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Hypertension in the routine healthcare: Focus on the results of health check-up

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Abstract

Background. Arterial hypertension (HTN) plays a major role (42%) for cardiovascular disease incidence, meanwhile routine early HTN detection remains low. Different measures are implemented in order to solve the problem of early HTN detection, as well as other chronic diseases leading to disability and the decrease in life expectancy. These measures include medical prevention based on the regular check-up and follow-up. **Objective.** To evaluate the quality of the check-ups regarding the diagnostics of blood pressure (BP) elevation and associated risk factors, and to evaluate the regional characteristics in the adult population. **Design and methods.** We analysed general data obtained in 2015 year during the check-ups in the country and regions. In this analysis, we present the data regarding HTN rates, including cases of preliminary diagnosis and elevated BP as a risk factor. **Results.** In 2015, 21,7 million people underwent health check-up. HTN incidence was 33,6%, including 16,5% of verified HTN, 3,6% cases of preliminary diagnosis, in 13,5% cases increased BP was considered as a risk factor. We found significant regional differences. In regions with a lower active HTN detection the overall HTN morbidity is lower, but primary HTN morbidity and CVD-related mortality are higher. In addition, in these regions active follow-up of patients with verified HTN is performed less frequently. In regions with high mortality associated with cerebrovascular diseases, the diagnosis of the diseases characterized by BP elevation is lower. **Conclusions.** We found a positive correlation between diagnosed HTN and nutrition-associated risk factors that confirms the importance of multi-factor prevention and control of HTN in primary health care. We suggest to use the ratio between the newly diagnosed cases of elevated BP of all cases with such diagnoses for rapid assessment of the quality of the health check-up for HTN detection at the regional level.

Key words: hypertension, clinical examination, morbidity, prevention, risk factors, primary health care, quality of care

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Артериальная гипертензия в реальной практике здравоохранения: что показывают результаты диспансеризации

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Резюме

Актуальность. Артериальная гипертензия (АГ) вносит основной вклад (около 42 %) в структуру заболеваемости сердечно-сосудистыми заболеваниями, при этом ранняя выявляемость АГ в рутинной практике остается невысокой. Для решения проблемы раннего выявления АГ, как и других хронических заболеваний, являющихся основной причиной потерь трудового и жизненного потенциала нашего общества, в настоящее время внедряется комплекс мер, в частности мер медицинской профилактики этих заболеваний на основе диспансерного метода, включающего диспансеризацию и диспансерное наблюдение. **Цель исследования** — оценить полноту и качество выявления в рамках диспансеризации взрослого населения заболеваний, характеризующихся повышенным артериальным давлением (АД), и связанных с ними факторов риска, и оценить региональные особенности. **Материалы и методы.** Проведен анализ обобщенных по всей стране и региональных результатов диспансеризации, проведенной в 2015 году. В статье проведен анализ частоты АГ, которая включает диагноз заболеваний, характеризующихся повышенным АД, в том числе и предварительный диагноз, а также повышенное АД как фактор риска. **Результаты.** В 2015 году прошли диспансеризацию 21,7 млн человек. Частота АГ составила 33,6 %, в том числе у 16,5 % установлен диагноз заболевания, у 3,6 % диагноз установлен как предварительный, у 13,5 % повышение АД было оценено как фактор риска. В регионах Российской Федерации отмечаются значительные колебания этих показателей. В регионах с более низкой активной выявляемостью АГ была ниже общая заболеваемость АГ по обращаемости, но выше первичная заболеваемость АГ и выше смертность от болезней системы кровообращения, и в ходе диспансеризации в этих регионах отмечена меньшая частота установления диспансерного наблюдения по поводу АГ. В регионах с высокой смертностью от цереброваскулярных болезней отмечена тенденция к более низкой постановке диагнозов заболеваний, характеризующихся повышенным АД при их активном выявлении. **Заключение.** Показана прямая взаимосвязь между выявленной при диспансеризации АГ и алиментарно-зависимыми факторами риска, что позволяет подтвердить важность многофакторной профилактики и контроля АГ в первичном звене здравоохранения. Доля случаев впервые установленного диагноза заболевания, характеризующегося повышенным АД, от всех случаев заболеваний с этими диагнозами может быть использована для оперативной оценки качества диспансеризации по выявлению АГ на региональном уровне.

Ключевые слова: артериальная гипертензия, диспансеризация, заболеваемость, профилактика, факторы риска, первичное звено здравоохранения, качество медицинской помощи

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Introduction

Despite of a steady trend of mortality decrease due to circulatory system diseases (CSD) in our country for the last years, the value remains one of the highest in the world which determines considerable expenses on medical care of patients [1–3]. So according to the World Health Organization (WHO) as of 2011 (the latest data presented in WHO), standardized mortality rate (SMR) due to CSD among population up to 65 years in the Russian Federation (RF) was one of the highest in Europe (192.11 per 100 thous. of population). Only the Republic Belarus had a higher value (197.73 per 100 thous. of population) [3], and SMR due to CSD in Russian exceeded the value in individual European countries in 6–10 times. It confirms relevance of implementation of effective measures for early detection and timely treatment and prophylaxis of the diseases, mainly on the level of primary healthcare chain. According to the official medical statistics, 33.3 mln. of CSD patients were registered in our country in 2015, among which the disease is newly identified in 17% every year.

Arterial hypertension (AHT) mainly contributes (about 42%) the cardiovascular (CV) morbidity structure, hereby early AHT detectability (AHT proportion in the structure of newly identified CDS cases) is low — 9.3% which, indeed, requires more active measures for timely detection of the disease.

Recently, due to formation on a federal level and implementation of the scientifically sound regulatory and methodical base to the practice of the national healthcare which is targeted on improvement of activity of the primary healthcare chain, we can definitely state that a steady formation of a medical prophylaxis system is ongoing in the national healthcare, mainly in relation to chronic non-infectious diseases and, in particular, cardiovascular diseases which are the main reason for premature population mortality [1, 4]. For the first time, the Procedure for prophylaxis of chronic non-infectious diseases has been approved in our country [4]. The key regulatory documents determining organizational and technological basic principles of medical prophylaxis are, undoubtedly, the orders of the Russian Ministry of Health concerning organization and conduct of medical check-ups of certain groups of adult population and medical follow-up [5–7].

Study aim — to assess completeness and quality of detection of the diseases as part of medical check-ups of adult population which are characterized with increased blood pressure (BP) and associated risk factors, and to aassess regional particularities.

Materials and methods

The RF generalized and regional results of medical check-ups made in 2015 were analyzed based on the data of statistical reporting form 131 [5]. The methodology for detection of the main CVD associated with atherosclerosis and having common factor risks included detection of ischemic heart disease, cerebrovascular diseases (CVD), was developed within the two stages of medical check-ups, according to regulatory documents of the Ministry of Health RF [6], the efficiency of the method for CVD detection was repeatedly published [8, 9].

AHT detection in mass screening tests is not difficult and is based on the BP measurement method. In the meantime, it is known that a process from BP measurement to establishing a diagnosis may not be one-time and often, besides mandatory diagnostic procedures, requires a certain long time period for additional tests [10, 11].

The process for establishing diagnosis of the diseases characterized with increased BP (codes I10-I15 per ICD-10), as part of medical check-ups of adult population includes:

- questionnaire (personal and family medical history, complaints, administration of anti-hypertensive drugs (AHD));
- BP measurement (criterion — BP level 140/90 mm Hg and above or AHD administration);
- anthropometry (measurement of height in standing position, body mass, waist circumference), calculation of body mass index;
- determination of total cholesterol (TC) and glucose levels in blood;
- electrocardiography at rest (for men above 35 years, for women — above 45 years);

▪ urine analysis.

The following tests are made per the certain age schedule:

▪ clinical blood test (three values — corpuscular hemoglobin concentration, white blood count and erythrocyte sedimentation rate) or

▪ clinical blood analysis, extended (in the age of 39 years and above with frequency once in 6 years);

▪ general therapeutic blood biochemistry test (creatinine, total bilirubin, aspartate aminotransaminase, alanine aminotransaminase levels), as well glucose and TC for subjects aged 39 years and above with frequency once in 6 years instead of express-tests of these values.

The following examinations are made per indications:

▪ with increased TC level, blood lipid spectrum is determined;

▪ with increased level of fasting glucose, glycated hemoglobin level is determined, or glucose-tolerant test is made;

▪ therapist examination (determination of a health group, medical follow-up, establishing diagnosis and, if indicated, referral to additional examinations for its clarification, determination of a further strategy, treatment prescription, brief prophylactic consulting and determination of indications for comprehensive prophylactic consulting).

The methodology of check-ups for adult population including the fixed set of screening methods on the first stage per the age schedule, and on the second stage — the range of diagnostic procedures, does not assign goals for establishing a final disease diagnosis which is characterized with increased BP, in all cases, but based on the summary data allows a physician:

a) to establish (or confirm based on the previously established diagnosis) a clinical diagnosis of a disease characterized with increased BP (codes I10-I15 per ICD-10);

b) to establish a preliminary clinical diagnosis of a disease characterized with increased BP;

c) to specify examined subjects with increased BP when the fact of BP increase is assessed and registered not as the diagnosis of hypertonic disease or symptomatic AHT, but as a cardiovascular risk factor (encoded per ICD-10 code R03.0).

So it is evident that from the point of view of BP control in the primary healthcare chain as the most important measure for CVD prophylaxis which are related to atherosclerosis, it is important to assess all three abovementioned categories of examined subjects in the analysis of check-up results, both individually and in summary. Only such approach allows to plan targeted individual treatment, diagnostics and prophylaxis strategy in these patients. Considering the abovementioned, in relation to interpretation of check-up results assessed per the statistical reporting form (form 131) [5], concept "arterial hypertension" includes collectively the diseases characterized with increased BP (established diagnosis or suspect — codes I10-I15 per ICD-10), as well increased BP as a risk factor (code R03.0 ICD-10).

In the present article, the check-up results are reviewed which was made in our country in 2015 in the period when the renewed order of the Ministry of Health RF № 36an [6] came into effect, with introduction of clarification on the identified pathology, in particular, with registration of newly identified disease cases and establishing medical follow-up per each nosological form of the disease.

The statistical processing of results was made with statistical program package IBM SPSS Statistics v.20.0. The significance of differences in values of the two groups was determined with Mann-Whitney test. χ^2 test was used for the analysis of correlation between age structure of subjects undergoing check-up and demographic population structure. Spearman's rank correlation coefficient was used for the analysis of relationship between values with normal distribution or without it. The differences were considered statistically significant at $p < 0.05$.

Results and their discussion

During the three years of implementation of a new check-up technology in our country, about 65 mln. of subjects had medical examination. In 2015, 21.7 mln. of people underwent check-ups (90% of the planned number).

Characteristics of subjects examined in medical check-ups in 2015

Considering specific features of check-ups (once in three years), we should assess representativeness of the obtained check-up results. For this purpose, the comparative analysis of the RF population structure was made based on the age, residence region and occupancy (working, students, not working).

The comparison of age structure considered particularity of age schedule of examinations in check-ups, therefore not continuous ages were

compared in age intervals, but with interval of three years, for which a country sample was made from those age groups which should undergo medical check-ups, and young (21–36 years), middle-aged (39–60 years) and elderly (above 60 years) subgroups of subjects were formed. The comparison showed the proximity of age structures of the RF population and citizens examined as part of check-ups: proportion of young people was 36.8 and 34.5%, respectively, middle-aged — 43.0 and 41.2%, elderly — 20.2 and 24.3% ($\chi^2 = 0.47$, $p > 0.05$).

The structure of citizens examined during check-ups, appeared also comparable with the structure of the country population according to the place of residence (town inhabitants were 79.8 and 74.3%, rural area — 20.2 and 25.7%, respectively, $\chi^2 = 1.02$, $p > 0.05$) and occupancy (proportion of working people was 54.8 and 65.0%, full-time students — 3.2 and 4.5%, non-working — 42.0 and 31.5%, respectively, $\chi^2 = 2.67$, $p > 0.05$).

Based on the comparison, the conclusion can be made that the obtained check-up results may be considered with certain reliability as representative for the country population in general and used as basic in determination of priorities and planning medical measures including prophylactic ones. Meanwhile, the trend is observed that medical check-ups cover on a lower extent young people, village dwellers and working citizens which should be further considered on local levels in arrangement of engagement of citizens to check-ups, especially those categories of citizens. Moreover, to make timely management decisions, we should assess check-up results on a local level from the point of view of data quality and completeness.

Diseases characterized with increased blood pressure

According to the official statistics of the Federal State Statistics Service, total disease morbidity characterized with increased BP, based on referral data, was in 2013 8718.8 cases per 100 thous. (or 8.7%) of the population, in 2014–9130.5 cases per 100 thous. (9.1%) of population, incidence of newly identified diseases was, respectively, 616.7 cases per 100 thous. (or 0.6%) of the population in 2013, and 691.5 cases per 100 thous. (0.7%) of the population in 2014 [12], i. e. the trend to increase of values was observed. The increase of primary mortality may be related on a certain extent to active disease detection in medical check-ups, however, for a final response to the question, much longer follow-up is required which is currently made in the regime of contact monitoring of check-up results all over the country.

Detection of arterial hypertension in medical check-ups

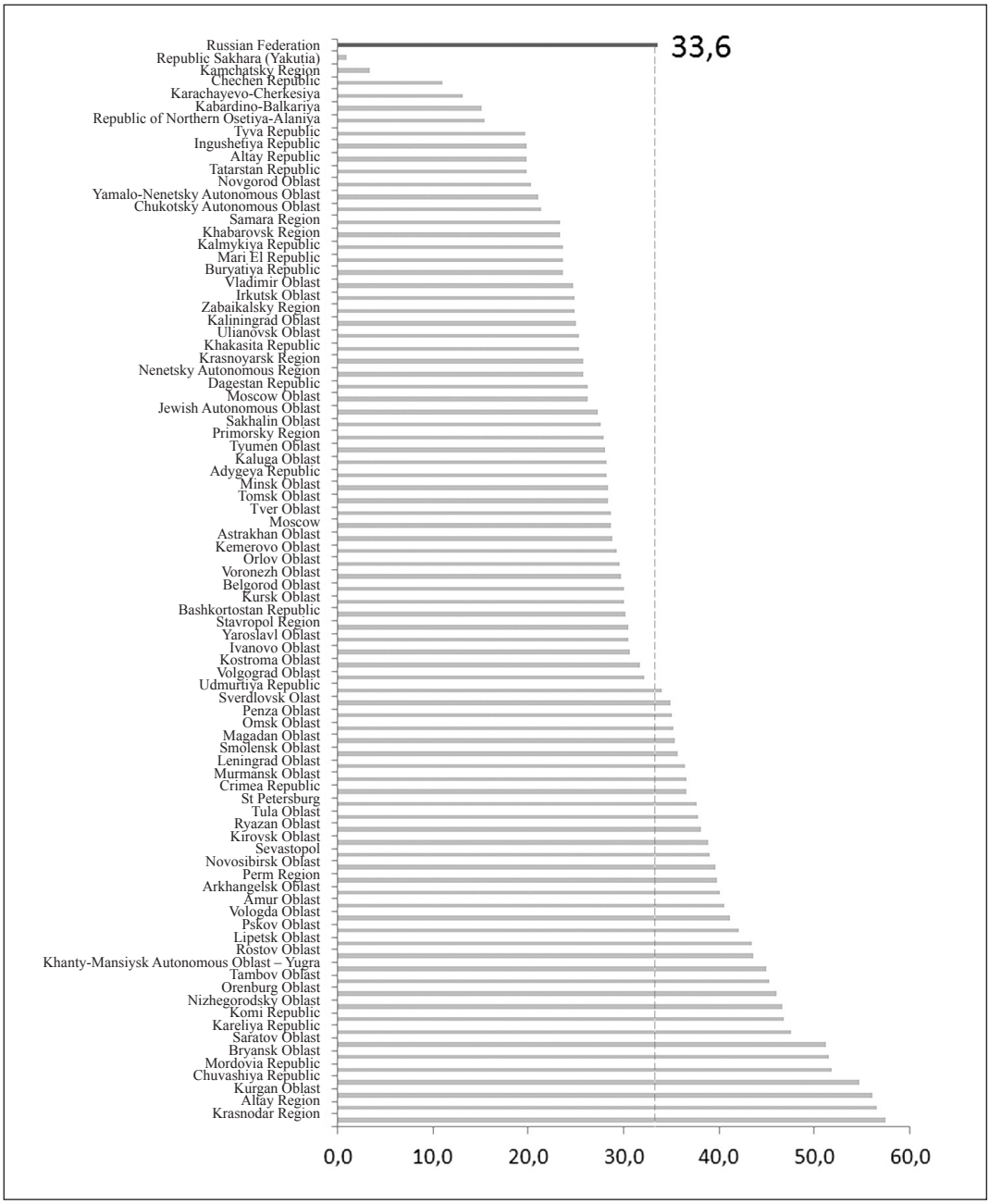
According the check-up data, frequency of AHT in 2015 (according to the data of reporting form (form 131)) in accordance with the definition laid down in the methodical part of the article, was 33.6% (about 6.2 mln. of subjects), among which the disease diagnosis characterized with increased BP was established in 16.5% (3 mln. of subjects) (codes I10-I15 per ICD-10), in 3.6% (about 670 thous. of subjects), the diagnosis was established as preliminary (totally with the diagnosis — 20.1%), and BP increase in 13.5% (2.5 mln. of subjects) was assessed by physicians as a risk factor (code R03.0 per ICD-10).

Among subjects examined during medical check-ups, the frequency of newly identified cases with the established diagnosis of the diseases characterized with increased BP was 2.8% (about 530 thous. of subjects), in more than 3.6% (about 670 thous. of subjects), the diagnosis was established as preliminary. Therefore the total frequency of newly identified diseases characterized with increased BP (established and preliminary diagnosis), was 6.4% (1.2 mln. of subjects), and we managed to make the final diagnosis in medical check-ups for less than a half of examined subjects (44.2%) which should be taken into consideration in the subsequent clinical activity of the primary chain, mainly, district physicians. Moreover, all cases of BP increase related not diseases but to the risk factor also require clinical examination as the risk factor may be a manifestation of an individual prognostically unfavorable disease and requires full-scale diagnostic and treatment strategy. In general, subsequent follow-up examination to find out reasons for BP increase according to the results of check-ups in 2015 required about 3.2 mln. of people which definitely determines emphases of physician practice.

While comparing frequency of AHT detection in RF regions, significant dispersion of values is observed: from 1.0% in the Republic Sakha (Yakutia) to 57.4% in the Krasnodar Region (fig. 1).

About half of the regions (40.0%) demonstrate higher frequency of AHT detection than the average Russian value, 6 regions — half lower than the average value. It is evident that quality control of AHT detection is required in all these

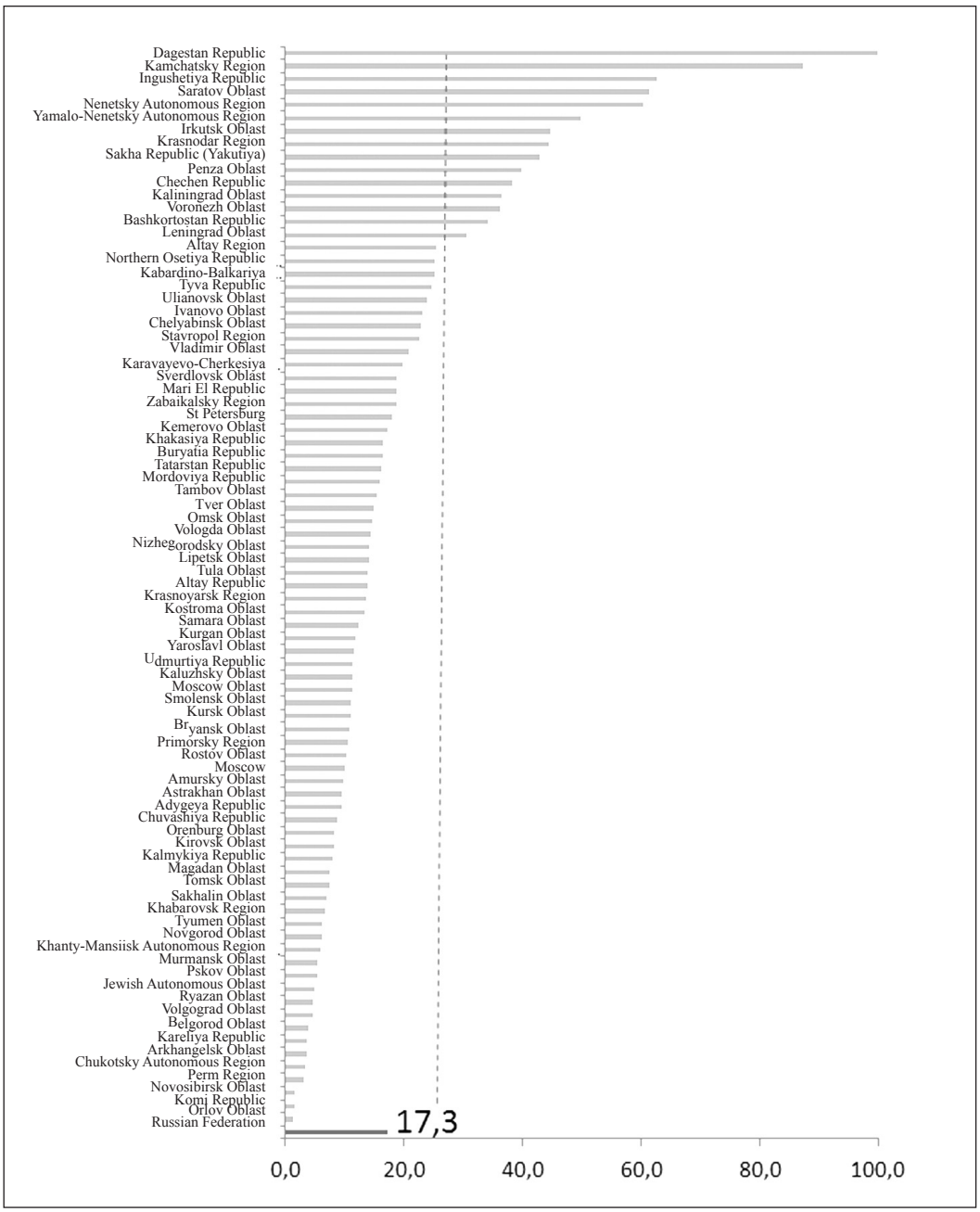
Figure 1. Frequency of detection of arterial hypertension in regions of the Russian Federation as part of a medical check-up of certain population groups in 2015 (data from reporting group № 131, order of the Ministry of Health of the Russian Federation № 87n)



regions on a local level. Often, opponents express their opinion that medical check-ups cover mostly patients visiting individually polyclinics for various reasons, but not been invited actively which may be assumed in regions with high AHT frequency. However, the correlation analysis did not confirm such a critical assumption: no correlation was observed between frequency of establishing diagnosis of the diseases characterized with BP increase (code ICD-10 I10-I15), and frequency of newly identified disease cases ($r = 0.03$).

Meanwhile making inter-regional comparisons, we have concerns that the procedure of active AHT detection is made in full accordance with the recommendations. So having the average Russian proportion of newly identified disease cases of all the diagnoses with codes I10-I15 per ICD-10 17.3 %, in 11 regions, the value was less than 5 %, i. e. more than three times less than the average value which may be related to low activity of citizen engagement in check-ups (fig. 2).

Figure 2. Proportion of certain population newly identified in medical checks in 2015, diagnoses of diseases characterized with increased arterial pressure, of all cases with the established diagnosis



Definitely, the comprehensive analysis of reasons for such differences is required. First of all, it is evident that a key problem — the control of quality and completeness of AHT detection, however such control requires specific analysis and is impossible only based on the statistical reporting data. In the meantime, based on the known data of epidemiological studies demonstrating high AHT incidence in the Russian middle-aged population [13], we may fairly assume that low AHT detectability may be a value of insufficient quality of check-ups in relation to establishing a disease diagnosis characterized with BP decrease.

To check the presumption, the inter-regional correlation analysis was made between frequency of AHT detection in check-ups and morbidity rates in these regions according to the medical statistics. The analysis showed that the regions with the less active AHT detectability showed negative correlation of the lower strength in primary AHT morbidity per referrals ($r = –0.19$) and direct correlation with general morbidity per morbidity ($r = 0.34$). In these

regions, low AHT detectability correlated negatively (correlation of the moderate strength) with CSD mortality (r = –0.25). In other words, we can assume that CSD mortality and its differences in the country regions depend on a certain extent on a timely (active) AHT detection.

It is known that general mortality rate from the preventive point of view reflects two opposite processes: positive (includes referrals as part of medical follow-up) and negative (includes referrals due to disease aggravation). The correlation analysis showed the presence of positive correlation, but of the lower strength (r = 0.05) between low active AHT detectability and registration of these patients to medical follow-up. I. e. the presumption is confirmed that low frequency of newly identified AHT in medical check-ups may indicate unsatisfactory quality of timely disease detection and, undoubtedly, may have a negative impact on further population health value, as well to increase referrals due to diseases and aggravations. The aim of modern strategies of the primary healthcare chain is the thrive for the increase of prophylactic visits to outpatient –polyclinic institutions (as well, as part of medical follow-up) instead of referrals due to diseases.

Correlation between arterial hypertension and main cardiovascular risk factors

The correlation analysis showed the presence of significant relationship between AHT frequency detected in medical check-ups and main risk factors which are also established in check-ups per the uniform regulatory approved criteria [6]. So Spearman correlation coefficient for decrease of correlation strength between AHT and risk factor was: for overweight and obesity — r = 0.72 ($p < 0.001$), for low physical activity — r = 0.69 ($p < 0.001$), for non-rational nutrition — r = 0.68 ($p < 0.001$), for dyslipidemia — r = 0.55 ($p < 0.001$), for hyperglycemia — r = 0.45 ($p < 0.001$). The direct correlation of lower strength was observed between AHT and smoking ($r = 0.36$, $p < 0.01$), as well between AHT and hazardous alcohol consumption ($r = 0.27$, $p < 0.05$). The correlations of the highest strength were established between non-rational nutrition and low physical activity ($r = 0.83$, $p < 0.001$), between overweight/obesity and non-rational nutrition ($r = 0.75$, $p < 0.001$), as well between overweight/obesity and low physical activity ($r = 0.75$, $p < 0.001$) which shows the important role and strong correlation of behavioral risk factor in the disease development.

So the analysis allows to assess the result of medical check-ups in relation to establishing risk factors in general as satisfactory as risk factor patterns and correlations known in epidemiological studies are confirmed. Moreover, as for AHT prophylaxis, it may be stated that results of check-ups may be used to plan priorities of AHT prophylaxis in the primary healthcare chain. And it is important to assess regional particularities for formation of local emphases of AHT prophylaxis in medical practice on a population level, as well.

The analysis of regional particularities of detection quality of arterial hypertension in medical check-ups

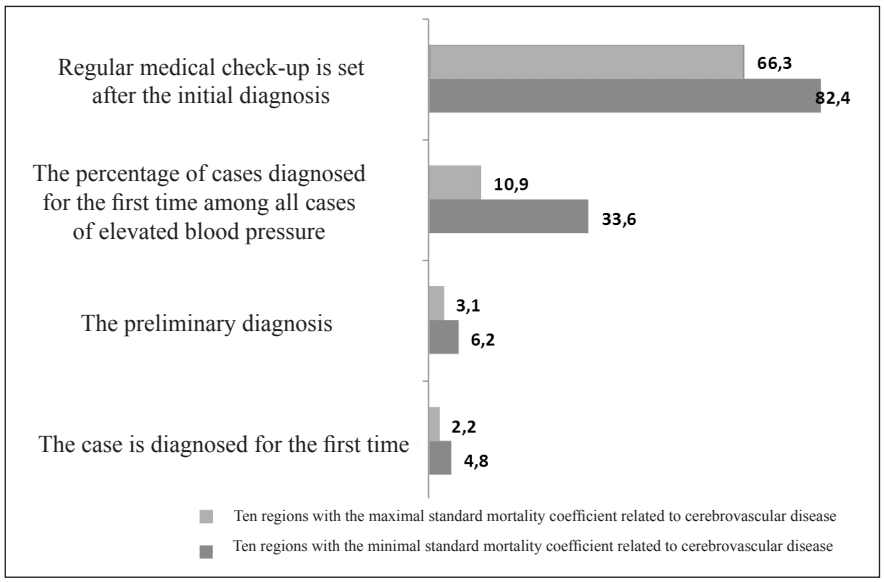
It is absolutely evident that while assessing results of check-ups, especially in its applied meaning, we should obtain quality proof of the results for which only quantitative assessment of results is insufficient.

The comparative analysis of check-up results was made in relation to AHT detection with regards to inter-regional differences in health values (based on SMR due to CVD for 2014), for which region subgroups were formed with various SMR values due to CSD (10 regions with the lowest and 10 regions with the highest values).

So with average SMR due to CVD in RF 156.1 cases per 100 thous. of subjects 2014, this value in 10 regions with the lowest CVD mortality of the population varied from 36.7 to 111.4 cases per 100 thous. of subjects, and in 10 region with the highest mortality — from 220.1 to 277.1 cases per 100 thous. of subject which, indeed, sets the analysis of such significant inter-regional differences to the range of essential tasks. Certainly, multifactorness of forming mortality rates requires in the meantime the analysis of inter-regional differences in frequency of detection and quality of AHT diagnostics as part of medical check-ups is of certain interest as CSD mortality is considerably related exactly to AHT (fig. 3).

All comparable values of active AHT detection appeared higher in regions with low CVD mortality then in regions with high mortality, though differences were on a trend level and not significant either by frequency of a newly established diagnosis ($p = 0.19$), or frequency of a preliminarily established diagnosis ($p = 0.14$), or frequency of medical follow-up based on a newly established diagnosis ($p > 0.05$). The proportion of newly established diagnosis of all disease cases characterized with increased BP ($p = 0.05$) appeared to be the only value with the difference close to significant. So according to the

Figure 3. Parameters of completeness and quality of establishing a disease diagnosis characterized with increased blood pressure (ICD codes-10 I10-I15) in the regions of the Russian Federation with the lowest and highest values of a standardized mortality rate due to cerebrovascular diseases [12] in percentage of examined subjects in allocated region subgroups



Remark: SMR — standardized mortality rate; CVD — cerebrovascular diseases.

current data, the value (proportion of subjects with a newly established diagnosis of all disease cases with code ICD-10 I10-I15) may be used for comparative quality assessment of check-ups in relation to AHT detection [14]. However, to range the value and determine criteria, further observation and analysis are certainly needed. Meanwhile, the analysis data already show that it is preferable that its value is close to the value in regions with low SMR due to CVD. The additional analysis showed the present trend to the higher frequency of alimentary-dependent behavioral AHT risk factors with high SMR due to CVD in comparison with the regions with low SMR due to CVD. So frequency of non-rational nutrition was 28.9 and 22.1%, respectively ($p > 0.05$), overweight and obesity — 22.1 and 18.7% ($p > 0.05$) which corresponds to the known concept of multifactor AHT prophylaxis among the population.

The key goals of medical check-ups are not only the detection of diseases and risk of their development, but also formation of further treatment and prophylaxis strategy, in particular, medical follow-up. It is shown for many times that exactly these goals of the primary chain should be revised, in the context of AHT control problem, mainly, goals of therapists (district physicians, general practitioners). Nowadays, medical check-up from that point of view may be considered as an active catalyst of prophylaxis process, as exactly mass examination allows to visualize the problem scope and determine its current condition. First of all, it should be highlighted that the value of AHT patient coverage is a starting mechanism for health management in this category of patients. The results of medical examination in check-ups allow only state patient registration for medical follow-up which further requires control of the process quality and efficiency. The special attention should be paid to patients with the newly diagnosed disease.

Conclusions

1. The obtained results of medical check-ups may be considered with a definite reliability as preliminary for the country population in general and used as basic while planning medical measures including prophylactic ones on a regional level. Meanwhile, on regional levels arranging citizen engagement in medical check-ups, you should pay more attention to engagement of younger age subjects, village inhabitants and working citizens in examinations.

2. According to medical check-ups, frequency of AHT in 2015 was 33.6% of which 16.5% represented the established diagnosis of the disease characterized with increased BP (codes I10-I15 per ICD-10), the diagnosis in 3.6% of cases was established as preliminary, and in 13.5% of cases, BP increase was assessed by physicians as a risk factor (code

R03.0 per ICD-10). Considerable inter-regional differences of AHT frequency are observed which requires a detailed specific analysis.

3. Average Russian proportion of newly identified disease cases was 17.3% of all the diagnoses with codes I10-I15 per ICD-10. However, the value was less than 5% in 11 regions which represents a challenge for the full-scale use in these regions for active citizen engagement for medical check-ups. The regions with lower active AHT detectability had lower general AHT mortality in referral, but higher primary AHT mortality and higher CSD mortality, and during medical check-ups in these regions, lower frequency of establishing medical follow-up due to AHT was observed.

4. The strong statistically significant relationship between AHT identified during medical check-ups and alimentary-dependent risk factors was revealed which allowed to confirm multi-factorness of AHT prophylaxis and control in the primary healthcare chain.

5. The proportion of cases of the newly identified disease diagnosis characterized with increased BP from all disease cases with such diagnoses may be used for timely quality assessment of medical check-ups in AHT detection on a regional level.

Conflict of interest
The authors declare no conflict of interest.

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