Eurasian J Med 2016; 48: 42-52 The Eurasian Journal of Medicine **Original Article**

Which Measures of Health Status Assessment are the Most Significant in Organized Cohorts with Low Current Cardiovascular Risk? The Screening Study of Penitentiary Staff in Saratov Region, Russia

Düşük Kardiyovasküler Riskli Organize Kohortlarda Yapılan Sağlık Değerlendirmelerinde Hangi Ölçümler En Önemlidir? Rusya'da, Saratov Bölgesinde Cezaevi Personelinin Taranması Çalışması

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Abstract

Objective: The aim of the present study was to compare different methods of health status assessment in organized cohort of penitentiary employees in Saratov Region, Russian Federation.

Materials and Methods: 1,014 penitentiary employees (81.8% male) aged 33.4±6.8 years were included in the cohort study. All participants underwent an annual preventive health examination in the Center of Medical and Social Rehabilitation of Russian Federal Penitentiary Service in Saratov Region. The prevalence of common cardiovascular risk factors was assessed. Risk Score and the number of fulfilled health metrics proposed by American Heart Association (AHA) were calculated for each participant.

Results: It is shown that penitentiary staff in Saratov Region is characterized by low current risk score (1.2±0.8%), but high prevalence of such risk factors as increased body weight and obesity (51%), tobacco use or passive smoking (81%), and unhealthy diet (55%). 98.4% of participants had the Score level of ≤5%, but only 4.5% of penitentiary staff met the ideal cardiovascular health (they met all seven AHA health metrics). One fifth of the participants met three or less AHA health metrics. A statistically significant correlation between the risk Score and the number of fulfilled AHA health metrics is revealed (Chi-square = 5.1, p=0.024). The probability of fulfilment of less than 5 AHA health metrics in subjects with medium risk score is shown to be almost twofold greater than in subjects with low risk Score. However, there are a lot of differences in the assessment of cardiovascular health by risk Score and AHA health metrics.

Conclusion: AHA health metrics are more preferable than the risk Score or assessment of separate cardiovascular risk factors for preventive management in organized cohorts with low current cardiovascular risk such as penitentiary staff in Saratov Region.

Keywords: Risk factors, cardiovascular risk, health metrics, penitentiary service

Öz

Amaç: Bu çalışmanın amacı, Rusya Federasyonu, Saratov Bölgesi cezaevi çalışanlarının organize kohortunda sağlık durumu değerlendirmede farklı yöntemleri karşılaştırmaktır.

Gereç ve Yöntem: Yaş ortalaması 33,4±6,8 yaş arası, 1014 ceza infaz çalışanı (%81,8 erkek) çalışmaya dahil edildi. Tüm katılımcıların, Saratov Bölgesi Rusya Federal Cezaevi Servisi Medikal ve Sosyal Rehabilitasyon Merkezi'nde yıllık koruyucu sağlık muayenesi yapıldı. Ortak kardiyovasküler risk faktörlerinin sıklığı değerlendirildi. Risk Puanı ve Amerikan Kalp Derneği (AHA) tarafından önerilen sağlık ölçümleri sayısı her bir katılımcı için hesaplandı.

Bulgular: Saratov Bölgesi cezaevi personellerinin risk skoru (%1,2±0,8) düşük olmakla birlikte, artan vücut ağırlığı ve obezite (%51), tütün kullanımı ya da pasif sigara (%81) ve sağlıksız beslenme (%55) gibi risk faktörlerinin yüksek prevalans ile karakterize olduğu gösterilmiştir. Katılımcıların %98,4'inin skoru %≤5 seviyesindeydi, ama cezaevi personelinin sadece %4,5'i (hepsi yedi AHA sağlık ölçeği ile uyumlu) ideal kalp sağlığı kriterlerine uymaktaydı. Katılımcıların beşte biri, üç veya daha az AHA sağlık ölçütlerine uymaktaydı. Risk puanı ve uyulan AHA sağlık ölçeği sayısı arasında istatistiksel olarak anlamlı bir ilişki (Ki-kare=5,1, p=0,024) ortaya çıkarılmıştır. Orta risk puanı olan kişilerde 5'ten az AHA sağlık ölçeğinin yerine getirilmesi olasılığının, düşük risk puanlı kişilerden neredeyse iki kat daha fazla olduğu gösterilmiştir. Ancak, kalp ve damar sağlığı değerlendirilmesinde risk puanı ve AHA sağlık ölçekleri arasında bir çok farklılık bulunmaktadır.

Sonuç: Saratov Bölgesi cezaevi personeli gibi organize kohortlarda düşük kardiyovasküler risklerin önleyici yönetiminde AHA sağlık ölçeğinin kullanımı risk faktörlerinin ayrı ayrı değerlendirilmesi ve risk skorlarına göre daha çok tercih edilebilir.

Anahtar Kelimeler: Risk faktörleri, kardiyovasküler risk, sağlık ölçekleri, ceza infaz hizmeti

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Introduction

High prevalence of cardiovascular risk factors (CVRF) is a great problem of primary prevention in many countries [1, 2]. Main CVRF are as follows: age, gender, smoking, unhealthy diet, sedentary lifestyle, stress, increased body weight and obesity, elevated blood pressure (BP), hyperglycaemia and hypercholesterolaemia [3]. It is known that cardiovascular disease (CVD) incidence is strongly correlated with the factors resulting from unhealthy lifestyle [4]. Correction of CVRF is a basis for both primary and secondary prevention of CVD.

Screening of CVRF is a principal point of prevention. It is especially preferable among adults with low social and economic status [5] and in organized groups. Different technologies are used for primary prevention. Among them are nurse-based activities in the community, preventive efforts of general practitioners and practicing cardiologists, hospital-based programs, and society-based programs [3, 6]. Anyhow, cardiologist plays a pivotal role in patient preventive examination [3]. Further involvement of nurses raises the effectiveness of prevention [3, 7].

Despite many effective primary prevention technologies, there are many barriers for the effective CVD prevention in primary care, such as low health professionals' awareness in prevention guidelines, lack of communication between population and healthcare services, lack of patients' motivation for healthy living, etc. [8, 9]. Thus, adherence to CVD prevention, especially to the screening of CVRF and risk stratification, is often insufficient in a routine care [9, 10].

Different strategies are used to increase the effectiveness of CVD prevention, such as clear guidelines for healthcare professionals, reminders for patients, clinical audit, etc. [11, 12]. Traditional approach to the assessment of population health is based on the frequency of main CVRF [3, 13]. American College of Cardiology Foundation (ACCF) and American Heart Association (AHA) have proposed performance measures for the primary prevention of CVD in adults [13]. These performance measures cover the preventive care for the control of main CVRF.

In 2010, AHA has proposed seven health metrics including not smoking, being physically active, having normal blood pressure, blood glucose levels, total cholesterol, and weight, and eating a healthy diet [14]. It is an alternative approach to the assessment of population health. AHA health metrics are based on the concept of ideal cardiovascular health [14, 15]. To meet the complete definition of ideal cardiovascular health, an individual would need to meet the ideal levels of all 7 health metrics [14].

Risk Score can also be used to access population health for preventive care [16].

It would be potentially interesting to access the applicability of the three approaches of preventive assessment (frequency of main CVRF, AHA health metrics and risk Score) in high-organized adult cohorts such as penitentiary employees in Saratov Region (Russia). Key points of current technology for primary CVD prevention in penitentiary staff include total coverage, annual frequency of preventive examinations, detailed pathways of preventive care, availability of all necessary equipment and medical staff, and clear duties of each participant. Primary prevention for penitentiary staff is delivered by the Center of Medical and Social Rehabilitation (CMSR) of Russian Federal Penitentiary Service in Saratov Region.

The aim of the present study was to compare the usefulness of different tools proposed for cardiovascular risk evaluation and management in penitentiary employees in Saratov Region (Russia).

Materials and Methods

Participant Selection

Cross-sectional screening study in penitentiary employees in Saratov Region (Russia) was conducted in 2012-2013. The data on the health status of penitentiary employees were gathered in the Center of Medical and Social Rehabilitation of Russian Federal Penitentiary Service in Saratov Region.

The following enrolment criteria were established for the purposes of the study:

i) annual health examination in CMSR,
ii) absence of any acute diseases at the time of preventive examination.

The initial group of penitentiary employees included in the preventive health examination consists of 1,063 subjects (the first enrolment criterion). 49 (4.6%) subjects were excluded from the study because of nonfulfillment of the second enrolment criterion. These subjects had acute diseases (respiratory virus infection, etc.) or exacerbation of chronic disease. There were no refusals from participation in the study.

We included 1,014 participants (185 females (18.2%) and 829 males (81.8%)) aged 47±8 years in the study. Ethics committee approval was received for this study from the CMSR local Ethics Committee (Saratov, Russia). All participants gave their written informed consents.

Technology of Preventive Health Examination in CMSR

Center of Medical and Social Rehabilitation is an outpatient institution conducting the prevention and treatment of chronic diseases in penitentiary employees. Every year, medical staff of CMSR compiles the list of penitentiary employees pertaining to the forthcoming preventive examination. It allows nearly full involvement of the penitentiary staff.

Center of Medical and Social Rehabilitation annually develops prevention flowcharts and pathways using recent prevention guidelines. Personnel have an annual training on the use of developed flowcharts.

Preventive health examination in CMSR is divided into two stages. The first stage includes all participants and aims at the screening of CVD and CVRF. The first stage investigations are presented in Table 1.

Short questionnaire (Table 1a) is used for screening at the first stage of the medical examination before the implementation of other examinations indicated in Table 1. The questionnaire contains the following questions (according to R.F. Redberg et al. [13]):

i) age (years),
ii) sex (male, female),
iii) smoking status (smoking, smoking cessation, no smoking),
iv) passive smoking (yes, no),
v) family history of coronary artery disease (CAD) (yes, no),
vi) family history of arterial hypertension (AH) (yes, no),
vii) family history of stroke (yes, no),
viii) alcohol drinking (>2, 1-2 or <1 drinks/day, no alcohol drinking),
ix) physical activity in lifestyle (high, medium, low),
x) components of daily diet (yes, no) such as fruit, vegetables, crop, low-fat or fat-free dairy products, fish, seafood, lean meat, limit salt (yes, no).

Questionnaire has the following comments:

i) passive smoking means a situation where for a long time you are near to smoking people at work or home,
ii) high physical activity means professional (or regular amateur) sports,
iii) medium physical activity means a physical exercise (e.g., walking, cycling) no less than 30 minutes per day and no less than 5 days per week,
iv) low physical activity means physical load less than 30 minutes and less than 5 days per week,
v) 1 alcohol drink (14 grams of "pure" alcohol) means 30 ml of strong alcohol, or 120 mL of wine, or 350 mL of beer. We did not specify the type of alcohol taking into account only the equivalent daily dose in drinks/day.

The questionnaire was used as the first selection step of cardiovascular screening by many authors [17]. It seems to be less efficient in identifying high-risk people than the examination of all elder subjects [18]. However, use of short questionnaire in the first stage accelerates the preliminary data collection of CVRF. For this goal, we use questionnaire in primary prevention. Using of questionnaire reduces the time of preliminary data collection by 30% or more. Furthermore, standardized questionnaire reduces the need of employment and training of practice nurses. The participation of nurses in preventive care significantly enhances the uptake of screening.

The second stage is intended for conducting the advanced diagnostic procedures in people with suspected CVD and for consultation on lifestyle modification in people with revealed CVRF (Table 1).

After preventive health examination, penitentiary employees can be referred to ambulatory care, specialized hospital care or sanatorium treatment, if necessary.

Main feature of the prevention in CMSR is the observation of a limited number of adults. It allows more intensive use of doctor's labour (for example, therapist, etc.) during the first stage examination. As a result, the peculiarity preventive care in CMSR is based on individual rather than group work with patients. Two-staged preventive care used in CMSR with fast preliminary data collection (short questionnaire, some laboratory investigations) in the first stage is preferable for cost-saving and increasing the effectiveness of preventive examination. According to Chamnan et al. [19], stepwise screening strategies showed also cost-effectiveness for identifying and treating the patients with type 2 diabetes.

Thus, key features of preventive care in CMSR are intensity (100% staff coverage and intensive use of doctors' labour) and personality.

Data Collection

Clinical data were obtained from all participants during an annual preventive health examination conducted in CMSR from October 1, 2012 to October 1, 2013.

The following data on CVRF were assessed in our study:

i) sex,
ii) age,
iii) height, weight, and BMI,
iv) systolic blood pressure (SBP) and diastolic blood pressure (DBP),
v) family history of CAD, AH and stroke,
vi) smoking status,
vii) alcohol consumption,
viii) physical activity,
ix) eating habits,
x) total cholesterol,
xi) blood glucose,
xii) blood creatinine,
xiii) diagnosis.

Measures for Health Status Assessment

Prevalence of the following risk factors was evaluated (according to Redberg et al. and Perk et al. [3, 13]):

i) men aged ≥55 years and women aged ≥60 years,
ii) BMI ≥25 kg/m^2,
iii) SBP ≥140 mmHg and/or DBP ≥90 mmHg,
iv) family history of CAD, AH and stroke,
v) smoking,

Table 1a. Components of annual preventive health examination in CMSR

No	Component	Performer	Patients	Stage
1	Brief questionnaire survey for the detection of chronic diseases and CVRF	Nurse	All employees	1st
2	BP measurement	Nurse	All employees	1st
3	Height, weight, and BMI	Nurse	All employees	1st
4	Total cholesterol analysis	Laboratory	Patients with BMI ≥25 kg/m2 and/or age >35 years	1st
5	Blood glucose analysis	Laboratory	Patients with BMI ≥25 kg/m2 and/or age >35 years	1st
6	Glycated haemoglobin analysis or test for glucose tolerance	Laboratory	Patients with chronic diseases, if necessary	2nd
7	Intraocular pressure measurement	Nurse	It is appointed by ophthalmologist	1st
8	Complete blood count (haemoglobin, erythrocytes, leukocytes, platelets, etc.)	Laboratory	All employees	1st
9	Urinalysis	Laboratory	All employees	1st
10	Biochemical blood analysis (total protein, albumin, creatinine, aspartate transaminase, alanine transaminase, bilirubin, natrium, potassium)	Laboratory	Patients with chronic diseases	1st
11	Fasting lipids profile (total cholesterol, high-density lipoprotein, low-density lipoprotein, triglycerides)	Laboratory	Patients with chronic diseases, if necessary	2nd
12	Prostate-specific antigen in blood	Laboratory	Patients with chronic diseases	2nd
13	Abdominal ultrasound	Laboratory	Patients with chronic diseases	1st, 2nd
14	X-rays of the lungs	Laboratory	All employees	1st
15	Other X-ray studies	Laboratory	Patients with chronic diseases or specific complaints	2nd

CMSR: Center of Medical and Social Rehabilitation; CVRF: cardiovascular risk factors; BP: blood pressure; BMI: body mass index

vi) alcohol overuse,
vii) low physical activity,
viii) unhealthy diet (≤5 components of daily healthy diet),
ix) total cholesterol ≥5 mmol/l,
x) blood glucose ≥5.6 mmol/l,
xi) blood creatinine >132 μmol/l for male and 124 μmol/l for female,
xii) diagnosed CVD.

For each participant, risk Score [16] and the number of fulfilled AHA health metrics (not smoking, physically active, normal BP, normal blood glucose levels, normal total cholesterol, normal weight, and eating a healthy diet) [14] were calculated. The number of fulfilled AHA 2012 health metrics was estimated in those patients whose data allowed the evaluation of all seven metrics (n=666). The demonstrative value and usefulness of abovementioned methods of health status assessment was compared during the screening study. Note that participants fulfilling all seven AHA metrics were included in the analysis to compare the AHA metrics and risk Score.

Statistical Analysis

We apply the Shapiro-Wilk test to check whether the data were approximately normally distributed. Continuous variables were reported as medians (Me) with inter-quartile ranges (Q_1, Q_3) for non-normal data or mean (M) with standard deviation (σ) for normal data. Categorical data were presented as frequencies and percentages. To compare the variables between the patient groups, we used the Mann-Whitney test. The difference between the two proportions was assessed by t-test.

The odds ratio (OR) and Chi-square index were used to compare the results of preventive health estimation obtained by risk Score and AHA metrics. The obtained estimations were

Table 1b. Components of annual preventive health examination in CMSR, cont'd

No	Component	Performer	Patients	Stage
16	ECG	Nurse	Healthy employees aged 18, 20, 22, 24, 26, 28, 30, 32, 34, ≥35 years, or all patients with chronic diseases	1st
17	Mammography	Laboratory	Women with gynaecopathy, or aged ≥40 years	1st, 2nd
18	Brachycephalic artery duplex scanning	Laboratory	Patients with chronic diseases, if necessary	2nd
19	EFGDS	Laboratory	Patients with chronic diseases or specific complaints	2nd
20	Colonoscopy and/or sigmoidoscopy	Laboratory	Patients with chronic diseases or specific complaints	2nd
21	Doppler echocardiography	Laboratory	Patients with chronic diseases, if necessary	2nd
22	Brief general medical consultation	Therapeutist	All employees	1st
23	Full general medical consultation	Therapeutist	All employees	1st, 2nd
24	Brief neurologic consultation	Neurologist	All employees	1st
25	Brief gynaecologic consultation	Gynaecologist	All women	1st
26	Brief surgical consultation	Surgeon	Patients with chronic diseases or specific complaints	1st
27	Brief ophthalmologic consultation	Ophthalmologist	All employees	1st
28	Brief urologic consultation	Urologist	Patients with urologic diseases or specific complaints	1st
29	Brief dentist consultation	Dentist	All employees	1st

CMSR: Center of Medical and Social Rehabilitation; ECG: electrocardiography; EFGDS: esophagogastroduodenoscopy

Table 1c. Components of annual preventive health examination in CMSR, cont'd

No	Component	Performer	Patients	Stage
30	Psychiatric consultation	Psychiatrist	Staff working with weapon; patients with psychological deviations (data from staff psychologist)	1st
31	Individual preventive consultation	Therapeutist	Patients with risk factors	1st or 2nd
32	Full neurologic consultation	Neurologist	Patients with neurologic diseases or specific complaints after additional examinations	2nd
33	Full gynaecologic consultation	Gynaecologist	Women with gynaecopathy after additional examinations	2nd
34	Full surgical consultation	Surgeon	Patients with surgical diseases or specific complaints after additional examinations	2nd
35	Full urologic consultation	Urologist	Patients with urologic diseases or specific complaints after additional examinations	2nd

CMSR: Center of Medical and Social Rehabilitation

considered statistically significant if $p<0.05$. We used the software package Statistica 6.1 (StatSoft Inc.; Tulsa, Oklahoma, USA) for statistical analysis.

Results

Participants' Clinical Characteristics

Anthropometric and clinical characteristics of the enrollers are presented in Table 2.

It should be noted that the majority of participants had almost all clinical parameters recorded. The exclusions were total cholesterol, blood glucose and creatinine. These parameters were not obligatory for all employees according to preventive examination chart presented in Table 1.

General features of the studied group were the following:

i) predominance of males (81.8%),
ii) high frequency of both active and passive smoking (59.4%) (the detailed description of subjects' relation

Table 2. Anthropometric and clinical characteristics of penitentiary employees (n=1,014)

Parameter	Penitentiary employees	Coverage of group, no. (%)
Male sex, no. (%)	829 (81.8)	1,014 (100)
Age, years, M±σ	33.4±6.8	1,014 (100)
Height, m, M±σ	1.75±0.08	1,014 (100)
Weight, kg, Me (Q1, Q3)	79 (68, 90)	1,014 (100)
BMI, kg/m2, Me (Q1, Q3)	25.8 (22.7, 28.7)	1,014 (100)
SBP, mmHg, M±σ	122±8	1,014 (100)
DBP, mmHg, M±σ	81±6	1,014 (100)
Family history of CAD, no. (%)	28 (2.8)	1,014 (100)
Family history of AH, no. (%)	103 (10.2)	1,014 (100)
Family history of stroke, no. (%)	21 (2.1)	1,014 (100)
Smokers, no. (%)	431 (42.5)	1,014 (100)
Former smokers, no. (%)	238 (23.5)	1,014 (100)
Never smoked, no. (%)	345 (34.0)	1,014 (100)
Passive smokers, no. (%)	387 (38.2)	1,014 (100)
Details of the smoking status are given in Table 3		
Alcohol >2 drinks/day, no. (%)	5 (0.5)	1,014 (100)
Alcohol 1-2 drinks/day, no. (%)	20 (2.0)	1,014 (100)
Alcohol <1 drinks/day, no. (%)	709 (69.9)	1,014 (100)
Alcohol abstinence, no. (%)	280 (27.6)	1,014 (100)
High physical activity in lifestyle, no. (%)	251 (24.8)	1,014 (100)
Medium physical activity in lifestyle, no. (%)	654 (64.5)	1,014 (100)
Low physical activity in lifestyle, no. (%)	108 (10.7)	1,014 (100)
Fruits in daily diet, no. (%)	807 (79.6)	1,014 (100)
Vegetables in daily diet, no. (%)	877 (86.5)	1,014 (100)
Crop in daily diet, no. (%)	454 (44.8)	1,014 (100)
Low-fat or fat-free dairy products in daily diet, no. (%)	411 (40.5)	1,014 (100)
Fish in daily diet, no. (%)	478 (47.1)	1,014 (100)
Seafood in daily diet, no. (%)	418 (41.2)	1,014 (100)
Lean meat in daily diet, no. (%)	565 (55.7)	1,014 (100)
Limit salt in daily diet, no. (%)	178 (17.6)	1,014 (100)
None of the above in daily diet, no. (%)	20 (2.0)	1,014 (100)
Blood glucose, mmol/l, M±σ	5.0±0.6	671 (66.2)
Total cholesterol, mmol/l, M±σ	4.7±0.8	667 (65.8)
Blood creatinine, μmol/l, M±σ	92.1±11.5	248 (24.5)
Diabetes mellitus, no. (%)	10 (1.0)	1,014 (100)
Chronic kidney disease, no. (%)	6 (0.6)	1,014 (100)
AH, no. (%)	224 (22.1)	1,014 (100)
CAD, no. (%)	0	1,014 (100)
Prior MI, no. (%)	0	1,014 (100)
CHF, no. (%)	0	1,014 (100)
Prior stroke, no. (%)	0	1,014 (100)
Peripheral arterial disease, no. (%)	0	1,014 (100)
Atrial fibrillation or atrial flutter, no. (%)	0	1,014 (100)
Physical type of labour activity, no. (%)	585 (57.7)	1,014 (100)
Intellectual type of labour activity, no. (%)	429 (42.3)	1,014 (100)

BMI: body mass index; SBP: systolic blood pressure; DBP: diastolic blood pressure; CAD: coronary artery disease; AH: arterial hypertension; MI, prior myocardial infarction; CHF, chronic heart failure

to smoking is given in Table 3),

iii) low prevalence of family history of CAD, AH and stroke,

iv) low alcohol consumption (<1 drinks/day) or abstinence in the majority of penitentiary employees (97.5%),

v) optimal (high or medium) level of physical activity in the majority of participants (89.3%),

vi) each of the five penitentiary employees has suffered from AH,

vii) low prevalence (≤1.0%) of diabetes mellitus and chronic kidney disease,

viii) absence of established CVD in the majority of subjects,

ix) low or moderate Score level (≤5%) in almost all employees (98.4%).

Table 3. Details of the smoking status in penitentiary employees (n=1,014)

Smoking status	Passive smoking		Total
	Yes	No	
Current smoker	216 (21.3)	215 (21.2)	431 (42.5)
Former smoker	80 (7.9)	158 (15.6)	238 (23.5)
Never smoked	91 (9.0)	254 (25.0)	345 (34.0)
Total	387 (38.2)	627 (61.8)	1,014 (100)

Data presented as no. (%). All percents are calculated from the total number of subjects (n=1,014)

The subgroup of employees fulfilling all seven AHA metrics (n=666) did not have statistically significant differences in most of the clinical indexes from the general group.

CVRF Prevalence

Studied group of penitentiary employees has the following CVRF prevalence (Table 4):

i) BMI ≥25 kg/m^2 in about of half of all participants,

ii) normal BP in the majority of participants during preventive examination,

iii) low prevalence of family history of CVD,

iv) high frequency of tobacco use (42.5%) and passive smoking (38.2%),

v) low frequency of alcohol overuse,

vi) low frequency of low physical activity,

vii) unhealthy eating habits in more than half of participants,

viii) hypercholesterolaemia in 29.5% of subjects,

ix) most of the participants have normal level of blood glucose and creatinine,

x) 22.1% of participants have CVD.

Risk Score

Distribution of risk Score in penitentiary employees group (n=1,014) is shown in Figure 1a. This group was characterized by the low risk Score associated with high prevalence of several core CVRF (in particular, increased body weight and obesity, active and passive smoking, unhealthy eating, and hypercholesterolaemia). In particular, the low risk was identi-

Table 4. CVRF prevalence in penitentiary employees (n=1,014)

no.	Measure	Frequency, no. (%)	Coverage of group, no. (%)
1	Men aged ≥55 years and women aged ≥60 years	0	1,014 (100)
2	BMI ≥25 kg/m^2	560 (55.2)	1,014 (100)
3	SBP ≥140 mmHg and/or DBP ≥90 mmHg	107 (10.6)	1,014 (100)
4	Family history of CAD, AH, and stroke	151 (14.9)	1,014 (100)
5	Smoking	431 (42.5)	1,014 (100)
6	Passive smoking	387 (38.2)	1,014 (100)
7	Alcohol overuse (>2 drinks/day)	5 (0.5)	1,014 (100)
8	Low physical activity	108 (10.7)	1,014 (100)
9	Unhealthy diet	626 (61.7)	1,014 (100)
10	Total cholesterol ≥5 mmol/l	197 (29.5)	667 (65.8)
11	Blood glucose ≥5.6 mmol/l	89 (13.3)	671 (66.2)
12	Blood creatinine >132 μmol/l for male and 124 μmol/l for female	2 (0.8)	248 (24.5)
13	Diagnosed CVD	224 (22.1)	1,014 (100)

CVRF: cardiovascular risk factors; BMI: body mass index; SBP: systolic blood pressure; DBP: diastolic blood pressure; CAD: coronary artery disease; AH: arterial hypertension; CVD: cardiovascular disease

fied in 92.6% of the subjects, moderate risk in 5.8%, high risk in 0%, and very high risk in 1.6%.

The subgroup of employees fulfilling all seven AHA metrics (n=666) were characterized mainly by the low risk Score. In particular, low risk was identified in 88.9% of the subjects, moderate risk in 8.8%, high risk in 0%, and very high risk in 2.3%. Distribution of risk Score in this subgroup is shown in Figure 1b. The part of subjects with low risk was statistically significantly smaller in this subgroup than in the general group ($p<0.05$). The part of the subjects with high and very high risk Score was comparable in the subgroup and the general group ($p=0.301$).

Table 5. Estimations of preventive health by the risk Score (very high or high risk / medium or low risk) and number of fulfilled AHA metrics

	Number of fulfilled AHA metrics	
Risk Score	<5	5-7
Very high or high risk	9	6
Medium or low risk	281	370

AHA: American Heart Association

Table 6. Estimations of preventive health by the risk Score (medium risk / low risk) and number of fulfilled AHA metrics

	Number of fulfilled AHA metrics	
Risk Score	<5	5-7
Medium risk	36	23
Low risk	245	347

AHA: American Heart Association

AHA Health Metrics

Studied group of penitentiary employees has the following AHA health metrics [14] prevalence (n=666):

i) not smoking - 59.8%,
ii) physically active - 86.8%,
iii) normal BP - 85.4%,
iv) normal blood glucose levels - 86.6%,
v) normal total cholesterol - 70.4%,
vi) normal weight - 27.6%,
vii) healthy diet - 38.7%.

It is important that only 4.5% of the employees (30 subjects) met all seven AHA health metrics (Figure 2). 16.1% (107) of the participants met six AHA metrics. It should be noted that clinical data of 34.3% (348) of the subjects were deficient to evaluate all seven AHA health metrics (see data collection section).

Comparison of Risk Score and AHA Health Metrics

To compare the estimations of preventive health by the risk Score and AHA health metrics, we present the results of risk Score in the form of binary variable "very high or high risk/medium or low risk" and the results of AHA health metrics in the form of binary variable representing the number of fulfilled metrics "<5/5-7" (Table 5). We did not reveal the statistically significant correlations between the considered indicators of preventive health: Chi-square=1.1, p=0.301, OR=1.98 (0.64-6.32).

We carried out the similar analysis for the risk Score in the form of binary variable "medium risk / low risk" (Table 6). A statistically significant correlation between the risk Score and the number of fulfilled AHA health metrics is revealed: Chi-square = 5.1, p=0.024, OR=1.89 (1.08-3.30). It is revealed

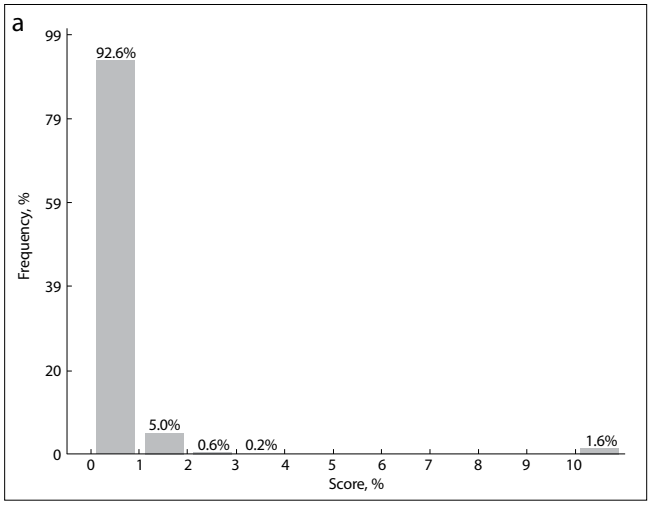

Figure 1, a, b. *Distribution of the risk Score in the general group (n=1,014) (a) and subgroup of employees fulfilling all seven AHA metrics (n=666) (b).*
** – statistically significant differences (P<0.05) from the general group.*

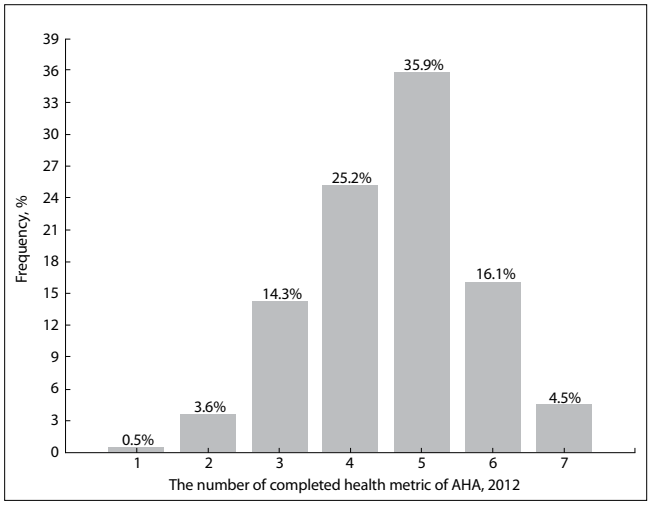

Figure 2. *Distribution of the number of completed AHA health metrics.*

that the probability of the fulfilment less than 5 AHA health metrics in subjects with medium risk Score is almost twofold greater than in subjects with low risk Score.

Discussion

In our study, it was shown that annual primary cardiovascular prevention does not provide a full control of CVRF in organized adults from CMSR. Therefore, the problem of health status assessment in penitentiary staff actually exists.

Assessment of the frequencies of main CVRF is the most frequently used approach for health status assessment during primary prevention. Most CVRF are well known (age, gender, BP, obesity, family history of CVD, smoking, low physical activity, and lipid levels, etc. [3, 13]), but some novel factors (elevated urinary albumin, platelet-activating factor acetylhydrolase, and some biomarkers) are suggested for use [20, 21]. Multifactorial pathogenesis of CVD reduces the value of each separate risk factor for cardiovascular risk stratification. For this goal, complex assessment of all CVRF should be used [22]. In our study, several classical cardiovascular factors were identified in adults from CMSR staff. High prevalence of active and passive smoking, hypercholesterolaemia, unhealthy diet, increased body weight and obesity are shown. They are observed despite the high intensity of preventive care in CMSR.

Frequency of some risk factors (active smoking, passive smoking, hypercholesterolaemia, and overweight) in penitentiary staff is higher than other healthy populations. For example, in Malaysia, frequency of main CVRF in adults with low cardiovascular risk is as follows: smoking - 16.6%, hypertension - 26.1%, hypercholesterolaemia - 23.2%, obesity - 38.4%, and diabetes - 4.0%, according to Selvarajah et al. [23].

The Seventh Report of the Joint National Committee (JNC 7) defined prehypertension in adults as SBP = 120-139 mmHg and/or DBP = 80-89 mmHg [24]. This status is very common in healthy adults (80.6% of subjects in our study). This fact is important for preventive care. In the meta-analysis of studies focused on the predictors of progression from prehypertension to hypertension, older age at baseline, male sex, low education status, Mongolian race, and alcohol-drinking were reported to be important predictors [25]. Overweight, dyslipidaemia and impaired glucose metabolism were observed also in adults with prehypertension [25]. No association between smoking and prehypertension was observed [25]. Continued research is necessary to determine the value of prehypertension for long-term cardiovascular risk versus other risk factors, including cross-correlation, in low-risk groups.

Low Score risk in most subjects that we studied does not guarantee high-level health status in the future. According to our results, only 4.5% of the employees met all seven health metrics proposed by AHA. 95.5% of the adults have 1 or more risk factors (from AHA health metrics). We assume that it is very dangerous for health in the future. In this cohort, the probability of cardiovascular events in a long period can be higher than that is predicted by Score. It is important to compare the risk models (Score, etc.) and health metrics to assess the long-term cardiovascular prognosis in healthy adults. Targeted cardiovascular risk screening strategy and taking into account age and gender, etc., is better than the policy recommendation of universal screening [23].

AHA health metrics [14] are the most useful and complex criteria for health status assessment in healthy adults. These metrics are actively used in many studies from USA and other countries [26-29]. AHA health metrics can be used for the assessment of trends in health status for primary preventive care [27, 28]. Some studies showed that the number of AHA health metrics is negatively associated with stroke [30], myocardial infarction [30], cancer incidence [31] and mortality rates from all causes and CVD [27, 29].

In Russia, assessment of cardiovascular health status is the main problem of cardiovascular primary prevention. Current approach to health status assessment used in Russia for primary prevention is based on the prevalence of separate risk factors. Prevalence of CVRF is quite variable across different social categories of Russian people [32-34, and present study]. The situation is similar in other countries [1, 2]. Results of Russian studies on the prevalence of CVRF [32-34] are difficult to compare the cardiovascular health status assessment. Assessment of trends of cardiovascular health in population (or cohort) by dynamics of separate risk factors is also difficult and not effective. This approach decreases the effectiveness of management of primary prevention.

It is known that ideal cardiovascular health must be assessed by CVRF complex [35]. The use of AHA health met-

rics is the approach for the standardization of health status assessment for primary prevention in Russia.

In National Health and Nutrition Examination Survey (USA), only 1.2% of the representative adults achieved all 7 health metrics, whereas only 8.8% of the same cohort achieved 6 or more metrics [27]. M.M. Moghaddam et al. [36] reported that ideal cardiovascular health was extremely low in adults (2861 women and 2004 men) from phase 4 of Tehran Lipid and Glucose Study (2009-2011): all 7 health metrics were observed only in 1 subject. Similar results with low prevalence of ideal cardiovascular health were reported also by other authors [37].

In our study, 4.5% of the penitentiary employees met all seven AHA health metrics. Our result is higher than those in the mentioned studies. However, ideal cardiovascular health is still seen very rarely in adults that we studied. We believe that use AHA health metrics in organized cohorts of healthy adults is an objective approach to the control of cardiovascular health trend during primary preventive care. This approach is better than the assessments based on prevalence of separate CVRF or the evaluation of risk Score in healthy cohorts. Despite the revealed statistically significant correlation between the risk Score and number of fulfilled AHA health metrics, we observed many differences in their assessment of cardiovascular health (Tables 5 and 6). It is found out that the estimation of preventive health by AHA health metrics is more related to the current cardiovascular prevention.

Conclusion

In conclusion, AHA health metrics based on the concept of ideal cardiovascular health are more preferable than risk Score or assessment of separate CVRF for preventive management in cohorts with low current cardiovascular risk, such as penitentiary staff in Saratov Region.

Study Limitations

In our questionnaire, we did not specify the type of alcohol taken by the subjects. We only took into account the equivalent daily dose in drinks/day. It is the limitation of study results, because CVD risk maybe related to the type of alcohol.

Ethics Committee Approval: Ethics committee approval was received for this study from the ethics committee of Center of Medical and Social Rehabilitation of Russian Federal Penitentiary Service in Saratov Region (Saratov, Russia).

Informed Consent: Written informed consent was obtained from all subjects who participated in this study.

Peer-review: Externally peer-reviewed.

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