

Changes in Cardiovascular Risk Factors in Residents of the Siberian Region (According to Epidemiological Studies)

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Aim. To analyze prevalence of cardiovascular risk factors in the Kemerovo region based on the results of epidemiological studies (2013 and 2016).

Material and methods. The study was based on two large epidemiological studies of the Kemerovo region: on 2013, «The epidemiology of cardiovascular diseases and their risk factors in the Russian Federation» and on 2016, «The prospective study of urban and rural epidemiology: study of the influence of social factors on chronic non-infectious diseases in low, middle and high income countries». In the study we analyzed cardiovascular risk factors using identical questionnaires, functional, anthropometric, biochemical means and measured on identical scales. As a result, we analyzed the prevalence of smoking, diabetes mellitus, overweight and obesity, abdominal obesity, hypercholesterolemia and hypertriglyceridemia, high levels of low-density lipoprotein (LDL).

Results. Univariate analysis indicates that in the sample of 2016, compared to the sample of 2013, the prevalence of smoking is statistically significantly lower, as well as the proportion of participants with high cholesterol levels, but not taking lipid-lowering drugs. In contrast, the prevalence of diabetes, hypercholesterolemia and hypertriglyceridemia is higher. In women, the frequency of abdominal obesity on 2016 is lower than on 2013: at 35-44 age group odds ratio (OR) = 0.67 with 95% confidence interval (CI) 0.44-1.03, at 45-54 age group OR = 0.47 with 95% CI 0.31-0.72, 55-65 age group OR = 0.49 with 95% CI 0.30-0.79. A high incidence of diabetes, hypercholesterolemia and hypertriglyceridemia is characteristic mainly of older women (55-65 age group): accordingly, OR = 1.96 with 95% CI 1.19-3.22, OR = 1.42 with 95% CI 1.02-1.97, OR = 1.51 at 95% CI 1.08-2.12. In the 45-54 age group of men, they smoked statistically significantly less often on 2016 compared to 2013, OR = 0.59 with 95% CI 0.36-0.96. The prevalence of overweight and obesity in both samples is the same: for women, the OR for overweight in different age groups is within 0.74-0.87, for men – within 0.95-1.78; for obesity OR in women is from 0.70 to 0.79, in men – from 1.03 to 1.34.

Conclusion. A significant advantage of the study is the analysis of changes in prevalence in age and gender groups, which showed significant differences in the dynamics of men and women in different age categories for a number of risk factors. Analysis of the dynamics of the prevalence of cardiovascular risk factors makes it possible to assess the effectiveness of state and regional policies in the field of health protection and, first of all, “risk groups” that require closer attention, development and implementation of targeted health-saving technologies.

Key words: cardiovascular risk, epidemiological studies, diabetes, hypercholesterolemia, hypertriglyceridemia, overweight.

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Introduction

The health status of the population changes in accordance with global, national and regional changes in social, socio-economic, managerial and other living conditions. Registration and analysis of these changes in population health is important not only as a statement of fact, but also from the standpoint of understanding new trends, responding to them, assessing the effectiveness of available technologies and searching for the required health-preserving technologies. Large studies of trends in cardiovascular health in developed countries demonstrate success in reducing mortality from cardiovascular diseases, the number of their complications, success in improving the quality of life of patients, in improving the quality and availability of cardiac care for the population. On the other hand, a global trend is the global «aging» of the population, which in turn poses new challenges to health care and requires the development and implementation of new scientific, social and administrative decisions.

Official data of state statistics provide information needs on indicators of population health, first of all, on total mortality, by classes of diseases and life expectancy. At the same time, they can't guarantee the representativeness of indicators for a number of classes of diseases (in particular, cardiovascular diseases) and their risk factors. As the researchers note, epidemiological monitoring based on sample population studies is designed to provide the necessary information for planning programs for the prevention of chronic non-communicable diseases and their risk factors [1]. In Russia, several successively conducted epidemiological studies of population health made it possible to analyze the dynamics of the prevalence of the main factors of cardiovascular risk [2-4]. Two large epidemiological studies were conducted in the Kemerovo Region – “The Epidemiology of Cardiovascular Diseases and Their Risk Factors in the Russian Federation” in 2013 and “The Prospective Study of Urban and Rural Epidemiology” in 2016: a study of the influence of social factors on chronic non-communicable diseases in low, middle and high income countries, these studies included epidemiological screening with the identification of the main factors of cardiovascular risk in a representative sample.

The aim of this study is to analyze the prevalence of cardiovascular risk factors in the Kemerovo region based on the results of epidemiological studies (2013 and 2016).

Material and methods

Sample characteristics

The study was based on two large epidemiological studies conducted in the Kemerovo region (Western Siberia, Russia). The representativeness of the sample was ensured by random selection in 3 consecutive stages according to the Kish method [5]: the selection of municipal health care institutions, medical districts and households. At the last stage, the methodology for selecting study participants was different: in 2013, 1 person from households was invited to participate in the study, the youngest person by age from the studied age group, in 2016 all household representatives suitable for age (35-65 years old) were invited to participation in the study.

The general analysis included 2,679 respondents who were surveyed in 2013 (1297 – 48.4%) and in 2016 (1382 – 51.6%). The main characteristics of the samples are presented in Table 1. The compared samples differ statistically significantly in age (mean age, respectively 51.1 ± 8.4 years and 52.1 ± 8.9 years, $p < 0.001$), gender composition, job availability, marital status and the share of urban/rural population.

Both studies were performed in accordance with Good Clinical Practice and Declaration of Helsinki principles. The study protocols were approved by the Ethics Committee of the Research Institute for Complex Issues of Cardiovascular Diseases. Written informed consent was obtained from all study participants.

Cardiovascular risk factors

The protocols of the two epidemiological studies were different, therefore, the work analyzed the cardiovascular risk factors, the data for which were obtained during examinations using identical questionnaire, functional, anthropometric and biochemical means and were measured on identical scales. As a result, the work analyzed the prevalence of smoking, diabetes mellitus, overweight and obesity, abdominal obesity, hypercholesterolemia and hypertriglyceridemia, high levels of low density lipoprotein (LDL).

Evaluation of smoking and the presence of diabetes mellitus was carried out according to the questionnaire. Height was measured with an accuracy of 0.5 cm, body weight was measured with an accuracy of 0.2 kg, followed by the calculation of body mass index (BMI) according to the formula: body weight (kg)/height (m). In accordance with national rec-

Table 1. Characteristics of the 2013 and 2016 samples

Characteristic	2013	2016	p-value
Sample size, n (%)	1297 (48.4)	1382 (51.6)	-
Men, n (%)	546 (42.1)	426 (30.8)	<0.001
Age, years	51.1±8.4	52.1±8.9	<0.001
Age groups			
35-44 years, n (%)	332 (25.6)	350 (25.3)	<0.001
45-54 years, n (%)	434 (33.5)	379 (27.4)	
55-65 years, n (%)	531 (40.9)	653 (47.2)	
Availability of work, n (%)	926 (71.4)	833 (60.3)	<0.001
Higher education, n (%)	453 (34.9)	492 (35.6)	0.720
Having a family, n (%)	796 (61.7)	958 (69.3)	<0.001
Accommodation in the city, n (%)	1034 (80.6)	950 (68.7)	<0.001
Data are presented as M±SD, unless otherwise indicated			

ommendations [6], overweight meant BMI values of 25-29.9 kg/m², obesity meant ≥30 kg/m². Abdominal obesity was determined by the waist circumference: in men >94 cm, in women >80 cm.

Hypercholesterolemia was classified at a total cholesterol concentration >5.0 mmol/L, hypertriglyceridemia was classified at a triglyceride concentration >1.7 mmol/L, and a high LDL level was classified at values >3.0 mmol/L.

Statistical analysis

Descriptive statistics included calculating the mean (M) and standard deviation (SD) for quantitative measures and frequency for qualitative measures. The Mann-Whitney test was used to assess the differences in quantitative indicators. Differences in the prevalence of cardiovascular risk factors in 2013 and 2016 were evaluated using the Pearson's chi-square test.

The compared samples differ in their main characteristics, therefore, the results obtained were corrected using logistic regression analysis. The 2013 sample was coded as «0» and the 2016 sample was coded as «1». The covariates were a gender, an age, an employment, a higher education, a family, and residence in the city. Logistic regression analysis for each factor was carried out in 6 sex and age groups to assess the modifying effect of gender and age. The covariates were the presence of a job, a higher education, the presence of a family and residence in the city. The odds ratio (OR) and 95% confidence interval (CI) were calculated.

The critical level of statistical significance was 0.05. Statistical analysis of the data was carried out using the Statistica 6.0 software (Statsoft Inc., USA).

Results

Main differences in the samples of 2013 and 2016

Univariate analysis suggests that smoking prevalence was statistically significantly lower in the 2016 sample than in the 2013 sample (Table 2). But the prevalence of diabetes mellitus, hypercholesterolemia, and hypertriglyceridemia was higher. There were no differences in the prevalence of overweight, obesity, abdominal obesity, high LDL cholesterol levels.

Adjustment of the results for gender, age and social factors based on the results of regression analysis led to the fact that the differences in smoking frequency in the samples of 2013 and 2016 turned out to be statistically insignificant (Table 3).

But the differences in the incidence of abdominal obesity, statistically insignificant according to one-way analysis (Pearson's chi-square), became statistically significant after adjustment: OR=0.70 at 95% CI 0.59-0.84. The rest of the associations remained unchanged. The 2016 sample is characterized by a higher incidence of diabetes mellitus compared to 2013 (OR=1.48 at 95% CI 1.06-2.07), a higher incidence of hypercholesterolemia (OR=1.23 at 95% CI 1.04-1.44) and a higher incidence of hypertriglyceridemia (OR=1.23 at 95% CI 1.02-1.48).

Gender and age features

The frequency of cardiovascular risk factors in the samples of 2013 and 2016 in age and gender groups are presented in Tables 3-4. The incidence of abdominal obesity in men in the two studies is the same across all age groups. The incidence of abdominal obesity in women in 2016 is less than in 2013.

Single modifying effects have been reported for other cardiovascular risk factors. The high incidence of diabetes mellitus, hypercholesterolemia and hypertriglyceridemia is characteristic mainly of older women (55-65 years old). In other age and gender groups, the differences are statistically insignificant, although they mainly reflect the trend of a higher frequency in the 2016 sample.

In the samples of 2013 and 2016, no differences in smoking frequency were found. But in 2016, compared to 2013, women 45-54 years old and 55-65 years old noted the highest, but statistically insignificant, smoking frequency, while men noted a lower smoking frequency. Smoking in the age group of 45-54-year-old men was observed statistically signifi-

Table 2. Prevalence of cardiovascular risk factors in 2013 and 2016

Factors	2013	2016	p-level
Smoking, n (%)	376 (29.0)	334 (24.2)	0.005
Diabetes mellitus, n (%)	62 (4.8)	115 (8.3)	<0.001
BMI			
Norm, n (%)	328 (25.3)	349 (25.2)	0.950
Overweight, n (%)	438 (33.9)	362 (33.4)	
Obesity, n (%)	527 (40.8)	571 (41.4)	
Abdominal obesity, n (%)	929 (71.8)	953 (69.0)	0.110
High levels of LDL, n (%)	914 (71.1)	941 (68.1)	0.100
Hypercholesterolemia, n (%)	754 (58.6)	887 (64.2)	0.003
Hypertriglyceridemia, n (%)	286 (22.2)	371 (26.9)	0.006

BMI – body mass index, LDL – low density lipoprotein

cantly less frequently in 2016 compared to 2013 (Table 4).

The prevalence of overweight and obesity in both samples is the same: OR for overweight in women in different age groups was within 0.74-0.87, in men – within 0.95-1.78; the OR for obesity in women ranged from 0.70 to 0.79, and in men – from 1.03 to 1.34.

Discussion

Diabetes mellitus

The study Global Burden of Metabolic Risk Factors of Chronic in 370 countries of the world has demonstrated a global trend towards an increase in both the average glycemic level and the prevalence of diabetes mellitus over the period 1980-2008 [7]. The prevalence of diabetes mellitus increased from 8.3% in men and 7.5% in women in 1980 to 9.8% and 9.2%, respectively, in 2008, which is mainly due to the aging of the population.

Russian studies show a similarity with global trends. From 2000 to 2009 in the Nizhny Novgorod, Rostov, Sverdlovsk, and Tyumen regions, the incidence of type 1 diabetes increased by 2.4% and type 2 by 45.5% [8]. According to the Federal Register of Diabetes mellitus, which includes 79 regions of the Russian Federation, an increase in the total number of patients in 2000-2016 is noted [9] from 2.043 million to 4.348 million, that is, by 2.3 million over 15 years. The multicenter Russian study NATION 2013-2015 indicates that the real incidence of diabetes mellitus is higher [3]: the prevalence of type 2 diabetes mellitus was 5.4%, including 2.5% previously diagnosed and 2.9% previously not diagnosed.

The results of this regional study are consistent with global and national trends. It's characteristic that the increase in the incidence of diabetes mellitus is most pronounced (it reaches a statistically significant level) in the older age group, which apparently reflects the emerging trend in Russia to reduce mortality and increase the life expectancy of patients with diabetes [8, 9]. This is probably a consequence of a combination of the increase in new cases of diabetes mellitus and the survival of patients with a long-diagnosed disease, which gives the maximum increase in prevalence in the older age group.

Obesity

The NCD Risk Factor Collaboration study, which includes 19.2 million participants 18 years and older from 186 countries of the world between 1975 and 2014, showed a worldwide trend towards an increase in BMI [10]. The prevalence of obesity (BMI ≥ 30 kg/m²) in men increased from 3.2% in 1975 to 10.8% in 2014, and in women – from 6.4% to

Table 3. The odds ratio for cardiovascular risk factors in 2016 compared to 2013 in the general sample and in women

Risk factors	n	All		Women					
				35-44 years		45-54 years		55-65 years	
		OR	95% CI	OR	95% CI	OR	95% CI	OR	95% CI
Smoking	2656	0.95	0.79-1.15	0.98	0.60-1.61	1.40	0.90-2.17	1.49	0.91-2.42
Diabetes mellitus	2644	1.48	1.06-2.07	-	-	1.23	0.47-3.22	1.96	1.19-3.22
Abdominal obesity	2653	0.70	0.59-0.84	0.67	0.44-1.03	0.47	0.31-0.72	0.49	0.30-0.79
High levels of LDL	2645	0.84	0.71-1.00	0.62	0.40-0.96	0.74	0.49-1.13	0.94	0.66-1.34
Hypercholesterolemia	2645	1.23	1.04-1.44	1.16	0.75-1.79	1.32	0.89-1.97	1.42	1.02-1.97
Hypertriglyceridemia	2645	1.23	1.02-1.48	1.12	0.60-2.10	0.89	0.58-1.38	1.51	1.08-2.12
Overweight	2652	0.92	0.77-1.11	0.87	0.57-1.33	0.74	0.49-1.13	0.78	0.52-1.18
Obesity	2652	0.86	0.73-1.01	0.70	0.44-1.12	0.73	0.50-1.06	0.79	0.59-1.08

LDL – low density lipoprotein, OR – odds ratio, CI – confidence interval

Table 4. The odds ratio for cardiovascular risk factors in 2016 compared to 2013 in men

Risk factors	35-44 years		45-54 years		55-65 years	
	OR	95% CI	OR	95% CI	OR	95% CI
Smoking	0.98	0.59-1.60	0.59	0.36-0.96	0.84	0.53-1.34
Diabetes mellitus	-	-	1.43	0.52-3.95	0.91	0.42-1.98
Abdominal obesity	1.01	0.63-1.64	1.00	0.63-1.60	0.83	0.53-1.31
High levels of LDL	0.84	0.51-1.39	1.08	0.64-1.82	1.04	0.64-1.69
Hypercholesterolemia	0.92	0.57-1.48	1.45	0.88-2.37	1.07	0.68-1.67
Hypertriglyceridemia	1.30	0.75-2.25	1.51	0.90-2.54	1.20	0.72-1.99
Overweight	1.06	0.62-1.80	1.78	0.97-3.26	0.95	0.56-1.61
Obesity	1.34	0.79-2.27	1.03	0.63-1.68	1.03	0.66-1.63

LDL – low density lipoprotein, OR – odds ratio, CI – confidence interval

14.9%. A similar study in the period 1980-2013 also revealed an increase in the proportion of people with overweight and obesity, and none of the countries showed any significant dynamics in reducing the prevalence of obesity [11]. The prevalence of abdominal obesity is also increasing [12, 13].

In Russia, individual epidemiological studies in different periods indicate an increase in the prevalence of obesity, including the abdominal type [4, 14, 15]. At the same time, the WHO data for Russia are not unambiguous [16, 17]. If men have an overall increase in the prevalence of overweight (2008 – 56.2%, 2010 – 57.2%, 2014 – 60.9%) and obesity (18.6%, 17.6% and 20.3%), then women have a decrease in the period from 2008 to 2010, followed by a slight increase in 2014 (overweight: 62.8%, 55.6% and 56.8%; obesity: 32.9%, 26.2% and 27.4%, respectively).

The data obtained in this study is mainly in line with this trend. Women had no statistically significant incidence of overweight and obesity in 2016, lower than in 2013, and men in different age groups had the same incidence of overweight and obesity, or higher. Differences in the frequency of abdominal obesity in according to sex are more pronounced: in 2016, the prevalence in women is lower than in 2013, and men had the same prevalence.

Dyslipidemia (hypercholesterolemia, hypertriglyceridemia)

Global studies of the prevalence of hypercholesterolemia and triglyceridemia have not been conducted, but national studies in developed countries indicate an increase in this pathology despite significant differences in prevalence [18, 19]. An increase in the proportion of patients taking lipid-lowering

drugs increases in most developed countries [20-22], which is usually accompanied by a decrease in average population cholesterol levels against the background of an increase in the prevalence of hypercholesterolemia [20, 22]. Average triglyceride levels and prevalence of hypertriglyceridemia also indicate an upward trend [23], but much less pronounced than for cholesterol. At the same time, a number of countries report a decrease in average triglyceride levels [24, 22].

In Russia, we can carefully judge the dynamics of hypercholesterolemia by comparing the WHO data and the results of recent epidemiological studies. According to the WHO, in Russia in 2008 the prevalence of hypercholesterolemia among the population aged 25 and over was 52.6%, including among men – 47.8%, among women – 56.4% [16]. In 2012-2013, the ESSE-RF study showed an average regional prevalence of hypercholesterolemia of 57.6% among people aged 25-64 years, including among men – 58.4%, among women – 56.3% [4], which in general indicates the growth of this pathology when compared with the WHO data.

According to the PROMETHEUS study [25], we can talk about a tendency towards an increase in the prevalence of hypertriglyceridemia in the Russian population: in 2011 – 28.3%, in 2012 – 28.4%, in 2013 – 30.1%. This analysis of epidemiological data in the Kemerovo region confirms the all-Russian and also the global trend of an increase in the prevalence of hypercholesterolemia and hypertriglyceridemia. The upward trend in frequency is manifested in most age and sex groups, but it's most pronounced and statistically significant in women 55-65 years old.

Smoking

The global trend (the study was conducted in 187 countries of the world) is a decrease in the prevalence of smoking from 41.2% in 1980 to 31.1% in 2012 for men and from 10.6% to 6.2% for women, with significant differences in countries, gender and age [26]. The study in 195 countries of the world in 2015 showed the preservation of this dynamics, but at a slower pace [27]. In most countries, these trends emerged from 1990 to 2005.

According to the WHO, the prevalence of smoking in Russia for the period 2008-2012 changed ambiguously [16, 17, 28]. If the overall prevalence of smoking has no dynamics (2008 – 40.5%, 2010 – 43.3%, 2011 – 40.0%, 2012 – 38.8%), then among men there is a tendency towards a decrease in prevalence (2008 – 65.5%, 2010 – 61.0%, 2011 – 59.0%, 2012 – 59.3%), and among women there is a tendency to increase the prevalence (2008 – 19.7%, 2010 – 22.1%, 2011 – 25.0%, 2012 – 22.0%). These statistics cover the adult population from the age of 15, which doesn't allow direct comparison with the results of this study, but we can state the similarity of all-Russian (according to WHO data) and regional (obtained in this study) trends. Similar results are shown in selective epidemiological studies in Russia [29]: «Russian monitoring of the economic situation and health of the population» in 1993, «Prevention and treatment of arterial hypertension in the Russian Federation» in 2003-2004 and ESSE-RF in 2012-2014. In particular, the prevalence of smoking among men decreased from 59.8% (1993) and 58.8% (2003-2004) to 39.0% (2012-2014), and among women, the prevalence of smoking increased from 9.1% (1993) and 8.4% (2003-

2004) to 13.6% (2012-2014). It seems that the state policy measures in relation to tobacco smoking in recent decades, along with changing social attitudes and aggressive marketing of tobacco products, determine such gender trends across Russia. It's interesting that a similar situation is described in Lithuania, which is also one of the countries of the post-Soviet space [30, 31].

Conclusion

Thus, the results of a comparative analysis of the prevalence of cardiovascular risk factors in 2013 and 2016 in the Kemerovo region mainly correspond to global and Russian trends. A significant advantage of the study is the analysis of changes in prevalence in age and gender groups, which showed significant differences in the dynamics of men and women in different age categories for a number of risk factors. It's also possible to distinguish large in number and severity changes in 2016 in women than in men, as well as the fact of an increase in the prevalence of some cardiovascular risk factors (diabetes mellitus, hypercholesterolemia, hypertriglyceridemia) in the older age group. Analysis of the dynamics of the prevalence of cardiovascular risk factors makes it possible to assess the effectiveness of state and regional policies in the field of health protection and, first of all, «risk groups» that require closer attention, development and implementation of targeted health-saving technologies.

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