

## Research Article

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## Social Support and the Risk of Hypertension in an Open Population in Russia/ Siberia (Who Monica-Psychosocial Program)

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### ABSTRACT

**Purpose:** To study the impact of social support (indices of close contacts and social networks) on the risk of arterial hypertension (AH) in an open population of 25-64 years in Novosibirsk.

**Methods:** A random representative sample of the population of both sexes of 25-64 years old in Novosibirsk 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 screening survey program included: registration of socio-demographic data determination of the level of social support (ICC - index of close contacts SNI - index of social networks). The period of prospective follow-up of participants was 16 years.

**Results:** In the open population of 25-64 years low rates of ICC and SNI were in 62% and 43.5% of men and 56.8% and 33.9% of women. During the first 5 years the risk of hypertension in men and women with a low ICC was the same in men HR = 2.063 (95% CI 1.019-5.213 p <0.05) and women with HR = 2.009 (95% CI 1.025- 3.938 p <0.05). The increase in the risk of AH in persons with low SNI over 5 years was higher in men in 5.9 (95% CI 1.278-8.361 p <0.05) times 10 years later the risk of developing AH in women 25-64 was 1.884 (95% CI 1.09-3.255 p <0.05). The risk of hypertension was highest among men: never married divorced and widowed with low ICC and SNI. Among women at risk were widowed women with low ICC as well as women with primary education with low ICC and SNI.

**Conclusion:** Low level of social support increased the risk of AH in men and women.

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### Introduction

The social environment has an important influence on the physical and psychological health and well-being of people. Social support is a qualitative and quantitative determinant of people's relationships. That is social support can be considered as in the structure of the family: relationships with loved ones emotional care instrumental help information support and in the structure of social relations such as the social relationship of a person in society [1]. Social support is defined in terms of social characteristics of the network such as assistance from the family friends neighbors and other members of the community. It includes "social transactions whose purpose is to help people in their daily lives and especially in response to critical situations"[2]. Well-developed social relationships suggest favorable levels of blood pressure. In such groups the frequency and risk of hypertension is lower [3-4].

On the contrary social isolation is an objective and quantifiable reduction in the size of the social network and the scarcity of social contacts. Socially isolated people have an increased risk of

developing cardiovascular diseases infectious diseases impairment of cognitive ability and an increase in mortality [5-10]. Social isolation is also associated with increased arterial pressure C-reactive protein and fibrinogen as well as with increased inflammatory and metabolic stress responses [11-14].

Therefore the purpose of our study was to study the impact of the level of social support (in the form of indices of close contacts and social networks) on the risk of arterial hypertension in an open population of 25-64 years in Novosibirsk.

### Materials and Methods

Under the III screening of the WHO MONICA-psychosocial program (Monitoring trends in morbidity and mortality from cardiovascular diseases and their determinants) [15] a random representative sample of the population aged 25-64 in the Oktyabrsky district of Novosibirsk city (n = 657 average age 44.3 ± 0.4 years response rate 82.1% women n = 689 mean age 45.4 ± 0.4 years response rate 72.5%) was examined in 1994.

The sample was generated according to the requirements of the WHO protocol "MONICA-psychosocial" [15].

The screening survey program included the following sections:

1) Registration of socio-demographic data was carried out according to the standard epidemiological protocol of the WHO program "MONICA-psychosocial": identification number place of residence full name date of birth date of registration. Sex: 1 - male 2 - female. The distribution by age group is presented in Table 1.

**Table 1: Distribution of population 25-64 years depending on age group (III screening 1994 y)**

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

$$\chi^2=2087 \text{ df}=3 \text{ p}=0555$$

The family situation was taken into account (Table 2) the level of education (Table 3) the professional level (Table 4).

**Table 2: Distribution of population 25-64 years depending on marital status (III screening 1994 y.)**

Gender	Age groups								Total
	Never Married		Married		Divorced		Widowed		
	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

$$\chi^2=33113 \text{ df}=3 \text{ p}=00001$$

**Table 3: Distribution of population 25-64 years depending on educational level (III screening 1994 y)**

Gender	Educational level								Total
	Higher/University		College		High school		Primary		
	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

$$\chi^2=8133 \text{ df}=3 \text{ p}=0043$$

**Table 4: Distribution of population 25-64 years depending on occupational status (III screening 1994 y)**

Gender	Occupational status																		Total
	Ex/D		MG		FLM		Eng		HMW		MW		LMW		Student		Retired		
	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

$$\chi^2=23816 \text{ df}=8 \text{ p}=0001$$

Ex/D - top executives/directors

MG- managers

FLM – first-line managers

Eng –engineers

HMW – heavy manual workers

MW – manual workers middle intensity

LMW – manual work light intensity

2) Psychosocial testing: to assess the level of social support (social support Berkman-Syme test) [16]. The index of close contacts (ICC) consisting of 17 points was determined. It was assessed as - low medium high. The index of social networks (SNI) consisting of 9 items was estimated as - low medium-1 medium -2 high. The subjects were asked to independently answer the questions of the scale according to the instructions. For the analyzed level of the risk factor it was important in the initial study and did not take into account the contribution of time dynamics. The methods were strictly standardized and met the requirements of the protocol of the WHO program "MONICA - psychosocial" [15].

The processing of the material under the WHO program "MONICA - psychosocial" was performed at the Information Collection Center "MONICA" in Helsinki (Finland). Quality control was carried out in the quality control centers "MONICA": Dundee (Scotland) Prague (Czech Republic) Budapest (Hungary). The presented results are considered satisfactory [15].

All women and men with cardiovascular diseases (ischemic heart disease cerebrovascular diseases arterial hypertension myocardial infarction) diabetes mellitus occurred before or during the screening were excluded from the study. The analysis included 384 women and 190 men at the initial age of 25-64 years. The period of prospective follow-up of participants was 16 years. The work

was carried out under the State Assignment within the framework of the budgetary theme No. AAAA-A17-117112850280-2.

The statistical analysis was carried out using the SPSS version 11.5 software package [17]. To check the statistical significance of the differences between the groups the Pearson  $\chi^2$ -square test was used [18]. To assess the hazard ratio (HR) and its 95% CI (confidence interval) (minimum-maximum) taking into account the different control times a one-factor and multi-factor regression model of Cox-regression was used [19]. Reliability in all types of analysis was adopted at a significance level of  $p \leq 0.05$ .

### Results

In an open population aged of 25-64 years a low ICC was found in 62% of men and 56.8% of women ( $\chi^2 = 22.603$  df = 2 p = 0.0001). In the distribution by age group the lowest ICC was observed in men in the age group 55-64 years -64.6% ( $\chi^2 = 14.85$  df = 2 p = 0.0001) and in women aged 35-44 -60.6% ( $\chi^2 = 3.917$  df = 2 p = 0.141) (Table 5).

Low SNI in the open population of 25-64 years was in 43.5% of men and 33.9% of women ( $\chi^2 = 21.546$  df = 2 p = 0.0001). The lowest SNI among men was among young people aged 25-34 -50% ( $\chi^2 = 15894$  df = 3 p = 0.001) in women in the group of 35-44 years (39.4%) ( $\chi^2 = 1.071$  df = 3 p = 1) (Table 5).

**Table 5: Distribution of population 25-64 years depending on social support**

		25-34				35-44				45-54				55-64				25-64			
		M		F		M		F		M		F		M		F		M		F	
		N	%	N	%	N	%	N	%	N	%	N	%	N	%	N	%	N	%	N	%
<b>Close contacts index</b>																					
Low	1994	102	63.8	82	57.7	85	55.9	86	60.6	79	64.2	72	54.1	102	64.6	71	54.2	368	62	311	56.8
Medium		39	24.4	50	35.2	44	28.9	45	31.7	33	26.8	52	39.1	37	23.4	55	42	153	25.9	202	36.9
High		19	11.9	10	7	23	15.1	11	7.7	11	8.9	9	6.8	19	12	5	3.8	72	12.1	35	6.4
Total		160	100	142	100	152	100	142	100	123	100	133	100	158	100	131	100	593	100	548	100
		$\chi^2=5.27$ v=2 P=0.072				$\chi^2=3.917$ v=2 P=0.141				$\chi^2=4.388$ v=2 P=0.111				$\chi^2=14.85$ v=2 P=0.0001				$\chi^2=22.603$ v=2 P=0.0001			
<b>Social networks index</b>																					
Low	1994	80	50	47	33.1	55	36.2	56	39.4	50	38.8	47	35.3	75	47.8	36	27.5	260	43.5	186	33.9
Medium-1		42	26.3	64	45.1	58	38.2	54	38	44	34.1	57	42.9	53	33.8	62	47.3	197	32.9	237	43.2
Medium-2		28	17.5	28	19.7	33	21.7	29	20.4	26	20.2	23	17.3	21	13.4	31	23.7	108	18.1	111	20.3
High		10	6.3	3	2.1	6	3.9	3	2.1	9	7	6	4.5	8	5.1	2	1.5	33	5.5	14	2.6
Total		160	100	142	100	152	100	142	100	129	100	133	100	157	100	131	100	598	100	548	100
		$\chi^2=15.894$ v=3 P=0.001				$\chi^2=1.071$ v=3 P=1				$\chi^2=2.489$ v=3 P=0.651				$\chi^2=17.727$ v=3 P=0.0001				$\chi^2=21.546$ v=2 P=0.0001			

Table 6 shows the distribution by ICC level and marital status. The lowest level of ICC was found in men who were not married - 85% ( $\chi^2 = 9681$  df = 2 p = 0008) and divorced women - 60.3% ( $\chi^2 = 8687$  df = 2 p = 0013).

**Table 6: ICC and marital status in population 25-64 years (III screening)**

	<b>Marital Status</b>															
	Never married				Married				Divorced				Widowed			
	M		F		F		M		M		F		M		F	
	N	%	N	%	N	%	N	%	N	%	N	%	N	%	N	%
Low	34	85	17	51.5	271	59.7	238	57.3	26	78.8	35	60.3	9	81.8	21	50
Medium	5	12.5	14	42.4	121	26.7	146	35.2	5	15.2	23	39.7	1	9.1	19	45.2
High	1	2.5	2	6.1	62	13.7	31	7.5	2	6.1	0	0	1	9.1	2	4.8
Total	40	100	33	100	454	100	415	100	33	100	58	100	11	100	42	100
	$\chi^2=9.681$ df=2; P=0.008				$\chi^2=13.09$ df=2; P=0.001				$\chi^2=8.687$ df=2; P=0.013				$\chi^2=4.866$ df=2; P=0.088			

Similarly a low SNI was observed more often in men who were never married - 63.2% ( $\chi^2 = 25.374$  df = 3 p = 0.0001) and among divorced women -46.6% ( $\chi^2 = 25.374$  df = 3; p = 0.0001) (Table 7).

**Table 7: SNI and marital status in population 25-64 years (III screening)**

	Marital Status															
	Never married				Married				Divorced				Widowed			
	M		F		F		M		M		F		M		F	
	N	%	N	%	N	%	N	%	N	%	N	%	N	%	N	%
Low	24	63.2	5	15.2	182	41.1	143	34.6	22	61.1	27	46.6	8	66.7	11	27.5
Medium	6	15.8	21	63.6	150	33.9	172	41.6	5	13.9	23	39.7	4	33.3	18	45
High	4	10.5	7	21.2	85	19.2	86	20.8	8	22.2	8	13.8	0	0	9	22.5
Total	4	10.5	0	0	26	5.9	12	2.9	1	2.8	0	0	0	0	2	5
	$\chi^2=25.374$ df=3; P=0.0001				$\chi^2= 10.308$ df=3; P=0.021				$\chi^2=8.392$ df=3;P= 0.05				$\chi^2= 7.472$ df= 2;P=0.076			

The lowest level of ICC was in men (66.1%) and women (58.1%) with an average level of education ( $\chi^2 = 18.672$  df = 2 p = 0.0001) (Table 8).

**Table 8: ICC and education in population 25-64 years (III screening)**

	Educational level															
	University				College				High School				Elementary			
	M		F		F		M		M		F		M		F	
	N	%	N	%	N	%	N	%	N	%	N	%	N	%	N	%
Low	105	64.8	91	58.1	88	59.9	93	53.1	84	66.1	72	58.1	63	61.8	49	57
Medium	43	26.5	55	35.4	39	26.5	68	38.9	24	18.9	48	38.7	26	25.5	30	34.9
High	14	8.6	10	6.5	20	13.6	14	8	19	15	4	3.2	13	12.7	7	8.1
Total	162	100	159	100	147	100	175	100	127	100	124	100	102	100	86	100
	$\chi^2= 3.024$ df=2; P=0.22				$\chi^2=6.672$ df= 2;P=0.036				$\chi^2=18.672$ df=2; P = 0.0001				$\chi^2=2.492$ df= 2; P=0.288			

Table 9 shows the distribution of SNI and the level of education. Low SNI was more common in men with incomplete higher education - secondary special education - 49.7% ( $\chi^2 = 18.672$  df = 2 p = 0.0001) and women with an average level of education - 40.3% ( $\chi^2 = 8.99$  df = 3 p = 0.038).

**Table 9: SNI and education in population 25-64 years (III screening)**

SNI	Educational level															
	University				College				High School				Elementary			
	M		F		F		M		M		F		M		F	
	N	%	N	%	N	%	N	%	N	%	N	%	N	%	N	%
Low	64	42.1	55	34.6	72	49.7	55	31.4	61	48.8	50	40.3	39	36.4	23	26.7
Medium -1	52	34.2	70	44	43	29.7	81	46.3	33	26.4	46	37.1	37	34.6	40	46.5
Medium -2	28	18.4	27	17	23	15.9	35	20	23	18.4	27	21.8	23	21.5	21	24.4
High	8	5.3	7	4.4	7	4.8	4	2.3	8	6.4	1	0.8	8	7.5	2	2.3
Total	152	100	159	100	145	100	175	100	125	100	124	100	107	100	86	100
	$\chi^2= 3.265$ df=3; P =0.477				$\chi^2=14.537$ df= 3;P=0.003				$\chi^2=8.99$ df=3; P = 0.038				$\chi^2=5.72$ df= 3; P=0.167			

When considering the ICC among the population of 25-64 years the low rate of ICC among male engineers (engineers and technicians) was significantly higher (63.9%) than among women in the same group (49.4%) ( $\chi^2 = 8.99$  df = 3 ; p = 0.038) (Table 10).

**Table 10: ICC and occupation in population 25-64 years (III screening)**

ICC	Occupational status																											
	Ex/D				MG				FLM				Eng				HMW				MW				LMW			
	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	%
L	19	76	3	60	30	56.6	22	56.4	32	64	33	70.2	46	63.9	44	49.4	69	58.5	7	58.3	90	59.2	40	51.3	8	57.1	56	61.5
M	4	16	1	20	21	39.6	17	43.6	9	18	12	25.5	18	25	39	43.8	32	27.1	4	33.3	40	26.3	29	37.2	4	28.6	27	29.7
H	2	8	1	20	2	3.8	0	0	9	18	2	4.3	8	11.1	6	6.7	17	14.4	1	8.3	22	14.5	9	11.5	2	14.3	8	8.8
Total 25	25	100	5	100	53	100	39	100	50	100	47	100	72	100	89	100	118	100	12	100	152	100	78	100	14	100	91	100
	$\chi^2=0.785$ df= 2; P=0.675				$\chi^2=1.577$ df= 2; P=0.459				$\chi^2=4.81$ df=2; P=0.09				$\chi^2=6.343$ df=2; P=0.042				$\chi^2=0.442$ df= 2; P=0.802				$\chi^2=2.931$ df=2; P=0.231				$\chi^2=1.858$ df= 2; P=0.395			

L - low  
M - middle  
H - high  
Ex/D - top executives/directors  
MG- managers  
FLM – first-line managers  
Eng –engineers  
HMW – heavy manual workers  
MW – manual workers middle intensity  
LMW – manual work light intensity

Similarly significantly lower SNI was found in men (50.7%) than in women (28.1%) of engineer specialnetworks ( $\chi^2 = 10.705$  df = 3 p = 0.017) (Table 11).

**Table 11: SNI and occupation in population 25-64 years (III screening)**

SNI	Occupational status																											
	Ex/D				MG				FLM				Eng				HMW				MW				LMW			
	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	%
L	11	44	1	20	17	43.6	14	35.9	21	39.6	19	40.4	37	50.7	25	28.1	51	44	4	33.3	55	41.7	29	37.2	7	43.8	38	41.8
M-1	8	32	2	40	10	25.6	20	51.3	21	39.6	20	42.6	26	35.6	39	43.8	32	27.6	7	58.3	44	33.3	31	39.7	7	43.8	29	31.9
M-2	5	20	1	20	10	25.6	5	12.8	9	17	6	12.8	8	11	23	25.8	27	23.3	1	8.3	22	16.7	14	17.9	1	6.2	23	25.3
H	1	4	1	20	2	5.1	0	0	2	3.8	2	4.3	2	2.7	2	2.2	6	5.2	0	0	11	8.3	4	5.1	1	6.2	1	1.1
Total 25	25	100	5	100	39	100	39	100	53	100	47	100	73	100	89	100	116	100	12	100	132	100	78	100	16	100	91	100
	$\chi^2=2.28$ df= 3; P=0.705				$\chi^2=7.29$ df= 3; P=0.082				$\chi^2=0.366$ df=3; P=1.000				$\chi^2=10.705$ df=3; P=0.017				$\chi^2=5.391$ df= 3; P=0.193				$\chi^2=1.563$ df=3; P=0.914				$\chi^2=4.711$ df= 3; P=0.259			

L - low  
M-1 – middle-1  
M-2 – middle-2  
H - high  
Ex/D - top executives/directors  
MG- managers  
FLM – first-line managers  
Eng –engineers  
HMW – heavy manual workers  
MW – manual workers middle intensity  
LMW – manual work light intensity

Cox's single-factor regression analysis showed that during the first 5 years the risk of developing hypertension in men and women with a low ICC score compared to those with a higher ICC score was approximately the same in men HR = 2.063 (95% CI 1.019-5.213 p <0.05) and women with HR = 2.009 (95% CI 1.025-3.938 p <0.05). In women aged 25-64 years 10 years after the start of screening the risk of developing hypertension decreased - HR = 1.926 (95% CI 1.138-3.261 p <0.05) and in the 55-64 year-old group on the contrary HR = 5.022 (95% CI 1.292-19.512; p <0.02); after 16 years the risk of developing hypertension was HR-1.423 (95% CI 0.992-2.04 p <0.05) and in the 25-34-year-old age group HR = 2.076 (95% CI 1.136-3.794; p <0.05) (Table 12).

When considering the risk of developing hypertension in individuals with a low SNI compared with individuals with higher SNI indices Cox's single-factor regression analysis found an increase in the risk of developing hypertension only in men in the 25-64 year old group in the first 5 years in 5.9 (95% CI 1.278-8.361 p <0.05) times. In 10 years from the beginning of the study the risk of

developing hypertension in women 25-64 was 1.884 (95% CI 1.09-3.255 p <0.05) in the 55-64-year-old age group HR = 6.667 (95% CI 1.342- 33.1 p <0.05). Over the 16-th years after the start of screening the risk of hypertension in women in the 25-64-year-old group decreased and HR = 1.582 (95% CI 1.110-2.274 p <0.05) (Table 13).

**Table 12: ICC and Hypertension in population 25-64 years (single-factor model)**

Follow-up	Gender	Male				Female				
		age group	p	HR	95% CI for HR		p	HR	95% CI for HR	
					bottom	upper			bottom	upper
5 years	25-34		-	-	-	0.295	4.983	0.033	7.4964	
	35-44	>0.05	0.713	0	2.635	0.126	3.277	0.718	14.963	
	45-54	>0.05	0.021	0	1.574	0.465	1.446	0.538	3.884	
	55-64	>0.05	5.229	2.371	10.38	0.466	1.703	0.406	7.133	
	25-64	0.05	2.063	1.019	5.213	0.042	2.009	1.025	3.938	
10 years	25-34		-	-	-	0.114	6.415	0.641	64.220	
	35-44		-	-	-	0.410	1.512	0.566	4.040	
	45-54	>0.05	0.087	0	3.073	0.201	1.874	0.716	4.906	
	55-64	>0.05	1.56	0	4.072	0.020	5.022	1.292	19.512	
	25-64	>0.05	1.03	0	3.068	0.015	1.926	1.138	3.261	
16 years	25-34		-	-	-	0.018	2.076	1.136	3.794	
	35-44		-	-	-	0.551	1.218	0.638	2.324	
	45-54	>0.05	0.01	0	2.263	0.988	1.006	0.478	2.117	
	55-64	>0.05	1.094	0	3.257	0.229	3.934	0.422	36.690	
	25-64	>0.05	1.3	0	2.946	0.05	1.423	0.992	2.040	

**Table 13: SNI and Hypertension in population 25-64 years (single-factor model)**

Follow-up	Gender	Male				Female				
		age group	p	HR	95% CI for HR		p	HR	95% CI for HR	
					bottom	upper			bottom	upper
5 years	25-34		-	-	-	0.548	0.578	0.097	3.459	
	35-44	0.459	1.784	0.026	2.967	0.517	0.684	0.217	2.157	
	45-54	0.295	0.031	0.001	3.113	0.144	0.473	0.173	1.292	
	55-64	0.193	1.584	0.094	5.924	0.638	0.709	0.169	2.972	
	25-64	0.04	5.928	1.278	8.361	0.597	0.597	0.323	1.103	
10 years	25-34		-	-	-	0.114	6.415	0.641	64.220	
	35-44	0.863	0.052	0.0001	2.936	0.579	1.379	0.444	4.288	
	45-54	0.206	4.236	0.672	7.415	0.313	1.639	0.627	4.283	
	55-64	0.152	5.715	0.384	8.492	0.020	6.667	1.342	33.118	
	25-64	0.395	3.823	0.062	5.236	0.023	1.884	1.090	3.255	
16 years	25-34		-	-	-	0.017	2.047	1.138	3.682	
	35-44		-	-	-	0.252	1.473	0.759	2.857	
	45-54	0.839	1.293	0.689	2.583	0.870	1.065	0.502	2.261	
	55-64	0.158	1.027	0.086	4.074	0.823	0.823	0.135	5.006	
	25-64	0.239	1.039	0.056	7.459	0.013	1.582	1.110	2.274	

In the multivariate model of regression analysis in men with a low index of close contacts taking into account the social parameters (education profession marital status) and age there was a tendency for an increase in the risk of AH in 1.2 (95% CI 0.7-1.9 p < 0.05) times. In the presented study the relationship between marital status and the risk of AH was found. The risk of hypertension was higher among men with a low index of close contacts never married HR = 6.9 (95% CI 3.1-15.4 p <0.001) diluted HR = 4.1 (95% CI 2 -8; p <0.001) widowed HR = 7.1 (95% CI 2.6-19.3 p <0.001) compared with men who are married and having an medium and high index of close contacts. The risk of AH was higher in the age group 55-64 years in 5.2 (95% CI 2.2-28 p <0.01).

The risk of developing AH in women was higher in those with primary/elementary level of education with a low index of close contacts HR = 2.1 (95% CI 1.246-3.7 p <0.006) compared with women with higher education and indexes of close contacts are medium and higher. There was a higher risk of AH among widowed women with a low ICC score of HR-2.7 (95% CI 1.03-7.3 p <0.04) compared

to married women with a high and average index of close contacts. Also the risk of hypertension was higher in women with low ICC in the age groups 35-44 years HR = 1.7 (95% CI 1.2-2.5 p <0.003) 45-54 years HR = 2 (95% CI 1.3-3.2 p <0.001); 55-64 years HR = 5.3 (95% CI 1.8-15.4 p <0.002) compared with women aged 25-34 with ICC average and high (Table 14).

**Table 14: ICC and risk of hypertension in population 25-64 years (multivariable Cox model)**

Reference group	Gender	Male				Female			
	Index	p	HR	95%CI	p	HR	95%CI		
ICC (High and Medium)	ICC (low)	0.05	1.275	1.07	7.9	0.272	0.850	0.635	1.136
Education: University	College	0.3	6.948	0.3	16	0.396	1.168	0.816	1.670
	High School	0.4	7.145	0.2	18	0.065	1.426	0.978	2.080
	Elementary	0.1	4.589	0.1	1.1	0.006	2.168	1.246	3.772
Occupation: Top Executives	Managers	0.8	1.114	0.3	3.8	0.434	1.807	0.410	7.957
	First-line Managers	0.4	1.446	0.5	4.1	0.362	1.974	0.457	8.516
	Engineers	0.3	1.806	0.5	6	0.711	1.312	0.311	5.526
	Heavy Manual Workers	0.1	2.127	0.7	5.9	0.896	1.128	0.184	6.926
	Middle Intensity Workers	0.3	2.229	0.5	14	0.924	1.073	0.251	4.595
Marital Status: married	Light Intensity Workers	0.7	2.156	0.3	7.8	0.400	1.850	0.442	7.750
	Never Married	0.001	6.938	3.1	15.4	0.395	1.362	0.668	2.775
	Divorced	0.001	4.124	2	8	0.090	1.999	0.898	4.452
Age Group: 25-34 years	Widowed	0.001	7.137	2.6	19.3	0.044	2.753	1.030	7.358
	35-44 years	0.3	3.802	1	13.5	0.003	1.749	1.203	2.543
	45-54 years	0.1	4.731	1.3	18	0.001	2.096	1.368	3.210
	55-64 years	0.01	5.267	2.2	28	0.002	5.382	1.876	15.442

In the multivariate model of Cox regression analysis the low index of social linkage increased in 1.7 (95% CI 1-2.7 p <0.05) times the risk of AH among women the risk of AH was 2.9 (95% CI 1.09-4.7 p <0.045). The initial level of education increased the risk of hypertension among women in 2 (95% CI 1.035-4.038 p <0.04) and in men there was only a trend of increased risk in 1.4 (95% CI 0.6-10; p <0.01) times in comparison with persons who have higher education with an index of social networks average and higher. When considering the professional status it turned out that there is a tendency for an increase in the risk of hypertension in hard manual workers at 2.9 (95% CI 0.6-17 p <0.05) times in comparison with top managers. The risk of hypertension among men who were never married was higher in 6.3 (95% CI 2.8-14.1 p <0.001) among diluted men at 3.7 (95% CI 1.8- 7.4 p <0.001) times among widowed men at 6.3 (95% CI 2.3-17.2 p <0.001) times compared with married men. In the age group 55-64 among those with a low social networks index the risk of hypertension was higher in men than in the HR = 8 (95% CI 2.2-28 p <0.001) and women HR = 5.3 (95% CI 1.8 -15.2 p <0.002) in comparison with the group of 25-34 years. Also the risk of hypertension among women with a low index of social linkage was higher in the 35-44 years groups HR = 1.6 (95% CI 1.15-2.45 p <0.007) and 45-54 years HR = 1.9 (95% CI 1.2-3 p <0.002) in comparison with women aged 25-34 years who have an index of social bonds average and higher (Table 15).

**Table 15: SNI and risk of hypertension in population 25-64 years (multivariable Cox model)**

Reference group	Gender	Male				Female			
	Index	p	HR	95%CI	p	HR	95%CI		
ICC (High and Medium)	SNI (low)	0.035	1.7	1	2.7	0.045	2.934	1.092	4.738
Education: University	college	0.4	1.7	0.3	9	0.405	1.200	0.781	1.844
	high school	0.4	1.6	0.5	3.4	0.181	1.402	0.854	2.302
	elementary	0.01	1.4	0.6	10	0.04	2.044	1.035	4.038
Occupation: Top Executives	managers	0.8	1.1	0.3	3.9	0.442	1.789	0.406	7.886
	first-line managers	0.7	1.5	0.5	4.1	0.423	1.819	0.421	7.863
	engineers	0.4	1.7	0.5	5.5	0.753	1.261	0.298	5.327
	heavy manual workers	0.05	2.9	0.6	17	0.984	1.019	0.165	6.305
	middle intensity workers	0.3	1.6	0.4	24	0.935	1.063	0.248	4.561
	light intensity workers	0.2	1.8	1	13	0.441	1.756	0.419	7.363
Marital Status: married	never married	0.001	6.3	2.8	14.1	0.317	1.487	0.684	3.236
	divorced	0.001	3.7	1.8	7.4	0.096	2.088	0.878	4.964
	widowed	0.001	6.3	2.3	17.2	0.096	2.415	0.854	6.823

Age Group: 25-34 years	35-44 years	0.3	4	1.1	14	0.007	1.684	1.157	2.452
	45-54 years	0.1	8	2.4	29	0.002	1.952	1.266	3.009
	55-64 years	0.001	8	2.2	28	0.002	5.345	1.870	15.284

## Discussion

In the study population two-thirds of men of working age (62%) and more than half of women (56.8%) had a low level of close contacts. In the distribution by age groups it was found that the lowest level of close contacts was found among men of the older age group of 55-64 years and among middle-aged women - 35-44 years.

A low level of social networks was affected by a third of men (43.5%) and women (33.9%) in the population. And he was more exposed to men of young age 25-34 years and women - middle - 35-44 years.

Later when considering the social status of the participants in the study it was found that people with low levels of social support single men and divorced women were found to be at risk for developing hypertension. It was found that the risk of developing hypertension is highest among men: never married divorced and widowed with low indices of close contacts and social networks compared to men who are married to high indexes. Among the women at risk were widowed women with a low index of close contacts.

In the distribution according to the level of education the studied persons the most socially isolated were men and women with secondary special education and lower education it was in these groups that the low indices of close contacts and social networks were more frequent. In addition women with unfinished middle - initial and low indices of close contacts and social networks had a twice higher risk of developing hypertension compared to women with higher education and higher rates of the indices presented.

As for men and women the lowest levels of social support met in the group of engineers and technical specialities.

In the presented study already during the first five years of follow-up the risk of developing hypertension in both men and women with a low index of close contacts was twice as high compared to those with higher indices. Later only among women there are reports of a significant reduction in the risk of developing hypertension among people with a low index of close contacts for 10 and 16 years.

In our population it was found in the first 5 years of observation an increase in the risk of developing hypertension among men by almost six times among those with a low index of social networks. Insufficient social activity among women also contributed to an increase in the risk of developing AH within 10 years among women by almost 2 times then the risk of developing AH decreased.

The risk of developing hypertension was also highest among women of the older age group with low indices of close contacts and social networks and the risk remained high even after inclusion in the model of social parameters.

So our study has shown the role of insufficient level of social support in the risk of AH development which was confirmed in foreign literature. For example in the NHANES study the association between hypertension and the level of social support was tested. The risk of developing hypertension increased

with a decrease in the level of social support [20]. Despite the fact that there is accumulated enough information about the relationship between social support and health mechanisms for its impact require discussion. One of the possible mechanisms in the development of cardiovascular reactions is the effects of sympathetic-adrenal and hypothalamic-pituitary systems that arise in response to stress [21].

## Conclusions

1. The indices of close contacts and social networks were at low levels in 62% and 43.5% of men and 56.8% and 33.9% of women respectively in the open population of 25-64 years.
2. The risk of hypertension was twice as high already over the first 5 years of observation both in men and women with a low index of close contacts compared to individuals with higher indices.
3. Those with a low index of social networks over the first 5 years of follow-up had increased risk of hypertension – in 5.9 times for men and over 10 years in 1.8 times in women.
4. The risk of hypertension was highest in men: never married divorced and widowed with low indices of close contacts and social networks. Widowed women with a low index of close contacts as well as women with primary level of education and low indices of close contacts and social networks were at risk of hypertension.

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