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CARDIOVASCULAR RISK FACTORS AMONG POLISH EMPLOYEES OF UNIFORMED SERVICES

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Abstract
Objectives: Employees of uniformed services (EoUS) were screened for cardiovascular risk factors. **Material and Methods:** A total of 1138 EoUS (age M±SD 49.9±6.0 years) and 263 controls (age M±SD 54.4±9.7 years) under the care of the cardiology clinic in Gdańsk, Poland, were included in the study. Medical history and blood samples were collected, and a physical examination was performed. Ten-year cardiovascular risk of death was calculated using the systematic coronary risk evaluation (SCORE) risk algorithm for high-risk countries. **Results:** Significantly higher values of mean systolic and mean diastolic blood pressure, mean total cholesterol level and mean BMI were recorded among the EoUS compared to controls (M±SD 141.7±11.6 mm Hg vs. 135.5±11.0 mm Hg, $p < 0.001$; 90.1±5.9 mm Hg vs. 84.5±6.8 mm Hg, $p < 0.001$; 6.01±0.76 mmol vs. 5.44±0.87 mmol, $p < 0.001$; 29.3±4.7 vs. 29.0±4.1, $p < 0.001$, respectively). Smoking cigarettes was most frequently reported by the youngest group (20–39 years old) – 47.7% and it was significantly higher in the entire EoUS group compared to control group (35.5% vs. 16.7%, $p = 0.001$). The occurrence of observed risk factors (blood pressure ≥140/90 mm Hg, total cholesterol concentration >5 mmol, smoking,) was significantly higher among EoUS compared to controls (92.1% vs. 57.8%, $p < 0.001$; 89.0% vs. 66.9%, $p < 0.001$; 35.5% vs. 16.7%, $p < 0.001$, respectively). In the male group, the mean calculated ten-year risk of fatal cardiovascular events, the percentage of high calculated risk, and very high risk were higher in the EoUS group compared to controls (M±SD 4.44±3.49 vs. 4.23±3.86, $p = 0.001$; 23.7% vs. 20.2%, $p = 0.007$; 7.4% vs. 6.5%, $p = 0.03$, respectively). **Conclusions:** The prevalence of all identified risk factors was found to be higher among employees of uniformed services when compared to the control group. The presence of these risk factors within the population of uniformed service employees results in a greater risk of mortality from cardiovascular diseases. Int J Occup Med Environ Health. 2023;36(5)

Keywords:
police officers, uniformed services, stress at work, cardiovascular risk factors, state fire brigade, border guards

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INTRODUCTION

Cardiovascular diseases (CVD) continue to be the leading cause of death worldwide, despite widespread health promotion programs [1,2]. Studies INTERHEART and INTERSTROKE outline the main factors that account for >90% of the risk of myocardial infarction and stroke. Smoking, hypertension, diabetes, abdominal obesity, and stress are among the primary risk factors related to acute myocardial infarction (MI) [3–5].

A study published in 2020 found that tobacco use was the strongest behavioral risk factor associated with death, and hypertension was a stronger risk factor for stroke compared to myocardial infarction. Diabetes, non-HDL cholesterol, and current tobacco use were stronger risk factors for MI compared to stroke. Modifiable risk factors accounted for approx. 70% of CVD cases in middle-income countries, including Poland, with hypertension being the leading risk factor for CVD [6].

Employees of uniformed services (EoUS) are often perceived as athletic and generally healthy when they start their careers [7]. However, a study by Gielerak et al. [8] showed that Polish soldiers present with multiple cardiovascular (CV) risk factors, as seen in the general population.

In a Czech study, male soldiers were burdened with significantly more CV risk factors compared to the civilian population [9]. Zimmermann demonstrated that CV risk factors result in high mortality rates among law enforcement personnel [10].

Among Quebec police officers, 9% of fatalities were attributed to CV cases despite their young age [11].

As population surveys among uniformed services are lacking in Poland, the authors aimed to assess this group for risk factors. In this study, factors such as age, gender, arterial hypertension, hypercholesterolemia, obesity, smoking, and the presence of diabetes were analyzed.

Aim of the study was to assess the CV risk factors among EoUS.

MATERIAL AND METHODS

It was a retrospective study. The study population comprised 1401 patients who visited the cardiology clinic, Gdańsk, Poland, and were either EoUS (N = 1138) or administrative staff of uniformed services (N = 263). Administrative staff constituted the control group.

The study group and the control group consisted of consecutive patients visiting the clinic. There was no other selection of study participants. All EoUS were professionally active.

The term "uniformed services" refers to employees of the police (P), prison service (PS), state fire brigade (SFB), border guards (BG).

The study was conducted in accordance with Good Clinical Practice guidelines and the Declaration of Helsinki, and the protocol was approved by the Committee of the Ministry of National Defense/CKL 0155-24-2018.

The doctor collected patient data during an in-person visit following an interview and physical examination. The following parameters were collected and analyzed: age, sex, weight, systolic and diastolic blood pressure (BP), heart rate, total cholesterol (TC), declared smoking, and a history of coronary heart disease and diabetes mellitus (DM).

Arterial BP was measured 3 times, and the average of the last 2 measurements was recorded. The OMRON M3 BP monitor (Omron Healthcare Co., Ltd. Kyoto, Japan) was used. The examination was performed in a seated position after at least 5 min of rest as part of a physical examination during a medical visit.

Target values and standards for BP and cholesterol levels were adopted from the European Society of Hypertension and the European Society of Cardiology guidelines [12]. Individuals smoking at least 7 cigarettes/week were classified as cigarette smokers. Blood pressure ≥140/90 mm Hg was considered hypertension and TC ≥5 mmol/l was considered high. The 10-year CV risk was calculated using the systematic coronary risk evaluation (SCORE) risk algorithm for high-risk countries [13]. Cardiovascular risk ≥5% and <10% was considered high, and ≥10% – very high. Participants with BMI in the range of 25–29.9 kg/m^2 and BMI ≥30 kg/m^2 were considered overweight and obese, respectively.

Partial correlation coefficients for pairs of CV risk factors (ρ) and the corresponding p-values were calculated.

All the epidemiological data and the results were gathered on a MySQL database on the server of the Medical University of Gdansk, Gdańsk, Poland.

The results are presented as a percentage of the total population; numbers were rounded to 1 decimal place and descriptive statistics were used. A p-value <0.05 was considered statistically significant.

For statistic tests with continuous variables, the 1-way analysis of variance (the 1-way ANOVA) was utilized to compare means of ≥2 samples using the Fisher-Snedecor distribution (F-distribution). The Kolmogorov-Smirnov test was used to confirm that each study population had the F-distribution, and the Brown-Forsythe test was used to check the equality of variances in the compared groups. The Kruskal-Wallis test was performed when the conditions for the ANOVA were not met. Regardless of the method used, finally, the p-value was calculated [14–16]. *Post hoc* tests (the least significant difference tests or the Dunn-Sidàk tests) were performed where appropriate.

The χ^2 test for independence based on the contingency table was utilized for categorical variables. The Fisher exact test was used if the basic condition for the reliability of the χ^2 test was not met. Both tests were used to check whether the variables used were likely to be related or not, and the p-value was computed [14,15,17]. *Post hoc* tests were performed where appropriate, and they compared each group pair using the χ^2 test of independence and Bonferroni correction.

In certain cases, alternative analytical techniques were employed to account for the influence of gender and/or age on the dependent variable and to adjust the p-value accordingly. For continuous dependent variables, the analysis of covariance (ANCOVA) was utilized with gender and/or age as covariates. For categorical variables, the Cochran-Mantel-Haenszel (CMH) test with the Yates's 0.5 continuity correction was employed to compare the outcomes across different values of the confounding variables: gender and/or age group. The age ranges were classified as follows: 20–39 years, 40–49 years, 50–59 years, and ≥60 years.

To evaluate the correlation between pairs of variables, which represent cardiovascular risk factors, the Spearman's partial correlation method was applied [15,18]. The partial correlation analysis measures the degree of association between 2 variables after controlling for other variables. For each variable pair, 2 values were obtained: the partial correlation coefficient (the adjusted degree of association) and the p-value that represents the statistical significance of the coefficient.

RESULTS

A total of 1401 participants were enrolled in this study, with age M±SD 50.8±7.1 years and 84.2% of the participants being male. Of the total participants, 1138 belonged to the EoUS group while 263 were controls, comprising administrative staff of uniformed formations. The mean age of the EoUS group was significantly different from that of the control group across the whole population, as well as among men and women (M±SD 49.9±6.0 vs. 54.4±9.7, $p < 0.01$; men: M±SD 50.0±6.0 vs. 53.3±10.1, $p < 0.01$; women: M±SD 49.1±6.2 vs. 56.2±8.8, $p < 0.01$). The majority of participants (91.2%) were 40–65 years of age.

Tables 1 and 2 present the characteristics of the groups.

In the EoUS group, the 50–59 years age group and ≥60 years age group had the highest rates of BP exceeding the recommended levels (RR ≥ 140/90 mm Hg) at 74.9% and 81%, respectively. Additionally, the 50–59 years age

Table 1. Characteristic of the employees of uniformed services under the care of the cardiology clinic in Gdańsk, Poland, and the control group, January 2018–March 2020

Variable	Participants (N = 1401)					p
	total	20–39 years	40–49 years	50–59 years	≥60 years	
Studied group						
age [years] (M±SD)						
total	49.9±6.0	38.8±0.6	45.0±2.8	53.9±2.8	60.7±1.6	–
females	49.1±6.2	38.9±0.36	44.9±2.8	53.8±2.5	60.7±1.2	–
males	50.02±6.0	38.8±0.7	45.0±2.8	53.9±2.8	60.7±1.7	–
gender (n [%])						
males	1014 (89.1)	51 (78.5)*	385 (90.0)*	539 (89.5)*	39 (92.9)*	0.018
BMI (M±SD)						
total	29.3±4.7	28.6±4.0	29.4±4.2	29.4±4.9	29.4±5.7	0.396
females	28.2±5.8	26.5±4.3	28.0±5.3	28.5±6.4	31.9±5.5	0.426
males	29.5±4.5	29.2±3.8	29.5±4.1	29.5±4.7	29.2±5.8	0.862
total cholesterol [mmol/l] (M±SD)						
total	6.01±0.76	5.65±0.84*	5.92±0.81*	6.11±0.69*	6.07±0.7	<0.001
females	5.85±0.71	5.78±0.53	5.65±0.70	6.00±0.67	5.89±1.80	0.067
males	6.03±0.76	5.61±0.91*	5.95±0.81*	6.13±0.69*	6.08±0.64	<0.001
heart rate [bpm] (M±SD)						
total	80.7±3.7	80.8±3.7	80.9±3.5	80.5±3.5	80.6±6.0	0.197
females	80.7±3.5	80.8±3.7	81.4±2.8	79.9±3.0	86.7±11.5	0.083
males	80.7±3.7	80.8±3.8	80.8±3.6	80.6±3.6	80.1±5.4	0.481
blood pressure [mm Hg] (M±SD)						
systolic						
total	141.7±11.6	136.9±6.6*	141.3±11.2	142.5±12.0*	142.9±13.6	0.003
females	139.6±10.6	135.7±7.6	139.4±10.1	140.2±11.5	146.7±5.8	0.186
males	142.0±11.7	137.2±6.3*	141.5±11.3	142.7±12.1*	142.6±14.0	0.017
diastolic						
total	90.1±5.9	86.9±5.9*	90.0±5.9*	90.5±5.9*	89.3±4.6	<0.001
females	88.9±6.3	83.6±5.0*	88.4±7.1	90.4±5.3*	86.7±5.8	0.001
males	90.2±5.9	87.8±5.8*	90.2±5.7*	90.5±6.0*	89.5±4.6	0.014
Control group						
age [years] (M±SD)						
total	54.4±9.7	37.7±2.0	44.8±3.0	54.7±2.8	64.3±3.1	–
females	56.2±8.8	37.8±0.5	44.1±2.9	55.3±2.8	63.8±2.9	–
males	53.3±10.1	37.7±2.1	45.1±3.0	54.3±2.8	64.6±3.3	–
gender (n [%])						
males	166 (63.1)	22 (84.6)*	42 (68.9)*	46 (60.5)*	56 (56.0) *	0.018

Table 1. Characteristic of the employees of uniformed services under the care of the cardiology clinic in Gdańsk, Poland and the control group, January 2018-March 2020 – cont.

Variable	Participants (N = 1401)					p
	total	20–39 years	40–49 years	50–59 years	≥60 years	
Control group– cont.						
BMI (M±SD)						
total	29.0±4.1	30.0±4.9	29.3±4.2	28.3±4.0	29.1±3.9	0.319
females	28.4±4.6	30.9±9.1	28.0±5.1	27.5±4.6	28.9±4.0	0.357
males	29.4±3.8	29.9±4.5	30.0±3.7	28.9±3.5	29.2±3.8	0.539
total cholesterol [mmol/l] (M±SD)						
total	5.44±0.87	5.28±0.78	5.42±0.94	5.52±0.78	5.43±0.92	0.469
females	5.65±0.78	4.95±0.82	5.50±0.81	5.61±0.75	5.82±0.75	0.196
males	5.31±0.90	5.33±0.78	5.39±1.00	5.46±0.80	5.13±0.93	0.226
heart rate [bpm] (M±SD)						
total	74.8±8.6	77.8±9.1*	76.0±7.6	75.4±7.9	72.8±9.2*	0.017
females	75.6±7.5	73.8±9.5	77.1±5.9	76.7±6.8	74.4±8.4	0.507
males	74.3±9.2	78.5±9.1*	75.4±8.3	74.5±8.5	71.6±9.7*	0.019
blood pressure [mm Hg] (M±SD)						
systolic						
total	135.5±11.0	136.5±12.7	135.7±9.2	134.1±8.5	136.3±13.1	0.872
females	136.2±12.2	131.3±2.5	135.3±11.7	135.3±8.8	137.6±14.7	0.787
males	135.2±10.3	137.5±13.6	135.8±8.0	133.4±8.2	135.2±11.8	0.442
diastolic						
total	84.5±6.8	84.8±8.1	86.2±6.2	84.7±6.4	83.3±7.0	0.167
females	84.7±7.0	90.0±10.0	86.3±7.0	85.7±6.8	82.9±6.8	0.227
males	84.4±6.7	84.0±7.8	86.2±5.9	84.0±6.2	83.7±7.2	0.319

* Statistically significant values.

group exhibited the highest average TC levels (M±SD 6.11±0.69 mmol/l).

The incidence of diabetes was 10.5%, with higher incidence observed among males (men: 11.3% vs. women: 4%) and increasing with age to reach 17.9% among male EoUS participants. Controls exhibited a higher incidence of diabetes (M = 14.1%), reaching 39.3% in the oldest male group (≥60 years) (Table 2).

The prevalence of coronary heart disease was 6.5% in the EoUS group, with the highest number of cases observed in males ≥60 years of age (20.5%). Similar to diabetes, the incidence of coronary heart disease reached higher levels among controls (18.3% in the whole group and 41.1% in the male ≥60 years group) (Table 2).

High and very high CV risk (≥5%) was calculated for 30.6% of the male population and 1.6% of the female population in the 40–65-year-old group. The majority of the population was overweight or obese, with a BMI ≥25 kg/m^2 found among 87.6% of male and 71.0% of female participants. There was no correlation between

Table 2. Prevalence of hypertension, coronary artery disease and diabetes in the employees of uniformed services under the care of the cardiology clinic in Gdańsk and the control group, January 2018-March 2020

Variable	Participants [n (%)] (N = 1401)					p
	total	20–39 years	40–49 years	50–59 years	≥60 years	
Studied group						
blood pressure						
130–139 mm Hg or 85–89 mm Hg						
total	317 (27.9)	24 (36.9)*	134 (31.2)*	151 (25.1)*	8 (19.0)*	0.016
females	46 (37.1)	8 (57.1)	18 (40.9)	20 (31.7)	0 (0.0)	0.136
males	271 (26.7)	16 (31.4)	116 (30.1)	131 (24.3)	8 (20.5)	0.084
140–159 mm Hg or 90–99 mm Hg						
total	971 (85.3)	52 (80.0)	362 (84.4)	517 (85.9)	40 (95.2)	0.290
females	102 (82.3)	9 (64.3)	36 (81.8)	54 (85.7)	3 (100.0)	0.145
males	869 (85.7)	43 (84.3)	326 (84.7)	463 (85.9)	37 (94.9)	0.699
160–179 mm Hg or 100–109 mm Hg						
total	856 (75.2)	36 (55.4)*	322 (75.1)*	465 (77.2)*	33 (78.6)*	0.023
females	84 (67.7)	5 (35.7)	27 (61.4)	50 (79.4)	2 (66.7)	0.227
males	772 (76.1)	31 (60.8)*	295 (76.6)*	415 (77.0)*	31 (79.5)*	0.071
≥180 mm Hg or 110 mm Hg						
total	37 (3.3)	0 (0.0)	11 (2.6)	23 (3.8)	3 (7.1)	0.129
females	3 (2.4)	0 (0.0)	1 (2.3)	2 (3.2)	0 (0.0)	0.796
males	34 (3.4)	0 (0.0)	10 (2.6)	21 (3.9)	3 (7.7)	0.166
coronary artery disease						
total	74 (6.5)	2 (3.1)*	9 (2.1)*	55 (9.1)*	8 (19)*	<0.001
females	6 (4.8)	0 (0.0)	1 (2.3)	5 (7.9)	0 (0.0)	0.299
males	68 (6.7)	2 (3.9)*	8 (2.1)*	50 (9.3)*	8 (20.5)*	<0.001
diabetes mellitus						
total	120 (10.5)	4 (6.2)*	28 (6.5)*	81 (13.5)*	7 (16.0)*	<0.001
females	5 (4.0)	1 (7.1)	1 (2.3)	3 (4.8)	0 (0.0)	0.688
males	115 (11.3)	3 (5.9)*	27 (7.0)*	78 (14.5)*	7 (17.9)*	<0.001
Control group						
blood pressure						
130–139 mm Hg or 85–89 mm Hg						
total	123 (46.8)	12 (46.2)	32 (52.5)	37 (48.7)	42 (42.0)	0.592
females	44 (45.3)	4 (1.0)	10 (52.6)	14 (46.7)	16 (36.4)	0.052
males	79 (47.6)	8 (36.4)	22 (52.4)	23 (50.0)	26 (46.4)	0.471

Table 2. Prevalence of hypertension, coronary artery disease and diabetes in the employees of uniformed services under the care of the cardiology clinic in Gdańsk and the control group, January 2018-March 2020 – cont.

Variable	Participants [n (%)] (N = 1401)					p
	total	20–39 years	40–49 years	50–59 years	≥60 years	
Control group – cont.						
blood pressure – cont.						
140–159 mm Hg or 90–99 mm Hg						
total	136 (51.7)	14 (53.8)	31 (50.8)	42 (55.3)	49 (49.0)	0.967
females	40 (41.2)	1 (25.0)	7 (36.8)	15 (50.0)	17 (38.6)	0.701
males	96 (57.8)	13 (59.1)	24 (57.1)	27 (58.7)	32 (57.1)	0.989
160–179 mm Hg or 100–109 mm Hg						
total	102 (38.8)	7 (26.9)	26 (42.6)	27 (35.5)	42 (42.0)	0.939
females	38 (39.2)	1 (25.0)	8 (42.1)	11 (36.7)	18 (40.9)	0.722
males	64 (38.6)	6 (27.3)	18 (42.9)	16 (34.8)	24 (42.9)	0.997
≥ 180 mm Hg or 110 mm Hg						
total	3 (1.1)	1 (3.8)	0 (0.0)	0 (0.0)	2 (2.0)	0.302
females	1 (1.0)	0 (0.0)	0 (0.0)	0 (0.0)	1 (2.3)	0.855
males	2 (1.2)	1 (4.5)	0 (0.0)	0 (0.0)	1 (1.8)	0.270
coronary artery disease						
total	48 (18.3)	1 (3.8)*	6 (9.8)*	10 (13.2)*	31 (31.0)*	0.009
females	10 (10.3)	0 (0.0)	2 (10.5)	0 (0.0)	8 (18.3)	0.786
males	38 (22.9)	1 (4.5)*	4 (9.5)*	10 (21.7)*	23 (41.1)*	0.001
diabetes mellitus						
total	37 (14.1)	0 (0.0)*	7 (11.5)*	4 (5.3)*	26 (26.0)*	0.053
females	8 (8.2)	0 (0.0)	2 (10.5)	2 (6.7)	4 (9.1)	0.782
males	29 (17.5)	0 (0.0)*	5 (11.9)*	2 (4.3)*	22 (39.3)*	0.017

* Statistically significant values.

obesity/overweight and gender in age groups, except for the 40–49 years age group (BMI 25–30 kg/m^2, women vs. men: 29.5% vs. 46.5%, p = 0.03) and 50–59 years age group (BMI ≥ 30 kg/m^2, women vs. men: 27.0% vs. 42.3%, p = 0.02).

In the male EoUS population, smoking was observed among 36.0% of participants, with cigarette smoking being most common in the youngest group (20–39 years) and significantly higher compared to the 50–59 years group (52.9% vs. 33.4%, p = 0.01). Among men aged ≥60 years, 28.2% declared smoking.

In the female EoUS population, 28.0% reported smoking. There was no statistically significant difference in smoking prevalence among females in different age groups.

Among males and females, elevated BP (≥140/90 mm Hg) was measured in 93.0% and 87.0% of the population, respectively. The occurrence of BP ≥140/90 mm Hg was significantly higher in the 50–59 years age group compared to the 20–39 years age group among females (92.1% vs. 64.3%, p = 0.04). There was no significant difference found in BP ≥140/90 mm Hg occurrence between men and women in age groups, except for the 20–39 years group where the difference was close to significance (men vs. women: 84.3% vs. 64.3%, p = 0.09).

The prevalence of elevated cholesterol (TC > 5 mmol) was observed among 89.0% of the male and 85.0% of the female EoUS. No differences were observed in the occurrence of elevated cholesterol between different age groups among females. However, statistically significant differences were found in the male population. The highest occurrence of TC >5 mmol was measured in the oldest age group, while it was less frequent in each of the younger groups (≥60 years vs. 50–59 years vs. 40–49 years vs. 20–39 years: 94.9% vs. 93.7% vs. 85.2% vs. 72.5%, p < 0.001).

When comparing risk factors (smoking, BP > 140/90 mm Hg, TC ≥ 5 mmol, BMI 25–30 kg/m^2, and BMI ≥ 30 kg/m^2) among different formations of uniformed services (P: N = 707, PS: N = 235, SFB: N = 163, BG: N = 33), only smoking cigarettes was found to be significantly more frequent among police officers compared to firefighters (38.0% vs. 25.2%). Other risk factors were evenly distributed within individual formations.

The authors analyzed the 10-year risk of a fatal cardiovascular event according to SCORE in different formations of uniformed services. The age was limited to 40–65 years due to the SCORE algorithm (age 40–65 years; P: N = 666, PS: N = 217, SFB: N = 159, BG: N = 30). The calculated risk for all EoUS was M±SD 4.10±3.47. Significant differences were found between all formations (P: M±SD 4.21±3.71, PS: M±SD 3.45±2.67, SFB: M±SD 4.54±3.27, BG: M±SD 4.02±3.63, p = 0.0125), but there were no differences between formations in the occurrence of high risk (SCORE ≥5% and <10%) or very high risk (SCORE ≥10%). Differences were only found in the mean calculated risk and in the very low-risk group (SCORE <1%) between PS and SFB (16.1% vs. 5.0%, p = 0.0023).

In the EoUS group, there were more men than in the control group (men: 89.1 vs. 63.1, p < 0.001), while in the control group, the participants were older (M±SD 54.36±9.73 vs. 49.92±6.0, p < 0.001). Therefore, before conducting further analysis, continuous values such as mean systolic and diastolic BP, mean TC level, and mean BMI in both groups, were compared, adjusting for age and gender in the statistical analysis. All the aforementioned factors differed significantly between both groups and reached higher values among the EoUS compared to the controls. The authors then compared the percentages of individuals who exceeded the values assumed as abnormal in the European Guidelines. Significant differences were found in the occurrence of all observed risk factors (smoking in male group, BP ≥ 140/90 mm Hg, TC > 5 mmol) between the EoUS and control groups, except for BMI ≥25 kg/m^2 (Table 3).

The comparison of risk factors between the EoUS and control groups according to age groups is presented in Table 4. Smoking cigarettes was reported more frequently by the EoUS group in all age groups <50 years. Elevated BP (≥140/90 mm Hg) and cholesterol levels (TC > 5 mmol) were found more often in the EoUS group in all age groups >40 years.

Although the mean calculated 10-year risk of fatal cardiovascular event according to SCORE was lower in the female EoUS group compared to the female control group, it was not statistically significant when age was included as a cofactor in the p-value calculation. In contrast, the mean risk SCORE was higher in the male EoUS group compared to the male control group. High calculated risk (SCORE ≥5% and <10%) and very high risk (SCORE ≥10%) were also more prevalent in the male EoUS group (Table 5).

Significant positive correlations were observed in the EoUS group between age and hypertension, cholesterol

Table 3. Risk factors adjusted for gender and age among employees of uniformed services and control group, January 2018-March 2020, Gdańsk, Poland

Variable	Participants (N = 1401)											
	employees of uniformed services			control			total		male		female	
	total	male	female	total	male	female	p	p adjusted for gender and age	p	p adjusted for age	p	p adjusted for age
Gender [n (%)]	1138 (100)	1014 (89.1)	124 (10.9)	263 (100)	166 (63.1)	97 (36.9)	<0.001					
Age [years] (M±SD)	49.92±6.01	50.02±5.97	49.12±6.23	54.36±9.73	53.27±10.10	56.23±8.80	<0.001		<0.001		<0.001	
Smoking [n (%)]	404 (35.5)	369 (36.4)	35 (28.2)	44 (16.7)	28 (16.8)	16 (16.5)	<0.001	<0.001	<0.001	<0.001	0.040	0.290
Blood pressure												
systolic [mm Hg] (M±SD)	141.7±11.6	142.0±11.7	139.6±10.6	135.5±11.0	135.2±10.3	136.2±12.2	<0.001	<0.001	< 0.001	0.001	0.006	0.002
diastolic [mm Hg] (M±SD)	90.1±5.9	90.2±5.9	88.9±6.3	84.5±6.8	84.4±6.7	84.7±7.0	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
≥140/90 mm Hg [n (%)]	1048 (92.1)	940 (92.7)	108 (87.1)	152 (57.8)	102 (61.4)	50 (51.5)	<0.001	<0.001	0.001	0.001	0.001	0.001
Total cholesterol [mmol/l] (M±SD)	6.01±0.77	6.03±0.76	5.85±0.71	5.44±0.87	5.31±0.90	5.65±0.78	<0.001	<0.001	<0.001	<0.001	0.015	0.003
>5 mmol/l [n (%)]	1013 (89.0)	907 (89.4)	106 (85.5)	176 (66.9)	99 (59.6)	77 (79.4)	<0.001	<0.001	<0.001	<0.001	0.233	0.144
BMI												
M±SD	29.3±4.7	29.5±4.5	28.2±5.8	29.0±4.1	29.4±3.8	28.4±4.6	0.016	<0.001	0.243	0.001	0.820	0.078
25–30 kg/m² [n (%)]	511 (45.0)	463 (45.7)	48 (38.7)	117 (44.5)	74 (44.6)	43 (44.3)	<0.001	0.750	<0.001	0.994	<0.001	0.428
>30 kg/m² [n (%)]	465 (40.9)	425 (41.9)	40 (32.3)	91 (36.7)	64 (38.6)	27 (27.8)	<0.001	0.193	<0.001	0.462	0.233	0.223

Table 4. Risk factors according to age groups adjusted for gender among employees of uniformed services and controls, January 2018-March 2020, Gdańsk, Poland

Variable	Participants (N = 1401) [n (%)]		p	p adjusted for gender
	employees of uniformed services (N = 1138)	control (N = 263)		
Smoking				
20–39 years	31 (47.7)	3 (11.5)	0.001	0.002
40–49 years	166 (38.7)	10 (16.4)	<0.001	0.003
50–59 years	196 (32.6)	16 (21.1)	0.041	0.085
≥60 years	11 (26.2)	15 (15)	0.116	0.351
Blood pressure ≥140/90 mm Hg				
20–39 years	52 (80.0)	17 (65.4)	0.141	0.184
40–49 years	394 (91.8)	34 (55.7)	<0.001	<0.001
50–59 years	562 (93.4)	42 (55.3)	<0.001	<0.001
≥60 years	40 (95.2)	59 (59.0)	<0.001	<0.001
Total cholesterol >5 mmol/l				
20–39 years	50 (76.9)	17 (65.4)	0.259	0.431
40–49 years	363 (84.6)	41 (67.2)	<0.001	0.002
50–59 years	561 (93.2)	53 (69.7)	<0.001	<0.001
≥60 years	39 (92.9)	65 (65.0)	0.001	<0.001

level, and diabetes ($\rho = 0.08$, $p = 0.007$; $\rho = 0.158$, $p < 0.001$; $\rho = 0.115$, $p < 0.001$, respectively), and a negative correlation with smoking ($\rho = -0.106$, $p < 0.001$). Male gender was positively correlated with obesity and diabetes ($\rho = 0.071$, $p = 0.018$; $\rho = 0.061$, $p = 0.041$, respectively). Moreover, hypertension was positively correlated with cholesterol level and obesity ($\rho = 0.078$, $p = 0.009$; $\rho = 0.102$, $p < 0.001$, respectively), and cholesterol level was positively correlated with smoking ($\rho = 0.114$, $p < 0.001$).

In the control group, a positive correlation was found between age and male gender and with diabetes ($\rho = 0.265$, $p < 0.001$; $\rho = 0.153$, $p = 0.017$, respectively), and a negative correlation between male gender and cholesterol level ($\rho = 0.165$, $p < 0.001$). Hypertension correlated positively with cholesterol level ($\rho = 0.165$, $p < 0.001$) and obesity with diabetes ($\rho = 0.190$, $p = 0.003$).

DISCUSSION

To the best of the authors' knowledge, this study represents the first investigation in Poland in recent years to examine cardiovascular risk factors among employees of uniformed services. Previous studies conducted in Poland have mostly focused on soldiers [8] or were conducted almost a decade ago [19].

Obesity is a multifaceted disease that has a significant impact on both physical and mental health [20–22].

Although there was no significant difference in the prevalence of overweight or obesity between the employees of uniformed services and the control group in this study, the mean BMI was significantly higher among male employees of uniformed services compared to the control group (M±SD 29.5±4.5 kg/m^2 vs. 29.4±3.8 kg/m^2, $p < 0.001$) when the p-value was cal-

Table 5. Calculated 10-year risk of fatal cardiovascular event adjusted for age according to systematic coronary risk evaluation (SCORE) and control group aged 40–65 years, January 2018-March 2020, Gdańsk, Poland

Variable	Participants (N = 1277)		p	p adjusted for age
	studied group (N = 1072)	control group (N = 205)		
Female				
n	110	81		
SCORE			<0.001	0.541
M±SD	1.09±0.94	1.96±1.63		
score [n (%)]				
<1%	65 (59.1)	27 (33.0)	<0.001	0.688
≥1% and <5%	45 (40.9)	51 (63.0)	0.003	0.779
≥5% and <10%	0 (0.0)	3 (3.7)	0.042	0.606
≥10%	0 (0.0)	0 (0.0)	–	–
Male				
n	962	124		
SCORE			0.160	<0.001
M±SD	4.44±3.49	4.23±3.86		
score [n (%)]				
<1%	58 (6.0)	12 (9.7)	0.119	0.043
≥1% and <5%	605 (62.9)	79 (63.7)	0.859	0.007
≥5% and <10%	228 (23.7)	25 (20.2)	0.380	0.007
≥10%	71 (7.4)	8 (6.5)	0.708	0.033

culated with age as a cofactor. The mean BMI was also higher in the employee of uniformed services group when the p-value was calculated with age and gender as cofactors (M±SD 29.3±4.7 kg/m^2 vs. 29.0±4.1 kg/m^2, $p < 0.001$). In a previous study, the BMI among Polish policemen was found to be M±SD 27.6±4.1 kg/m^2 [19]. It is worth noting that most of the population in that study was overweight or obese (85.6%). Another study conducted in the south of Poland in 2007–2010 found a lower prevalence of overweight or obesity (71.9%) among people living in rural and urban areas [23].

In this study, obesity was found in 42% of the male population and 32% of the female population. A study conducted among male Saudi Arabian police officers found that 42.5% of the population was overweight and 24.4% were obese [24]. In a study conducted in New York, 50.7% of men and 21.3% of women were found to be obese [25]. The prevalence of obesity among police officers in Russia was much lower (4.6% and 17.2% for men and women, respectively), although it was demonstrated that BMI alone was not an accurate method for classifying weight among them [26]. In a study from Germany, the BMI among male police officers was M±SD 28.0±3.2 kg/m^2, which was lower than in this study (M±SD 29.3±4.67 kg/m^2) [27].

A study conducted in Quebec found that obesity was more prevalent among policemen than among their age-matched counterparts, with >80% of them perceiving themselves to be in good or very good health [11]. Pavlík et al. [9] found significantly worse anthropometric and biochemical parameters in the selected male military cohort compared to a male civilian cohort.

Smoking is one of the most significant cardiovascular risk factors, associated with an increased risk of developing a first myocardial infarction as well as an increased risk of cancer, respiratory diseases, and higher all-cause mortality [28–30].

Gielerak et al. [8] reported that 46% of Polish soldiers were smokers. Similarly, studies conducted in other countries have also found high tobacco use among police officers [31]. In a recent study conducted by Jankowski et al. [32] in the Mazovian Voivodeship of Poland, it was revealed that half of the police employees had ever smoked cigarettes, with one-fifth of them being daily smokers.

The prevalence of daily cigarette smoking was found to be higher among men compared to women (19.7% vs. 19.0%, respectively). In this study, smoking cigarettes was also found to be more prevalent among men, although there were no statistically significant differences observed. Moreover, higher odds of daily cigarette smoking were observed among respondents living in cities with populations of 20 000–100 000 and >500 000 compared to those living in rural areas [32]. Furthermore, a higher prevalence of daily cigarette smoking was observed among respondents who reported living alone (24.7%). Interestingly, in the Mazovian Voivodeship of Poland, the prevalence of daily smoking was highest in the group ≥60 years of age (27%), while in the youngest group of 20–29 years, occasional smoking was declared more frequently (24.4%) than daily smoking (18.8%). In this study, the authors did not differentiate between daily and occasional smokers, and smoking was defined as smoking >7 cigarettes/week; therefore, some occasional smokers may have been defined as smokers in the study. Considering this, the authors' observations could approach those of the Jankowski study, although the prevalence of smoking among police officers seems to be at a higher level in Pomeranian Voivodeship, where this study was conducted. Additionally, the prevalence of cigarette smoking was found to be much higher in this study compared to a German study (35.5% vs. 18.2%) [27].

Furthermore, the authors observed that Polish EoUS as a whole, Polish police officers, and Polish PS officers had higher rates of poorly controlled BP (≥140/90 mm Hg: 92.1%, 91.4%, and 93.2%, respectively) than German police officers [27]. In this study, BP ≥ 140/90 mm Hg was more frequently observed among EoUS in all age groups >40 years of age. Compared to the control group, the mean systolic blood pressure (SBP), mean diastolic blood pressure (DBP), and BP ≥ 140/90 mm Hg were significantly higher in the EoUS group (M±SD 141.7±11.6 mm Hg vs. 135.5±11.0 mm Hg, $p < 0.01$; M±SD 90.1±5.9 mm Hg vs. 84.5±6.8 mm Hg, $p < 0.001$; 92.1% vs. 57.8%, $p < 0.01$, respectively).

Gielerak et al. [8] reported a comparable prevalence of elevated BP among 84% of assessed soldiers, but lower BP levels that were more closely related to the measurements in this study control group (SBP M±SD 134.7±16.5 mm Hg, DBP M±SD 83.1 ±11.4 mm Hg).

Employees of unformed services had higher mean TC levels in the entire population compared to German police officers (TC M±SD 6.01±0.77 vs. 5.32±1.04). Also, a very high rate of poorly controlled hypercholesterolemia (TC > 5 mmol) (89.0%) was observed. Other studies have reported lower percentages, such as high TC in 52% of Polish soldiers [8], 72.5% of Polish pilots [33], and 50% of professional drivers [34], while in the NATPOL study, hypercholesterolemia was found in 61% of the population [35]. The data from NATPOL is in line with the control group in this study (TC > 5 mmol = 66.9%).

The prevalence of DM in other studies was much lower compared to that observed among EoUS in this study [36].

Certain relationships between the investigated parameters were expected, such as the higher prevalence of diabetes, arterial hypertension, and elevated cholesterol levels with advancing age or obesity in men. However, it is noteworthy that arterial hypertension was found to be correlated with cholesterol levels and obesity in the EoUS group. This indicates that modified risk factors tend to co-occur, possibly due to an unhealthy lifestyle adopted by some of the participants.

Uniformed service workers, such as police officers, are a group exposed to chronic stress in the workplace and experience significantly more severe stress compared to other professions [37].

Work-related stress, may result in sleep disorders and increased cortisol levels, which have been associated with insulin resistance, and could accelerate the progression of type 2 diabetes, atherosclerosis, hypertension and metabolic syndrome [38]. It is often not possible to avoid stressors that provoke acute emotional stress; thus, mental health courses may be introduced to reduce anxiety levels among those who face stressors [39].

Since there have been promising attempts to improve CVD risk factors among police officers through educational intervention [40], it would be worth considering the implementation of a comprehensive CVD prevention program to reduce the risk factors among Polish EoUS, consisting of both education on lifestyle changes and methods to improve coping with mental stress.

Limitations

In this study, the authors did not assess the level of stress due to the fact that it is not typically included in routine medical examinations for the occupational groups under study. However, it is possible that patients' stress levels may have had an impact on the results and thus should be assessed in future studies. Failure to do so may have resulted in an overestimation of the prevalence of cardiovascular risk factors.

CONCLUSIONS

The prevalence of all identified risk factors was found to be higher among employees of uniformed services when compared to the control group. Furthermore, the presence of these risk factors within the population of EoUS results in a greater risk of mortality from CVD.

Author contributions

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