Gender-related differences of hypertension risk in population with depression in Russia/Siberia (WHO program "MONICA-psychosocial")

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Abstract

Objective. To determine the gender-related differences of depression impact on the risk (HR — hazard ratio) of hypertension (HTN) development in the general population of 25–64 years old in Russia/Siberia. **Design and methods.** Within the III screening WHO program "MONICA-psychosocial", a random representative sample (both genders, aged 25–64 years old) of Novosibirsk citizens was formed in 1994 (men: n = 657, 44.3 ± 0.4 years, response — 82.1 %; women: n = 689, 45.4 ± 0.4 years, response — 72,5 %). The examination included registration of social and demographic data, diagnostics of depression. During 16-year follow-up new-onset HTN was diagnosed in 229 women and in 46 men. **Results.** In an open population of 25–64 years, depression rate was higher in women (54.5 %) compared to men (29 %). There were no gender differences in social gradient in depressive subjects divided by marital status: women with high levels of education prevailed over men; depressive men more frequently were leaders and workers of heavy physical labor, while women mostly were engineers and workers of light physical labor. Hazard ration of HTN at 5, 10, 16 years was higher in depressive men compared to women. **Conclusions.** Depression is more common in women than in men, however, HR is significantly higher in men than in women.

Key words: gender differences, depression, hypertension, hazard ratio

Гендерные особенности риска развития артериальной гипертензии у населения с депрессией в России/Сибири (программа ВОЗ «MONICA-psychosocial»)

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Резюме

Цель исследования — определить гендерные различия влияния депрессии на риск развития артериальной гипертензии (АГ) в открытой популяции 25–64 лет в России/Сибири. **Материалы и методы.** В рамках III скрининга программы ВОЗ «MONICA-psychosocial» обследована случайная репрезентативная выборка населения Новосибирска (обоего пола, 25–64 лет) в 1994 году (мужчины: n = 657, 44,3 ± 0,4 года, отклик — 82,1 %; женщины: n = 689, 45,4 ± 0,4 года, отклик — 72,5 %). Программа скринирующего обследования включала: регистрацию социально-демографических данных, диагностику депрессии. За 16-летний период было выявлено 229 впервые возникших случаев АГ у женщин и 46 случаев — у мужчин. **Результаты.** В открытой популяции 25–64 лет уровень депрессии был выше у женщин — 54,5 %, чем у мужчин — 29 %. Социальный градиент у лиц с депрессией по семейному положению гендерно не различался; женщины с высоким уровнем образования превалируют над мужчинами; среди мужчин больше руководителей и лиц тяжелого физического труда, среди женщин — инженерно-технических работников и лиц легкого физического труда. Риск развития АГ через 5, 10, 16 лет был выше у мужчин с депрессией, чем у женщин соответственно. **Заключение.** Депрессия в большей степени распространена у женщин, чем у мужчин; в то же время относительный риск АГ при депрессии у мужчин значительно выше, чем у женщин.

Ключевые слова: гендерные различия, депрессия, артериальная гипертензия, относительный риск

Introduction

Depression is a relatively common condition affecting all social groups independently of their social status. It is a mental disorder characterized by low mood, loss of ability to experience joy, thought disorders, and motor retardation [1, 2]. Mechanisms of depression impact on morbidity and mortality can be divided into two classes: direct pathophysiologic and behavioral mechanisms [3, 4].

Depression, as well as associated mental disturbances and excitements can lead to the development of arterial hypertension (HTN) both in men and women [5]. Depression increases the risk of HTN development in males aged 45–64 almost twofold [6]. Indeed, in persons with depression ambulatory blood pressure (BP) levels are higher compared to the control group [7]. The HTN risk in males increases with each new depressive episode over time and becomes more severe in elderly age groups [8]. A meta-analysis of prospective studies by Meng L. et al. evidences the correlation between depression and HTN morbidity in apparently healthy normotensive persons. Depression was associated with 1.42-fold increase of the HTN risk [9].

Opposite data were shown, for instance, in the Nord-Trøndelag Health Study (HUNT), Norway [10–12]. It demonstrated that high level of anxiety and depression is a predictor of BP decrease 11 years after the baseline examination [11], while persistently high combined level of anxiety and depression was associated with 20 % reduction in HTN risk in 22 years [10].

Table 1

**AGE-RELATED DISTRIBUTION OF THE POPULATION AGED
25–64 YEARS (III SCREENING. 1994)**

Gender	Age groups								Total
	25–34 years		35–44 years		45–54 years		55–64 years		
	n	%	n	%	n	%	n	%	
Male	169	50.8	136	45.9	177	47.7	175	50.6	657
Female	164	49.2	160	54.1	194	52.3	171	49.4	689
Total	333	100	296	100	371	100	346	100	1346

$\chi^2 = 2.087.$ df = 3. p = 0.555

Table 2

**POPULATION DISTRIBUTION ACCORDING TO THE MARITAL STATUS
OF THE POPULATION AGED 25–64 YEARS (III SCREENING. 1994)**

Gender	Marital status								Total
	Single		Married		Divorced		Widower (widow)		
	n	%	n	%	n	%	n	%	
Male	45	51.1	559	51.7	40	35.7	13	20	657
Female	43	48.9	522	48.3	72	64.3	52	80	689
Total	88	100	1081	100	112	100	65	100	1346

$\chi^2 = 33.113.$ df = 3. p = 0.0001

Table 3

**DISTRIBUTION ACCORDING TO THE EDUCATIONAL LEVEL
OF THE POPULATION AGED 25–64 YEARS (III SCREENING. 1994)**

Gender	Educational level								Total
	Higher		Incomplete higher / secondary special		Average		Elementary		
	n	%	n	%	n	%	n	%	
Male	186	49.2	178	44.3	150	49.2	143	55.6	657
Female	192	50.8	224	55.7	155	50.8	114	44.4	685
Total	378	100	402	100	305	100	257	100	1342

$\chi^2 = 8.133.$ df = 3. p = 0.043

Current scientific evidence provides very little information on the characteristics of the impact of depression on the HTN risk in males and females.

Therefore, the **objective** of our **study** was to determine gender differences in the impact of depression on the HTN risk over a period of 16 years in an open population aged 25–64 years old in Russia/Siberia.

Design and methods

As part of the III screening of the WHO "MONICA-psychosocial" program (MONItoring of Trends and Determinants in CArdiovascular Disease) [15], a random representative sample of the population aged 25–64 years old in Oktyabrsky district of Novosibirsk was examined in 1994 (males: n = 657, average age 44.3 ± 0.4 years, response rate 82.1 %; females: n = 689, average age 45.4 ± 0.4 years, response rate 72.5 %). Distribution of the population aged 25–64 years old according to the age groups is given in Table 1.

The sample was formed in compliance with the requirements of the WHO "MONICA-psychosocial" protocol [15].

The screening examination included the following:

1. Registration of social and demographic data was carried out according to the standard epidemiologic protocol of the WHO "MONICA-psychosocial" program: ID number, place of residence, last name, first name, patronymic, date of birth, date of registration, sex (1 — male, 2 — female). Distribution according to the age groups is given in Table 1. Marital status (Table 2), level of education (Table 3), and occupational level (Table 4) were also registered.

2. Psychosocial testing:

Depression Scale. For the assessment of depression, a depression scale (MOPSY test) [15] consisting of 15 statements was offered to the subjects. Two answer options were given for each statement: "agree", "disagree". The severity of depression was graded as follows: no depression (ND), moderate depression (MD), severe depression (SD). The participants were asked to answer the questions of the scale independently according to the instructions given in the scale. The analyzed level of risk factor was considered as its baseline value, no changes over time

were taken into account. According to the study protocol, the social aspect of the scale reflected the social gradient: marital status, educational and occupational level. The methods were necessarily standardized and met the requirements of the WHO "MONICA-psychosocial" program protocol [15].

Data were processed in "MONICA" Data Center in Helsinki (Finland). Quality control was carried out in "MONICA" quality control centers: Dundee (Scotland), Prague (Czech Republic), Budapest (Hungary). The submitted results were considered satisfactory [16].

All men and women with diagnosed cardiovascular disease (coronary heart disease, cerebrovascular diseases, HTN, myocardial infarction) and diabetes mellitus occurred before or during the screening were excluded. Altogether 384 females and 190 males aged 25–64 years old at the baseline were enrolled in the analysis. The duration of prospective follow-up of the subjects made 16 years.

As endpoints of the study, new-onset HTN registered during the study were assessed. HTN was identified based on the annual examination of the population cohort, medical records, hospital discharge reports, district outpatient clinics, death certificates, relatives' interviews, pathologist's and forensic reports.

During the annual examination standardized BP measurement with a mercurial sphygmomanometer was carried out on the right hand (phase I of Korotkoff sounds was registered as the systolic BP (SBP) value, phase V — as the diastolic BP (DBP) value), the average of two measurements was included into the analysis. HTN was diagnosed when SBP was 140 mm Hg or higher and/or DBP was 90 mm Hg or higher in patients who did not receive antihypertensive therapy at baseline. Males with normal BP were also classified as hypertensives if they took antihypertensive drugs at baseline examination or had stopped therapy less than 2 weeks before the examination (WHO, 1993).

During the follow-up period in the cohort 229 and 46 cases of new-onset HTN were registered in females and males, respectively.

Statistical analysis was carried out using the program software SPSS, version 11.5 [17]. Pearson χ^2-test was used to test the differences between the

Table 4

DISTRIBUTION ACCORDING TO THE OCCUPATIONAL LEVEL OF THE POPULATION AGED 25–64 YEARS (III SCREENING, 1994)

Gender	Профессиональный уровень																		Total
	TM		MM		M		EP		HLW		MLW		ELW		Students		Pensioners		
	n	%	n	%	n	%	n	%	n	%	n	%	n	%	n	%	n	%	
Male	28	84,8	55	55,6	65	50,8	84	42	144	88,9	167	63,3	21	17,1	9	81,8	84	34,7	657
Female	5	15,2	44	44,4	63	49,2	116	58	18	11,1	97	36,7	102	82,9	2	18,2	158	65,3	605
Total	33	100	99	100	128	100	200	100	162	100	264	100	123	100	11	100	242	100	1262

$\chi^2 = 238,16, df = 8, p = 0,001$

Note: TM — top managers; MM — middle managers; M — managers; EP — engineering personnel; HLW — hard labor workers; MLW — medium labor workers; ELW — easy labor workers.

Table 5

DEPRESSION IN THE POPULATION AGED 25–64 YEARS

D	25–34 years				35–44 years				45–54 years				55–64 years				25–64 years			
	M		F		M		F		M		F		M		F		M		F	
	n	%	n	%	n	%	n	%	n	%	n	%	n	%	n	%	n	%	n	%
SD	1	0.6	10	9.7	3	1.8	18	13.6	9	6.9	1	2.9	6	4	8	18.6	19	3.1	37	11.8
MD	39	23.4	44	42.7	39	23.9	53	40.2	35	26.9	17	48.6	44	29.5	20	46.5	157	25.9	134	42.8
ND	127	76	49	47.6	121	74.2	61	46.2	86	66.2	17	48.6	99	66.4	15	34.9	433	71	142	45.4
Total	167	100	103	100	163	100	132	100	130	100	35	100	149	100	43	100	609	100	313	100
	$\chi^2 = 28.674, \upsilon = 2,$ $p = 0.0001$				$\chi^2 = 29.695, \upsilon = 2,$ $p < 0.0001$				$\chi^2 = 6.219, \upsilon = 2,$ $p < 0.05$				$\chi^2 = 18.210, \upsilon = 2,$ $p < 0.0001$				$\chi^2 = 66.724, \upsilon = 2,$ $p < 0.0001$			

Note: Д — depression; M — Male; F — Female; SD — severe depression; MD — moderate depression; ND — no depression.

DEPRESSION AND MARITAL STATUS IN THE POPULATION AGED 25–64 YEARS (III SCREENING)

D	Marital status															
	Single				Married				Divorced				Widower (widow)			
	M		F		M		F		M		F		M		F	
	n	%	n	%	n	%	n	%	n	%	n	%	n	%	n	%
SD	0	0	3	10.7	12	2.7	24	10.4	5	14.7	6	20	0	0	3	21.4
MD	12	30	13	46.4	113	25.1	101	41.9	10	29.4	12	40	4	36.5	8	57.1
ND	28	70	12	42.9	326	72.3	115	47.7	19	55.9	12	40	7	63.6	3	21.4
Total	40	100	28	100	451	100	241	100	34	100	30	100	11	100	14	100
	$\chi^2 = 7.558.\ \upsilon = 2.$ $p < 0.05$				$\chi^2 = 45.434.\ \upsilon = 2.$ $p < 0.0001$				$\chi^2 = 1.610.\ \upsilon = 2.$ $p > 0.05$				$\chi^2 = 1.44.\ \upsilon = 2.$ $p > 0.05$			

Note: D — depression; M — Male; F — Female; SD — severe depression; MD — moderate depression; ND — no depression.

groups [18]. For the assessment of risk and its 95 % confidence interval (CI) (minimum-maximum) with regard to different follow-up points, univariate and multivariate Cox regression proportional hazard models (Cox-regression) were applied [19]. In all types of analysis, results were considered significant at p-level ≤ 0.05.

Results

In the open population of subjects aged 25–64 years depression was diagnosed more frequently in females: 29 % of males vs 54.5 % of females. Moreover, SD was found more often in females (11.8 % of cases) compared to males (3.1 %; $\chi^2 = 66.724$, df = 2, p = 0,0001). In the age group 45–54 years old the prevalence of SD was significantly higher in males (6.9 %) than in females (2.9 %; $\chi^2 = 6.219$, $\upsilon = 2$, p = 0.05). In the age group 55–64, vice versa, SD prevalence was significantly higher in females (18.6 %) than in males (4 %; $\chi^2 = 18.210$, $\upsilon = 2$, p = 0.0001) (Table 5).

The structure of the marital status of the persons with MD and SD is given in Table 6. Comparison of the male and female groups for each of the options "have never been married" and "married" showed that subjects without depression prevailed ($\chi^2 = 7.558$, $\upsilon = 2$, p = 0.05 and $\chi^2 = 45.434$, $\upsilon = 2$, p = 0.0001, respectively). SD was predominant in divorced males 14.7 % compared to married males 2.7 % ($\chi^2 = 14.519$, $\upsilon = 2$, p = 0.001). Among females with different depression level and marital status no statistically significant differences were found.

The structure of educational level in the population with MD and SD is shown in Table 7. In each of the groups with different educational level, SD and MD prevalence were higher in females compared to males (Table 7). The highest SD level was found in females with the higher education (54.7 %) compared to females with incomplete secondary and elementary education (39.3 %; $\chi^2 = 5.89$, $\upsilon = 2$, p = 0.05). On the contrary, in males with incomplete secondary/elementary education SD level was higher (7.4 %) compared to males with higher education ($\chi^2 = 6.211$, $\upsilon = 2$, p = 0.05).

Occupational levels in males and females with MD and SD are shown in Table 8. The highest SD levels compared to males were found in females who were top managers (66.7 % and 4.5 %; $\chi^2 = 11.111$, $\upsilon = 2$, p = 0.004) and managers (64.9 % and 3.7 %; $\chi^2 = 45.8$, $\upsilon = 2$, p = 0.001). MD level was significantly higher in males-managers (31.5 %), than in females (27 %; $\chi^2 = 45.8$, $\upsilon = 2$, p = 0.001).

Univariate Cox regression analysis showed that 5 years after the beginning of the study the HTN onset risk (DR) was higher in males with depression: DR = 6.7 (95 % CI 3.5–8.2, p = 0.01), whereas only a tendency towards the increase of HTN risk was found in females with depression: DR = 1.6 (95 % CI 0.8–2.9, p = 0.05) compared to subjects without depression. 10 years later the HTN risk among males was higher — DR = 4.2 (95 % CI 2.5–6.1, p = 0.05) than in females — DR = 1.7 (95 % CI 1.01–3, p = 0.045). 16 years later the risk of HTN in males was higher: DR = 2.15 (95 % CI 1.1–7.2, p = 0.05), whereas in females with depression no increase of HTN risk was found: DR = 0.9 (95 % CI 0.6–1.4, p = 0.05) (Table 9).

Multivariate Cox regression analysis with the inclusion of age and social characteristics

Table 7

DEPRESSION AND EDUCATIONAL LEVEL IN THE POPULATION AGED 25–64 YEARS (III SCREENING)

D	Educational level															
	Higher				Incomplete higher / secondary special				Average				Elementary			
	M		F		M		F		M		F		M		F	
	n	%	n	%	n	%	n	%	n	%	n	%	n	%	n	%
SD	4	2.6	52	54.7	2	1.3	50	42	4	3.1	29	40.8	7	7.4	11	39.3
MD	35	22.9	35	36.8	41	26.1	57	47.9	33	25.2	32	45.1	30	31.6	10	35.7
ND	114	74.5	8	8.4	114	72.6	12	10.1	94	71.8	10	14.1	58	61.1	7	25
Total	153	100	95	100	157	100	119	100	131	100	71	100	95	100	28	100
	$\chi^2 = 126.601$, $\upsilon = 2$, $p < 0.0001$		$\chi^2 = 126.601$, $\upsilon = 2$, $p < 0.0001$		$\chi^2 = 126.601$, $\upsilon = 2$, $p < 0.0001$		$\chi^2 = 126.601$, $\upsilon = 2$, $p < 0.0001$		$\chi^2 = 76.654$, $\upsilon = 2$, $p < 0.0001$				$\chi^2 = 20.487$, $\upsilon = 2$, $p < 0.0001$			

Note: D — depression; M — Male; F — Female; SD — severe depression; MD — moderate depression; ND — no depression.

Table 8

DEPRESSION AND OCCUPATIONAL LEVEL IN THE POPULATION AGED 25–64 YEARS (III SCREENING)

Д	Professional level																																			
	TM				MM				M				EP				HLW				MLW				ELW				Students				Pensioners			
	M		F		M		F		M		F		M		F		M		F		M		F		M		F		M		F		M		F	
	n	%	n	%	n	%	n	%	n	%	n	%	n	%	n	%	n	%	n	%	n	%	n	%	n	%	n	%	n	%	n	%	n	%	n	%
БД	1	4.5	2	66.7	2	4.8	10	45.5	2	3.7	24	64.9	0	0	26	46.4	5	4.1	3	33.3	3	2.2	25	45.5	0	0	26	41.9	0	0	1	100	4	6.5	10	26.3
УД	4	18.2	1	33.3	8	19	12	54.5	17	31.5	10	27	17	23	25	44.6	31	25.4	4	44.4	40	29.9	23	41.8	2	11.8	28	45.2	2	22.2	0	0	18	29	20	52.6
НД	17	77.3	0	0	32	76.2	0	0	35	64.8	3	8.1	57	77	5	8.9	86	70.5	2	22.2	91	67.9	7	12.7	15	88.2	8	12.9	7	77.8	0	0	40	64.5	8	21.
Всего	22	100	3	100	42	100	22	100	54	100	37	100	74	100	56	100	122	100	9	100	134	100	55	100	17	100	62	100	9	100	1	100	62	100	38	100
	$\chi^2 = 11.111$, $\upsilon = 2$, $p < 0.004$				$\chi^2 = 35.334$, $\upsilon = 2$, $p < 0.001$				$\chi^2 = 45.8$, $\upsilon = 2$, $p < 0.001$				$\chi^2 = 69.986$, $\upsilon = 2$, $p < 0.001$				$\chi^2 = 15.774$, $\upsilon = 2$, $p < 0.001$				$\chi^2 = 73.734$, $\upsilon = 2$, $p < 0.001$				$\chi^2 = 37.054$, $\upsilon = 2$, $p < 0.001$				—				$\chi^2 = 19.365$, $\upsilon = 2$, $p < 0.001$			

Note: TM — top managers; MM — middle managers; EP — engineering personnel; HLW — hard labor workers; MLW — medium labor workers; ELW — easy labor workers; D — depression; M — Male; F — Female; SD — severe depression; MD — moderate depression; ND — no depression.

(marital status, level of education, occupational status) into the model showed the increase of HTN risk in males with depression — DR = 5.3 (95 % CI 2.2–13.2, p = 0.0001) — to a greater extent than in females with depression — DR = 1.4 (95 % CI 1.04–1.98, p = 0.02). In the oldest age group aged 55–64 years, however, the risk of HTN in females with depression turned out to be higher: DR = 6.9 (95 % CI 2.92–16.35, p = 0.001) than in males with depression: DR = 4.9 (95 % CI 2.1–11.4, p = 0.001). Higher risk of HTN was also found in females aged 45–54: DR = 2.53 (95 % CI 1.65–3.9, p = 0.0001), whereas in males only a tendency towards the increase of HTN risk was found: DR = 1.4 (95 % CI 0.9–11, p = 0.05). In males with depression and incomplete secondary/elementary education the risk of HTN was 5.6-fold higher (95 % CI 1.5–20.4, p = 0.01) than in males with depression and higher education. Such differences were not found in females. HTN risk was higher in males with depression doing blue-collar job if compared to managers or engineering personnel — DR = 2.8 (95 % CI 1.5–11, p = 0.04), in females only a tendency towards the increase of AH risk in persons with blue-collar job was found — DR = 2.05 (95 % CI 0.47–8.91, p = 0.05). In divorced males with depression HTN risk was 3-fold higher

(95 % CI 1.1–9.3) compared to married males (p = 0.05), in divorced females only a tendency towards the increase of HTN risk was found: DR = 1.15 (95 % CI 0.48–2.76, p = 0.05) (Table 10).

Discussion

According to the results of our study, depression was found more often in females (54.5 %) than in males (29 %) including SD (11.8 and 3.1 %. respectively). SD was registered more often in middle-aged males (45–54 years old, 6.9 %) and elderly females (55–64 years old, 18.6 %). Increased depression prevalence in this age group is common. Depression is a contemporary social sickness. According to DALY criteria (reduction of functional, socially full life), by 2020 depression will be the second most common disease next to the coronary heart disease. Depression is twice common in females than in men, and in females it develops most frequently at the age over 50 years, whereas in males it starts at the age over 45 years old. Scientists believe that aging is one of the reasons causing depressive state. Awareness of increasing physical weakness, beginning difficulties with self-maintenance, vision and hearing impairment, difficulties in interpersonal

Table 9

DEPRESSION AND RISK OF ARTERIAL HYPERTENSION DEVELOPMENT IN THE OPEN POPULATION AGED 25–64 YEARS (UNIVARIATE COX REGRESSION ANALYSIS)

Gender		Male				Female			
	Age group	p	RR	95% CI		p	PP	95% CI	
				Lower	Upper			Lower	Upper
5 years	25–34	–	–	–	–	0.07	7.3	0.8	65.9
	35–44	0.14	2.5	0.3	5.9	0.52	1.4	0.4	4.4
	45–54	0.7	0.02	0.001	1.4	0.4	1.6	0.5	5.1
	55–64	0.16	12.3	4.7	25.7	0.40	1.8	0.4	7.8
	25–64	0.01	6.7	3.5	8.2	0.14	1.6	0.8	2.9
10 years	25–34	–	–	–	–	0.36	0.4	0.1	2.4
	35–44	0.31	3	0.2	6.7	0.07	2.6	0.9	7.5
	45–54	0.62	1.27	0.02	4.1	0.21	1.8	0.6	4.9
	55–64	0.09	5.31	1.7	12.1	0.57	4.1	0.0001	8.75
	25–64	0.05	4.2	2.5	6.1	0.045	1.7	1.01	3
16 years	25–34	0.18	1.1	0.06	2.5	0.61	1.1	0.6	2.1
	35–44	0.08	3.4	1.5	5.9	0.83	1.1	0.5	2
	45–54	0.12	1.15	0.07	4.4	0.99	0.9	0.2	4.2
	55–64	0.25	1.7	0.03	5.2	0.95	1.1	0.1	10.5
		0.05	2.15	1.1	7.2	0.95	0.9	0.6	1.4

Note: RR — relative risk; CI — confidence interval.

**DEPRESSION AND RISK OF ARTERIAL HYPERTENSION DEVELOPMENT
IN THE POPULATION AGED 25–64 YEARS WITHIN 16 YEARS
OF FOLLOW-UP (MULTIVARIATE COX REGRESSION ANALYSIS)**

Gender		Male				Female			
Reference group	**Risk group**	**p**	**RR**	**95% CI**		**p**	**RR**	**95% CI**	
				Lower	**Upper**			**Lower**	**Upper**
No depression	Depression	0.0001	5.3	2.2	13.2	0.02	1.4	1.04	1.98
Married	Single	0.3	2.8	0.3	22	0.82	1.08	0.51	2.29
	Divorced	0.05	3	1.1	9.3	0.75	1.15	0.48	2.76
	Widower (widow)	0.2	2.6	0.5	12.5	0.4	1.54	0.55	4.28
Education Higher	Incomplete higher / secondary special	0.4	1.8	0.4	7.5	0.91	1.02	0.64	1.62
	Average	0.3	1.4	0.3	6.5	0.03	0.56	0.33	0.95
	Elementary	0.01	5.6	1.5	20.4	0.56	0.82	0.42	1.59
Managers and engineering personnel	Workers	0.04	2.8	1.5	11	0.33	2.05	0.47	8.91
24–34 years	35–44 years	0.8	1.7	0.3	16	0.21	1.26	0.87	1.84
	45–54 years	0.6	1.4	0.9	11	0.0001	2.53	1.65	3.9
	55–64 years	0.001	4.9	2.1	11.4	0.0001	6.9	2.92	16.35

Note: RR — relative risk; CI — confidence interval.

relations and, finally, loneliness, i.e. issues that often are typical for the old age, may be reasons for depression development [27–30]. According to the results of our study, among females depression was diagnosed more often in elderly age groups, and the risk of HTN in these groups was almost 1.4-fold higher than in males [31]. Higher prevalence of depression in middle-aged males is caused not only by a pathophysiological response to stress in the setting of a long-term social and economic crisis [32], but also by the influence of internal and external factors facilitating psychological changes [33].

The so-called "midlife crisis" promotes a new self-image of a person as a result of changes in life conditions, reappraisal of values, need for rethinking of life aims and goals. Therefore, one needs adaptation to the rapidly changing lifestyle, to the changed social conditions [34]. Such living conditions cause the feeling of insecurity and lead to the development of anxiety and depression [35, 36].

The structure of marital status between males and females did not change substantially. However, the analysis of marital status and depression showed that married men and women as well as those who "have never been married"

have lower rates of depression. We discovered that SD was found more often in divorced males (14.7%). Moreover, exactly in this category the risk of HTN was higher if compared to married persons (DR = 3). Marital status, on the contrary, turned out to be a powerful factor protecting from depression and HTN risk. Based on the available evidence, both marital status and the "marriage quality" are important for BP decrease. Married subjects show higher life satisfaction and lower BP levels than lonely persons. Marriage satisfaction is associated with BP decrease, stress reduction, decreased depression risk [37]. On the contrary, divorce as well as widowhood is one of the most serious stressors people encounter in their lives [27]. Divorce and emotional sufferings contribute to the HTN development in males [38]. Females demonstrated no significant differences in the HTN risk in groups with various marital status and depression.

In our study we found a tendency towards increased prevalence of SD in females with secondary education. The highest SD level was found in females with higher education (54.7%), and MD — in females with incomplete higher or secondary vocational education (47.9%). In males, on the contrary, higher prevalence of SD and MD

was found in persons with elementary education (7.4 and 31.6 %). This can be a priori attributed to the fact that higher level of education more often implies employment in superior positions. According to the study by Pudrovska T. et al. [39], depression symptoms are found more often in female managers than in male managers. In males positions that imply the possibility to hire and dismiss, on the contrary, are associated with lower prevalence of depressive symptoms. The highest level of education enables higher awareness of HTN risk factors, gives more possibilities to take care of one's health, etc. compared to subjects with low level of education [28]. For this reason we did not find an increased HTN risk in well-educated females with depression. On the contrary, the low level of education implies hard and strenuous work characterized by high requirements and lacking control causing HTN increase. In our study, only males with low level of education and depression showed higher risk of HTN. No such associations were found in females.

Although females and males with depression held leading positions, no significant differences in HTN risk were found between females and males.

Therefore, our study demonstrated that, although depression is more common in females, in males it begins almost ten years earlier than in females, affects more social groups and is associated not only with internal but also with external problems. This can be the reason of the higher the risk of HTN development in males with depression than in females over a period of 5, 10 and 16 years, whereas females with depression had higher HTN risk only 10 years later and the increase was much lower than in males.

Conclusions

1. Depression in females (54.5 %) occurred 1.8-fold more often than in males (29 %), and SD was registered 3.8-fold more often (11.8 and 3.1 %, respectively).

2. The social gradient in males and females with depression was different: in each of the groups of subjects with different education level the depression level was higher in females compared to males; the same was found in subgroups with different occupations. The structure of marital status did not differ significantly.

3. In spite of depression dominance in females compared to males in terms of both prevalence and social gradient, the risk of HTN development was much higher in males than in females over a period of 5, 10 and 16 years (DR = 6.7, 4.2, 2.15 and 1.6, 1.7, 0.9 in males and females, respectively) from the beginning of the study.

Conflict of interest
The authors declare no conflict of interest.

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