of respondents were employed.

Traditional risk factors include smoking, hypertension, tachycardia, alcohol abuse, a sedentary lifestyle, unhealthy diet, hypercholesterolemia, low levels of HDL cholesterol, family history of CVD and metabolic disorders. New risk factors include hypertriglyceridemia, fasting hyperglycemia, impaired glucose tolerance after two-hour glucose load, abdominal obesity and chronic stress [11].

According to the results, about 43% of men were smokers, about one third had never smoked, and 23% had given up smoking. During assessment of the smoking prevalence among men of various age groups it was found that every second man at the age of 30–59 years was a smoker, whereas there was a 2-fold decrease in smoking prevalence in the elder age group (60–69). Only 12% of young adults had given up smoking, whereas there was a 3-fold increase of ex-smokers in the elder age group. No more than 3% of women were regular smokers. These results differ from previous Russian studies. According to Rimma Potemkina's data, obtained during a phone survey and conducted in 3 Russian cities, it was found that 56% to 61.1% of men and 19.6% to 31.7% of women smoked. It is possible that these differences are due to social and ethnic characteristics of the sample [5,12].

There is no doubt that alcohol abuse dramatically increases all-cause mortality and mortality from ischemic heart disease (IHD), in particular [7,9]. This problem is challenging in Russia. In our sample almost every third man drinks alcohol above the recommended levels, causing somatic disorders, and this tendency is more pronounced at the age of 30–59 years. In the older age group alcohol abuse was slightly lower, at 18%. The prevalence of alcohol abuse among women is significantly lower and no more than 1.5%.

According to Iestra *et al.* the relative risk associated with a sedentary lifestyle is comparable with a significant risk factor such as smoking, hypertension or hypercholesterolemia [13]. Currently, questionnaires are a common method for detecting individuals with low physical activity [7]. In our study, physical activity was assessed by using a standard questionnaire

Table 1. **Socio-demographic characteristics of a random sample of adults**

Age			
30–39 years	40–49 years	50–59 years	60–69 years
15.4%	29.7%	35.7%	19.2%
Ethnicity			
Chuvash	Russian	Ukrainian	Others
67.7%	29.5%	0.8%	1.7%
Marital status			
unmarried	married	divorced	widower
7.3%	76.4%	9%	7.3%
Education			
higher	college	secondary	incomplete secondary
24.5%	38.2%	35%	2.4%
Employment			
unemployed		employed	
35.4%		64.6%	

which included information about sitting duration during working hours, duration of everyday walking and engaging in physical exercises. It was found that every second respondent had a sedentary lifestyle, and no statistically significant difference was found between men and women. Interestingly, the prevalence of a sedentary lifestyle among different age groups of men and women was the same.

We also assessed the degree of nutritional disorders in a random sample. According to the data collected, only one in four working age individuals had a balanced diet. About 40% of responders had mild nutritional imbalance, 27% had a moderate imbalance, while less than 8% had severe nutritional imbalance. The number of cases among women without nutritional disorders was statistically higher than among men, whereas moderate and severe nutritional disorders were more common among men. No difference in the prevalence of moderate and severe nutritional disorders among different age groups was found.

This was greatly facilitated by the implementation of the Federal Target Program of 2002–2008 years. Hypertension is one of the important and well studied risk factors in the Russian Federation [11,14]. Our study revealed that different degrees of hypertension were experienced by, on average, 39.2% of respondents. It was less common among men than among women. These results are comparable with national average values [14]. There is a linear relationship between age and BP levels. For example, hypertension at a young age was found in 11% of the respondents, with an increase in prevalence corresponding to the age of participants: 40–49 years — 26.1%, 50–59 years — 48.8%, and, 60–69 years — 64%.

One of this study's objectives was to analyze the validity of drug treatment used in people suffering from hypertension. Most patients (77.6%) were receiving antihypertensive therapy, and only 22.4% of hypertension patients were not receiving treatment. Seventy two percent of men with hypertension received antihypertensive therapy, while more than 80% of women received antihypertensive therapy (P<0.04). Single agent therapy was delivered to 48% of participants with hypertension, and among them target BP levels were obtained in every second case (55% of men and 49% of women). Combined antihypertensive therapy delivered to 29% of patients with hypertension, and among them target BP levels were obtained in every third patient (41% of men and 22.8% of women). In general, the awareness and effectiveness of hypertension treatment in the city of Cheboksary are higher than average in Russia [14].

Our study has revealed that hypercholesterolemia is a common CVD risk factor. Hypercholesterolemia in a random sample of working age participants was diagnosed in 62%. Elevated levels of total cholesterol were revealed in 58.9% of men and 64% of women. The majority of respondents (43.7%) had mild hypercholesterolemia, whereas moderate and severe hypercholesterolemia was detected in 14.8% and 2.7% of cases, respectively. These results are comparable with the data obtained in other regions. In an epidemiological study conducted in different regions of Russia by the *National Research Center for Preventive Medicine,* it was shown that total blood cholesterol levels of >5.2 mmol/L were detected in about 60% of adults and levels of >6.5 mmol/L detected in about 20% of adults [15,16].

At the same time we estimated the prevalence of the low levels of antiatherogenic particles — HDL cholesterol, which is an independent risk factor for IHD [17]. In this study, low levels of HDL cholesterol were detected in every fourth participant (n=399). Low HDL cholesterol levels among men were diagnosed in 18% of cases, with significantly higher levels among women, 30% of cases (P<0.001). In general, the prevalence of low HDL cholesterol levels among men and women increased with age. Comparing two age groups of men and women, it was detected that the prevalence of low HDL cholesterol levels in women was much higher than in men (25.5% vs. 13.2%, P<0.05; 29.9 vs. 16.2%, P<0.005). The prevalence of traditional risk factors among men and women is shown on figure 1.

According to the international INTERHEART study (30,000 participants from 52 countries) the development of myocardial infarction results from traditional as well as other risk factors, including stress, depression, obesity, diabetes and low consumption of fruits and vegetables [1].

In a random sample of individuals of working age, hypertriglyceridemia was diagnosed in 27% of cases (28.5% among men and 26% among women). The majority of patients (25.5%) had mild (1.7–2.3 mmol/L) and moderate (2.3-4.5 mmol/L) hypertriglyceridemia. There was an increase in hypertriglyceridemia prevalence due to aging (from 20.8% of people aged 30–39 years to 28.7% of 60–69 years). Hypertriglyceridemia is a major metabolic disorder, which has close association with unhealthy lifestyle and other risk factors. According to the *National Research Center for Preventive Medicine*, among people with hypertension and high cardiovascular risk, hypertriglyceridemia was detected in 40.2% of cases, 35% of which were in combination with hypercholesterolemia [10].

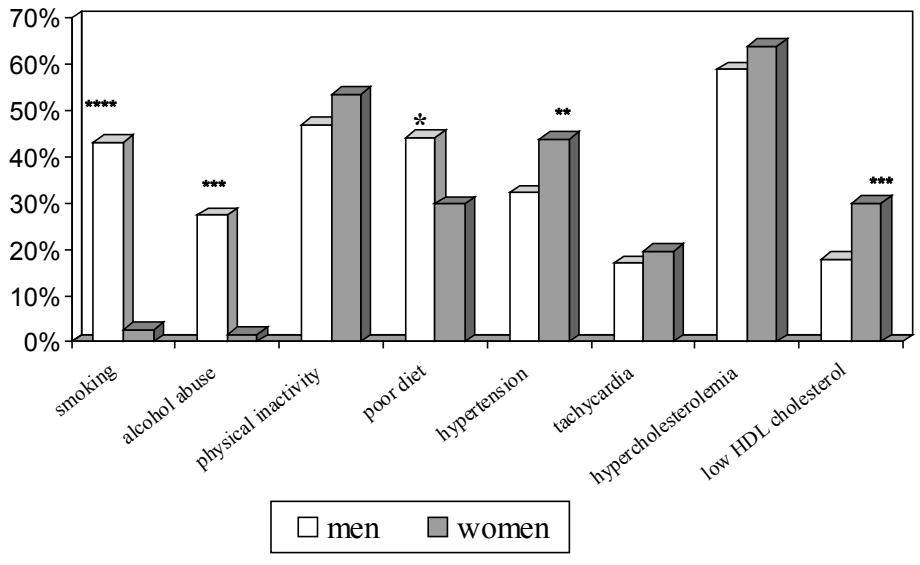

Figure 1. Prevalence of traditional risk factors in the adult population of the city of Cheboksary.
Note: *P<0.05, **P<0.002, ***P<0.001, ****P<0.0001 significant differences between men and women.

Over recent years obesity has been considered as a dominant metabolic risk factor for CVD. According to the epidemiological studies, conducted in the U.S., 61% of adults suffer from overweight and obesity [18]. Interestingly, over recent years there has been a 50% increase in the prevalence of obesity. Prevalence of obesity in Russia was found in 51% of cases, which is comparable to its prevalence in other European countries [19,20]. In our sample, 50% of men and 44.2% of women had normal body weight; 38.4% of men and 34.4% of women were overweight. The prevalence in obesity among women was three times higher than in men (21.4% and 7.4%, respectively). There was a significant increase in overweight / obesity prevalence due to aging (from 22.7% and 5.4% of respondents aged 30–39 years to 43.9% and 20.3% aged 60–69 years). We have also estimated the prevalence of abdominal obesity. Using ATP III criteria, we diagnosed abdominal obesity in 16.4% of men and 27.9% of women. According to Shalnova *et al*. in a Russian representative sample (5,760 men and 7,768 women), age-standardized values of abdominal obesity were 10.1% ± 0.5% in men and 38.9% ± 0.5% in women [21]. In this study, we also used *IDF* criteria for defining abdominal obesity, which was detected in about 48% of cases: 15% of men and more than 60% of women. The prevalence of abdominal obesity significantly increased with age (from 5% of participants aged 30–39 years to 29.6% aged 60–69 years). In general, abdominal obesity was observed more often than general obesity, because individuals with borderline values of BMI had already developed pronounced abdominal obesity.

Diabetes has been defined by *WHO* as a pandemic disease of the 21st Century. The medical and social importance of diabetes is determined by the development of early disability and high mortality due to both macro- and microvascular complications. Results of several reliable 12–20 year studies have showed that diabetes is a strong predictor and an independent risk factor for CVD [24,25]. Pre-diabetes, including fasting hyperglycemia and impaired glucose tolerance, is considered a metabolic stage, being a transitional stage between normal glucose homeostasis and diabetes [8]. On the other hand, pre-diabetes is considered an independent risk factor for CVD [25]. In November 2005, the joint committee of *WHO* and *IDF* adopted a resolution which stated that for a full assessment of glycemic status it is necessary to conduct an oral glucose tolerance test. In the present study, all respondents except for those with an established diagnosis of diabetes, completed a glucose tolerance test. According to the results, fasting hyperglycemia was detected in 3.9% of participants; whereas post-load hyperglycemia in 2.5% (P<0.04). Respondents aged 30–39 years had no impairments of carbohydrate metabolism. The prevalence of both fasting and post-load hyperglycemia was similar in patients aged 40–49 years (2.4–2.6%). In older age groups there was an increase in the prevalence of hyperglycemia, especially fasting hyperglycemia (two times more often than post-load hyperglycemia).

The first scientifically demonstrable data on the role of psychosocial factors in the development of CVD were presented in the mid-Twentieth Century. Experimental studies have shown that chronic stress causes, on the one hand, damage to the vascular endothelium, triggering processes of atherogenesis; and, on the other hand, activation of the sympathoadrenal system, which leads to the increased vasoconstriction and platelet activation [26]. According to

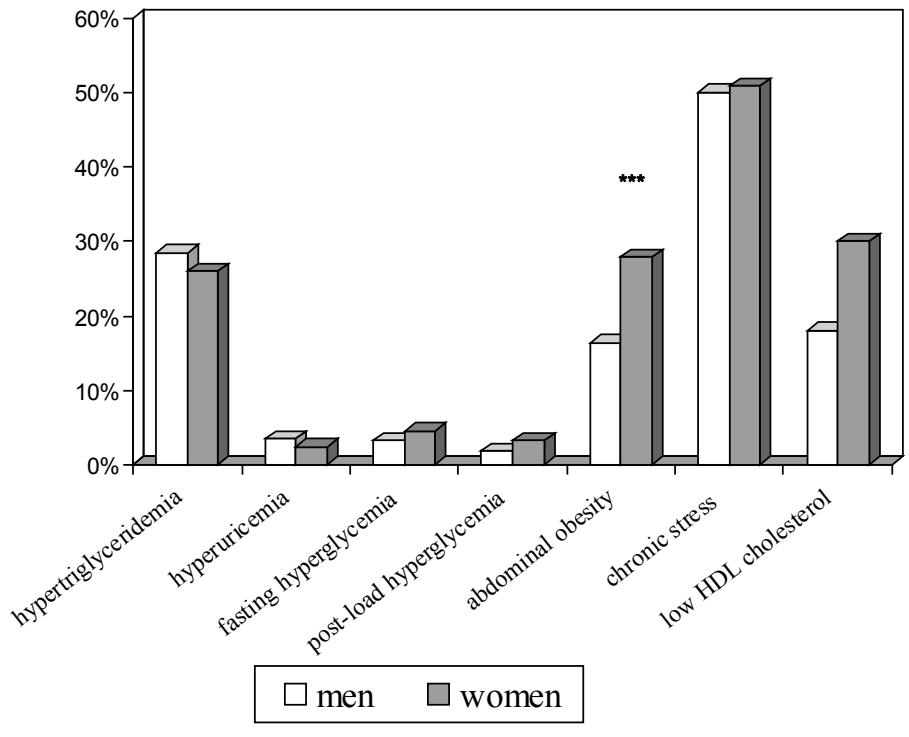

Figure 2. Prevalence of new risk factors in the adult population of the city of Cheboksary.
Note: ***P<0.001 significant difference between men and women.

the current study data from Cheboksary, a minority of respondents were experiencing low stress (11.2%). The remaining respondents in this random sample had medium stress, whereas high stress was detected in 38.3% of respondents. The prevalence of different degrees of stress was similar among men and women. We also investigated the association between stress and age. At the age of 30–39 years, every forth respondent reported high or medium stress. In the middle age groups there was a two-fold increase in the number of people reporting medium stress, while the number reporting high stress was lower compared with the younger respondents. In the older age group, the number of respondents reporting high stress increased. There was no clear relationship between the frequency of high stress, different marital status, and level of education. A summary of prevalence of metabolic risk factors and chronic stress is shown in Figure 2.

Conclusion

This epidemiological study has demonstrated that the prevalence of traditional and metabolic risk factors is high in a single city of the Volga Federal District. The majority of risk factors have a linear relationship with age. The prevalence of some risk factors depends on gender. In the development of primary prevention strategies, not only traditional, but also new risk factors should be taken into account, due to the latter's high prevalence.

Conflict of interest: None declared

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