PREHYPERTENSION: HOW OFTEN THIS CARDIOVASCULAR CONDITION OCCURS IN CITIZENS OF EUROPEAN RUSSIA (EPOCH-AH, 2002–2007)

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In recent years there has been actively discussed the problem of prehypertension since this arterial pressure level combined with three or more risk factors is a separate stratification index of cardiovascular incidence and mortality rate.

The aim of the investigation was to study the prehypertension prevalence depending on gender and age, state its dynamics and determine the frequency of combinations of various risk factors in European Russia population from 2002 till 2007.

Materials and Methods. Population in nine European Russian subjects was randomized in 2002. The respondents included in the sampling were examined by outpatient physicians. The prevalence of prehypertension and a number of risk factors in respondents were reanalyzed 2007.

Results. 286 outpatient physicians examined 6780 families (14 555 respondents). Prehypertension prevalence in 2002 was 13.7% of the population size, in 2007 the prevalence reached 16.9% ($p<0.001$). Prehypertension develops reliably more frequently in men than in women that subsequently predetermines earlier formation of arterial hypertension and cardiovascular complications. Age-specific prehypertension prevalence in RF increases in the period from 10 to 60 years, men preserving priority. The number of prehypertensive respondents with three and more risk factors did not change significantly over the period of five years and was 84.2% in 2002 and 65.2% — in 2007.

Conclusion. Prehypertension prevalence in the Russian Federation is high, over 60% of respondents have normal or high normal arterial pressure level and three and more hypertension risk factors that is a major medical and social problem for the country.

Key words: representative sampling; prehypertension; risk factors of cardiovascular complications; gender differences.

Arterial hypertension (AH) is a major national health care problem in many countries worldwide. The higher arterial pressure (AP) level is, the more aggressive modifiable risk factor (RF) of cardiovascular complications it becomes [1]. AH increases the risk of heart involvement, stroke, cardiac and renal failure [2, 3].

AH prevalence in the world varies within large ranges: from minimal rate in rural Indian areas (5%) to maximal — in Poland (71%) [4–7]. In Russia AH prevalence for the past 10 years has increased from 33.9 to 39.6%, and according to some reports — up to 41% of cases [8–10]. The presence of high AH prevalence rate in population of any country further results in significant economic waste due to strokes, myocardial infarctions and target lesions causing disability and early cardiovascular death rate.

Today, the prevention strategy of cardiovascular morbidity and death rate is based on RF detection and their control [11]. AH with the increase of AP ratio combined with age is an important RF of cardiovascular events [12]. Effective AP control, particularly through the use of modern prolonged antihypertensive drugs, decreases the risks of complications. It is said in the supplement to the last European recommendations on AH therapy that only 24-hour AP control is essential for prognosis and can be considered effective treatment [13]. The target AP achievement (below 140/90 mm Hg) decreases the risks of formation of myocardial infarction, stroke, and target lesions. It has been strongly indicated by the findings of the recent multicenter studies (VALUE, ASCOT-BPLA, INVEST, ACCORD). According to these findings, the achievement of AP in the range from 120/80 to 139/89 mm Hg in antihypertensive therapy proved to be maximum efficient, safe and economically justified [14–17].

In USA this AP level is referred to prehypertension. It is due to the fact that in respondents with prehypertension and three RF of cardiovascular complications in past medical history the risk of cardiovascular morbidity and death rate is significantly increased. First data on prehypertension prevalence in USA were received in 2006, prehypertension being 28% of the population. The patients with three RF and no medical prevention in this sampling amounted to 50% [18]. Within 5 years prehypertension has been found to transform to AH of various degrees that significantly increases the risk of morbidity and lethality.

Concurrently, Framingham Study [19, 20] showed the risks of any cardiovascular complications in patients with normal and high AP over the period of 10 years to increase by 2.5 times — for women and by 1.6 times — for men. It was assumed that normal and high AP is statistically significant RF of myocardial infarction and stroke development in patients with many risk factors [20].

In Russia the prevalence of prehypertension and various combinations of risk factors in normal and high AP in different populations has not been studied.

The aim of the investigation was to study the prehypertension prevalence depending on gender and age, state its dynamics and determine the frequency of combinations of various risk factors in European Russia population from 2002 till 2007.

Materials and Methods. In 2002 epidemiological survey of patients in European Russia (EPOCH) was carried out. It was the first stage of the study that enabled to reveal the prevalence of the main population RF of cardiovascular morbidity in European Russia [21]. For representative sampling from 43 European Russian subjects there were randomized nine subjects representing 20.9% of European Russia population: Kirov, Nizhny Novgorod, Orenburg, Ryazan, and Saratov regions, Republic of Tatarstan, Chuvash Republic, Stavropol and Perm Territories.

In each randomized subject there was formed the sampling due to step-by-step randomization according to State Statistic Committee data on population size, and 10 centers were chosen (the population of the subject being not more than 5.0 million of citizens). Only one prevention and treatment facility was chosen from the list of the facilities in each center, and four therapeutic areas were determined at random. Using step-by-step technique 25 apartments (total 100 apartments) were randomized, and the respondents were examined by a polyclinic physician. In 2002, 359 polyclinic physicians participated in the survey, they examined 339 therapeutic areas (94.2% out of the proposed), and in them — 8534 families. In the representative sampling there appeared to be 19 503 respondents.

The repeated sampling was studied in 2007. 286 polyclinic physicians took part in the survey, and they examined 6780 families. 14 555 respondents were included into the study. The inclusion criteria were the following:

age over 10 years, registered and permanently residing in the area. Due to the fact that within the period of five years 347 persons died, 562 respondents were absent (military service, a long-term business trip or vacation), 624 respondents refused the examination (they are in the data base and will be examined in 2013), this sampling was representative, as true loss amounted to 8.3% of the experimental subjects (emigration, unknown change of domicile) [22]. The findings obtained in the study can be extrapolated on the entire European Russia.

All researchers completed questionnaires that included not only personal data, past history, but also clinical condition at the moment of examination, AP measured on both arms, in sitting position, the data on the medications taken specifying the doses. AH was diagnosed if mean AP on both arms was 140/90 mm Hg and higher. AH degree was determined by AP level according to the classifications of ESC (Europian Society of Cardiology, 2007) [12] and RSC (Russian Society of Cardiology, 2008) [23]. Effectively treated patients were considered those taking any antihypertensive drug and having AP under 140/90 mm Hg. Prehypertension was distinguished from the general population of patients, who had AP ranging from 120/80 to 139/89 mm Hg on examination.

The following risks factors were analyzed: gender and age (men over 55 years, and women over 65 years), obesity (body mass index over 25 kg/m^2), physical activity (physical exertion less than 30 min daily), unmeasured salt consumption (salting of food), drink abuse (daily alcohol consumption: over 20 alcohol units for women, and over 30 — for men), smoking, heredity (mother, father) [11].

Age-related AH prevalence and RF of cardiovascular complications were studied both in 2002 and 2007 [22, 24, 25]. The present article represents for the first time the information on prehypertension prevalence in the representative sampling of the European Russia population.

Medical data were statistically processes using OPENOFFICE program at the Department of Internal Diseases, Nizhny Novgorod State Medical Academy.

Results. In 2002 the prehypertension prevalence in the Russian Federation was 13.7%. Five years later the rate increased by 21% and reached 16.9% (p<0.001). The number of AH patients regardless the therapy strategy over this period did not changed and was 39.7 and 39.6%, respectively (p=0.56). Within the sampling of AH patients, the number of effectively treated patients grew nearly twice: from 3 to 5.6% (p<0.001).

The analysis of the prehypertension and AH figures depending on gender (Table 1) showed the prehypertension prevalence among men both in 2002 (17.5%), and in 2007 (19.9%) to be statistically significantly higher than among women (10.8 and 14.6%, respectively). Over the five-year observation period the number respondents with prehypertension has statistically significantly increased regardless of gender, especially due to women. The dynamics has changed the relation in the population between AH respondents and the patients with optimal AP level. The number of patients without AH over the five years of observation has decreased by 6.7% (p<0.001).

The number of healthy respondents in the population has decreased only due to the increase of prehypertensive patients. Over the observation period AH prevalence has not changed. The structure of AH patients has undergone considerable changes: the number of effectively treated changes has increased nearly twice. The figure has changed due to a marked increase of the number of effectively treated patients, both men and women. The most significant changes over the period — from 2.0 to 4.7% (p<0.001) have been found among male patients. The obtained data suggest that in the Russian Federation the phenomenon is being formed: the number of AH patients does not change, though the number of healthy people reduces from year to year due to the increase of prehypertension patients. It indicates the lack of national work on primary prevention of cardiovascular incidence, that subsequently can be a significant risk of earlier and more common AH incidence in the Russian Federation.

The analysis of age-related prehypertension prevalence in 2002 (Table 2) enables to suggest that the maximum number of prehypertensive respondents is in the age group from 40 to 59 years. This regularity remained unchanged in 2007. Over the five-year period the number of test subjects with prehypertension statistically significantly grew in two age groups: 10–39 years and 40–59 years. In age group over 60 the prehypertension prevalence did not changed, since in this age period the risk of AH itself is very high. The study of the problem according to gender differences showed the men regardless of the year of the research to have maximum age-specific prehypertension prevalence in middle-aged group (from 40 to 59 years) — 22.0%. This figure statistically significantly increased over five years up to 25.7% (p<0.001).

Both in general population, and in groups differed in gender, there have been no changes in prehypertension prevalence in age group over 60. Thus, the most prehypertension sensitive

Table 1

The dynamics of prehypertension and AH prevalence depending on gender in the population of European Russia (2002–2007), %

Indices	2002	2007	$p_{2002/2007}$	2002		$p_{m/f}$	2007		$p_{m/f}$	2002/2007	
				m	f		m	f		$p_{m/m}$	$p_{f/f}$
APopt	46.6	43.6	<0.001	46.9	46.5	=0.54	46.2	41.6	<0.001	=0.39	<0.001
PreAH	13.7	16.9	<0.001	17.5	10.8	<0.0001	19.9	14.6	<0.001	<0.001	<0.001
AH	36.7	34.0	<0.001	33.5	39.1	<0.0001	29.2	37.5	<0.001	<0.001	<0.001
AHeff	3.0	5.6	<0.001	2.0	3.6	<0.0001	4.7	6.3	<0.001	<0.001	=0.02

Note: APopt — optimal AP; PreAH — prehypertension; AHeff — effectively treated AH; m, f — male, female.

Table 2

The dynamics of prehypertension prevalence depending on gender and age in the population of European Russia (2002–2007), %

Age, years	2002	2007	$p_{2002/2007}$	2002		$p_{m/f}$	2007		$p_{m/f}$	2002/2007	
				m	f		m	f		$p_{m/m}$	$p_{f/f}$
10–39	10.7	13.9	<0.001	14.7	7.3	<0.001	16.2	11.8	<0.001	=0.09	<0.001
40–59	18.1	22.6	<0.001	22.0	15.2	0.021	25.7	20.3	<0.001	=0.0014	<0.001
⩾60	12.4	12.0	=0.61	16.3	10.2	<0.001	15.8	10.0	<0.001	=0.71	=0.79

Table 3

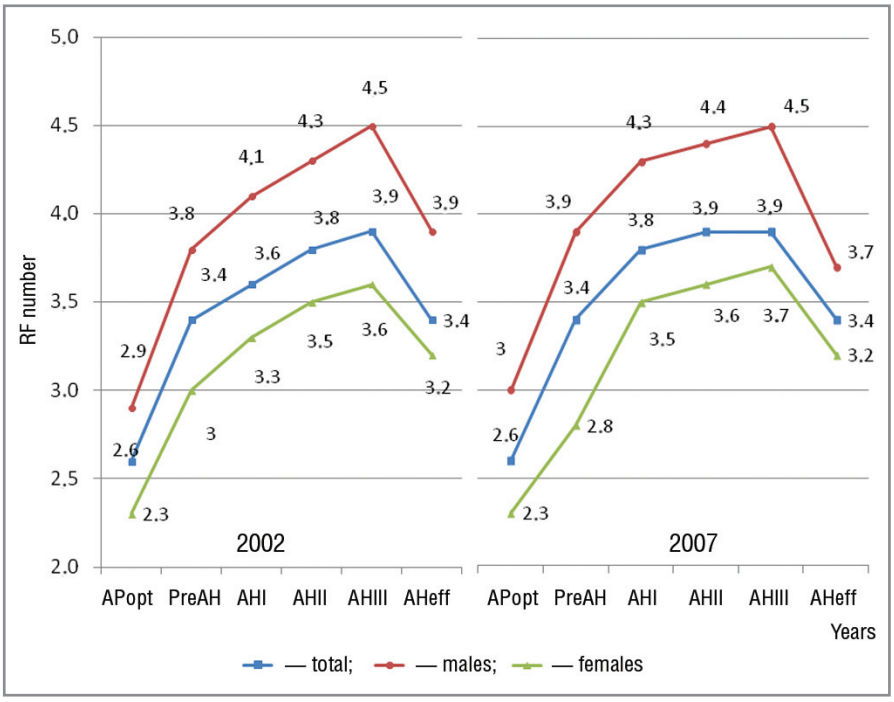
The dynamics of RF number per a respondent depending on AP level and gender in the population of European Russia (2002–2007), %

Risk Factors	2002	2007	$p_{2002/2007}$	2002		$p_{m/f}$	2007		$p_{m/f}$	2002/2007	
				m	f		m	f		$p_{m/m}$	$p_{f/f}$
APopt	2.57	2.62	0.015	2.92	2.31	<0.0001	3.01	2.24	<0.001	0.008	0.61
PreAH	3.40	3.38	0.21	3.75	2.97	<0.0001	3.96	2.77	<0.001	<0.001	<0.001
AH	3.72	3.83	<0.001	4.17	3.42	<0.0001	4.32	3.52	<0.001	<0.001	<0.001
AHeff	3.43	3.38	0.38	3.87	3.24	<0.0001	3.66	3.18	<0.001	0.053	0.69

age group is that from 40 to 59 years, which regardless of gender remains the main risk group of AH development. The findings are supported by the fact that mean age of respondents with prehypertension is statistically significantly lower than in AH patients. The mean age of the men in the sampling of prehypertensive respondents in 2002 was 44.8±15.5 years, and the figure did not statistically significantly change in 2007 (45.7±14.3 years). However, the women with prehypertension in 2007 appeared to be younger (47.6±14.5 years; p=0.02) compared to 2002 (49.5±15.4 years). Gender differences turned out to be highly significant (p<0.001). Men in any epidemiologic survey were younger than women.

The comparison of the sampling findings of AH patients showed that regardless of the year of the survey and gender differences the prehypertensive respondents to be significantly younger than AH patients (p<0.0001). Mean age of AH male patients in 2002 was 54.6±15.4 years and AH female patients — 59.9±14.1 years. In 2007 AH patients became statistically significantly older: men — 58.3±12.9 years (p<0.01) and women — 64.0±12.7 years (p<0.001). The fact can be explained by the increased number of effectively treated patients in the Russian Federation and the reduction of cardiovascular death rate among AH patients.

A separate part of the survey was the analysis of RF frequency in European Russia according to the representative sampling (Table 3). Minimum number of RF was found in respondents with normal AP (2.57 RF per a test subject in 2002 and 2.62 — in 2007). The number of risk factors in respondents with prehypertension is statistically significantly higher than in those with normal AP regardless the year of the survey (3.4 and 3.38 RF, respectively, $p_{APopt/preAP}$<0.001 in 2002 and $p_{APopt/preAH}$<0.01 — in 2007). In AH patients the number of RF appeared to be significantly larger (3.72 — in 2002, and 3.83 — in 2007) compared to the samplings of respondents with normal AP or prehypertension (p<0.001). Moreover, deliberately we excluded AH as a risk factor of cardiovascular events from the group of patients with AH.



The number of risk factors in the population of European Russia depending on the degree of AP increase (EPOCH-AH)

Thus, the RF number increase enables to intensify the onset of cardiovascular continuum and promote the change from normotension to hypertension. It is proved by the RF number analysis among AH patients with different degrees of elevated AP (See Fig.).

The analysis of RF number depending on gender showed the number of RF in men with any AP level and regardless of the years of the survey to be statistically significantly higher than the number of RF in women ($p<0.001$). In addition, over the five-year period of observation the number of RF in men regardless of the degree of AP increase has grown: statistically significantly – in normal AP and in prehypertension, and close to significance level – in AH ($p=0.053$). Among women there is the opposite tendency: there is statistically significant decrease of RF number in women with prehypertension ($p<0.001$) and insignificant — in normal AP ($p=0.61$) and AH ($p=0.69$). Thus, primary prevention of cardiovascular complications in real clinical practice holds out a hope that in women life style change can reduce the incidence. In men the main risk factors are alcohol abuse and the lack of physical exertion that forms the stratification background of high incidence and death rate from the main AH risk factor.

In 2002, 76.2% of respondents with prehypertension had three or more RF: men — 84.0%, women — 66.8%. Five years later the part of the respondents with prehypertension and over two RF decreased and amounted to 73.2% ($p=0.01$). Among men this value was 83.4%, and among women — 62.9%.

Discussion. For the first time the prehypertension was spoken about in 2003 in USA in the seventh report of JNC recommendations [26]. The introduction of prehypertension definition (AP over 120/80 mm Hg reaching 139/99 mm Hg) appeared to be necessary, since in this group of respondents within 4–6 years the risk of true AH, one of the main RF of cardiovascular complications, increases twice. Concurrently, in this year (2003) in European recommendations on AH diagnostics and prevention there were first distinguished the AP levels: optimal, normal, and high normal [27]. In 2007 in European guidelines there was introduced the term prehypertension [12].

The need for the introduction of the term prehypertension is caused by the fact that the risks of cardiovascular complications and death rate significantly increase in this elevated AP compared to optimal AP. If a respondent has three RF, the risks double. The findings of Framingham Study [20] showed that the surveillance over the representative sampling including 6859 respondents over the period of 11 years revealed 397 cases of cardiovascular events in subjects with prehypertension, among them: 72 deaths, 190 myocardial infarctions, 85 strokes, and 50 cases of chronic cardiac failure. Moreover, the risks of complications developed more aggressively within the range of high normal pressure compared to normal AP level. The life prognosis in women with AP from 130/85 to 139/89 mm Hg within four years is worse compared to those with normal AP. The same regularity in men forms in 6 years. In patients with diabetes mellitus, prehypertension increases the risks of cardiovascular complications by 1.8 times [28].

In USA one in three citizens has prehypertension [18] that 1.7 times as much than in the Russian Federation. And on the contrary, the number of AH patients in Russia is 1.4 times as much compared to the same value in USA (according to NHANES 2006 — 29%) [29]. In addition, on the average, 50% of Americans have prehypertension and three RF vs. the Russians who had prehypertension and three RF in 73.2% of cases according to our survey in 2007. The data indicate that the presence of prehypertension and the combination of three RF promotes the formation of AH and its cardiovascular complications.

Thus, modern preventive cardiology has to study the problem of prehypertension and develop new methods to control the efficiency of treatment and prevention of cardiovascular complications not only in AH [30], but also in prehypertension, since in this case complications develop in the state of complete health.

Conclusion. Prehypertension prevalence in European Russia in 2002 was 13.7% of the total population, in 2007 the index increased by 21% and was 16.9%.

Men have prehypertension significantly more frequently than women, and further it predetermines the earlier formation of arterial hypertension and cardiovascular complications in them. Male respondents with prehypertension on the average are 2 years younger than women with prehypertension.

Age-specific prevalence of prehypertension is increasing in the period from 10 to 60 years, preserving male priority.

Men significantly more frequently have the larger number of risk factors than women, and over the five-year period no tendency for its reduction has been observed.

The number of respondents with prehypertension and three or more risk factors (76.2% — in 2002 and 73.2% — in 2007) has not statistically significantly changed over the period of five years ($p=0.01$): in 2002 it was 12 409 thousand people among 118 867 thousand of total adult population in the Russian Federation, and in 2007 — 14 786 thousand per 119 521 thousand of population [31]. Extrapolation of the findings to the risks of formation of cardiovascular complications according to Framingham Study [20] enables to suggest that on average over the subsequent 5 years (from 2007 to 2012) 2.9% of patients will form a primary myocardial infarction, stroke, chronic cardiac or renal failure, that will amount to 429 thousand new cases of cardiovascular events.

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