

# Sleep disorder trends in 1988–2018 among the 25–64 years old population in Russia/Siberia (WHO MONICA Psychosocial study)

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**Objective:** to study sleep disorders prevalence and trends among the population of Novosibirsk (age group 25–64 years) in 1988–2018.

**Patients and methods.** We screened a representative sample of a 25–64-year-old population: in 1988–1989 (II screening: 725 men, mean age – 43.4±0.4 years, response – 71.3%; 710 women, mean age – 44.8±0.4 years, response – 72%); in 1994–1995 (III screening: 647 men, mean age – 44.3±0.4 years, response – 82.1%; 391 women, mean age – 45.4±0.4 years, response – 72.5%); in 2003–2005 (IV screening: 576 men, mean age – 54.23±0.2 years, response – 61%; 1074 women, mean age – 54.27±0.2 years, response – 72%); in 2013–2016 (V screening: 427 men, mean age – 34±0.4 years, response – 71%; 548 women, mean age – 35±0.4 years, response – 72%); in 2016–2018 (VI screening: 275 men, mean age – 49±0.4 years, response – 72%; 390 women, mean age – 45±0.4 years, response – 75%) according to the standard MONICA Psychosocial study (MOPSY) protocol. Sleep disorders in the studied population were assessed with Jenkins Sleep Questionnaire.

**Results and discussion.** We found a high prevalence of sleep disorders among the 25–64 years old population with the following trends: decrease from 1988–1989 to 1994–1995 (men – 11 and 8.6%, women – 21.8 and 16.6% respectively); increase in 2003–2018 (men – 13.1%, women – 20.5%). An increase in sleep disorders prevalence in 2003–2018 occurred mainly due to older age groups – 45–64 years ( $\chi^2=122.061$ ;  $\nu=16$ ;  $p<0.001$  – men;  $\chi^2=230.626$ ;  $\nu=16$ ;  $p<0.001$  – women). In 1988–2018 there was a 2-fold increase in sleep disorders prevalence among women than men in all age groups. This increase in sleep disorders prevalence was associated with increasing age, reaching its maximum in the 55–64 age group (men: 1988–1989 – 20.8%, 1994–1995 – 12.1%, 2016–2018 – 19.7%;  $\chi^2=41.093$ ;  $\nu=12$ ;  $p<0.001$ ; women: 35.8; 21.8; 24.9% respectively;  $\chi^2=22.01$ ;  $\nu=12$ ;  $p<0.001$ ). Different trends were observed in 25–44 years old women in 1988–2018 and in 35–44 years old men in 2013–2016: sleep disorders prevalence decreased (25–44 years old women: in 1988–1989 – 13.7%, in 1994–1995 – 7.9%, in 2013–2016 – 5.7%;  $\chi^2=24.715$ ;  $\nu=8$ ;  $p<0.001$ ; 35–44 years old women 35–44: in 1988–1989 – 17.9%, in 1994–1995 – 20%, in 2013–2016 – 14.2%, in 2016–2018 – 10.3%;  $\chi^2=21.177$ ;  $\nu=12$ ;  $p<0.001$  respectively; men: in 1988–1989 – 9.5%, in 1994–1995 – 9.3%, in 2013–2016 – 4.2% and in 2016–2018 – 11%;  $\chi^2=12.67$ ;  $\nu=12$ ;  $p<0.05$  respectively).

**Conclusion.** We found a high prevalence of sleep disorders among the 25–64 years old population with the following trends: a decrease from 1988–1989 to 1994–1995; an increase in 2003–2018 mainly due to older age groups. Sleep disorders prevalence decreased in younger women in 1988–2018. There also was a 2-fold increase in sleep disorders prevalence in women than men in all age groups and with increasing age in 1988–2018.

**Keywords:** sleep disorders; population; men; women; trends.

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There are several reasons behind the growing interest in sleep disorders. Sleep problems can lead to accidents and human errors [1]. Sleep disturbances are predicted to double the risk of fatal accidents at work over the next 20 years [2]. Insomnia is the most common sleep disorder: it is believed that 30% of the adult population has it intermittently, and 10% of people suffer from chronic insomnia [3]. Obstructive sleep apnea, characterized by respiratory disturbances during sleep, is also widespread and is found in 9–21% of women and 24–31% of men [4]. Sleep problems can only get worse every year. The rapid growth in the number of communities with 24/7 format, that is, 24 hours 7 days a week, 24-hour events and the

increase in the use of televisions, the Internet and mobile phones at night means that adequate uninterrupted night sleep is becoming a rarity. Some data indicate a decrease in the duration of night sleep over the past 30 years [5]. The number of complaints of sleep problems increased significantly over the same period; short sleep duration (<6 hours per night) in full-time workers have become increasingly common [6]. The proportion of circadian workers required to serve 24/7 communities is likely to be increasing. Just as the proportion of older people and the prevalence of obesity in populations around the world are increasing, so sleep disturbances will be increasingly common in both men and women, in both low and high income

countries [7]. There is a growing awareness among the scientific community of the link between sleep problems and health. Long-term evidence has accumulated for associations between sleep deprivation, sleep disturbance and multiple health consequences, including premature mortality, cardiovascular disease, hypertension, inflammation, obesity, diabetes and impaired glucose tolerance, and mental disorders (eg, anxiety and depression) [3, 7].

Thus, taking into account these facts, as well as the lack of data on the dynamics of sleep disorders over a long period in Russia, **the purpose** of our study was to analyze the prevalence and long-term trends of sleep disorders in 1988–2018 among the population of Novosibirsk (age group 25–64 years).

**Patients and methods.** Screening studies of representative samples of persons 25–64 years old living in one of the districts of Novosibirsk (budget topic no. AAAA-A17-117112850280-2) were carried out: at the second screening in 1988–1989, 1435 persons were examined (725 men, average age –  $43.4 \pm 0.4$  years, response – 71.3%; 710 women, average age –  $44.8 \pm 0.4$  years, response – 72%); at screening III in 1994–1995, 1038 persons were examined (647 men, average age –  $44.3 \pm 0.4$  years, response – 82.1%; 391 women, average age –  $45.4 \pm 0.4$  years, response – 72.5%); at screening IV in 2003–2005, 1650 persons were examined (576 men, average age –  $54.23 \pm 0.2$  years, response – 61%; 1074 women, average age –  $54.27 \pm 0.2$  years, response – 72%); at screening V in 2013–2016, 975 persons were examined (427 men, average age –  $34 \pm 0.4$  years, response – 71%; 548 women, average age –  $35 \pm 0.4$  years, response – 72%); at screening VI in 2016–2018, 665 persons were examined (275 men, average age –  $49 \pm 0.4$  years, response – 72%; 390 women, average age –  $45 \pm 0.4$  years, response – 75%). General survey in 1988–1989, 1994–1995, 2003–2005, 2013–2016, 2016–2018 was carried out according to the standard protocol of the WHO program «MONICA-psychosocial» (MOPSY) [8]. The standard Jenkins questionnaire was used to study sleep disorders. Statistical analysis was performed using the SPSS software package version 20.0 [9]. To check the statistical significance of the differences between the groups, we used the Pearson  $\chi^2$  test [10]. Significance was accepted at a significance level of  $p \leq 0.05$ .

**Results.** The analysis showed that the level of sleep disorders («bad» or «very bad» sleep), in men in the 25–34-year-old group in 1988–1989 amounted to 5.4%, in 1994–1995 – 3.6%, in 2013–2016 – 4.3% ( $\chi^2=14.858$ ;  $v=8$ ;  $p<0.01$ ). Among women, the level of sleep disorders in 1988–1989 was 13.7%, in 1994–1995 – 7.9%, in 2013–2016 – 5.7% ( $\chi^2=24.715$ ;  $v=8$ ;  $p<0.001$ ; see Table).

In the group of 35–44 year-old men, the level of sleep disorders in 1988–1989, amounted to 9.5%, in 1994–1995 – 9.3%, in 2013–2016 – 4.2% and in 2016–2018 – 11% ( $\chi^2=12.67$ ;  $v=12$ ;  $p<0.05$ ). The level of sleep disorders among women in 1988–1989 was 17.9%, in 1994–1995 – 20%, in 2013–2016 – 14.2%, in 2016–2018 – 10.3% ( $\chi^2=21.177$ ;  $v=12$ ;  $p<0.001$ ).

In the group of men aged 45–54, the level of sleep disorders in 1988–1989 was 11%, in 1994–1995 – 9.8%, in 2003–2005 – 12.5%, in 2016–2018 – 4.9% ( $\chi^2=14.280$ ;  $v=12$ ;  $p<0.05$ ). Among women of the age group of 45–54 years old in 1988–1989 the level of sleep disorders was 24%, in 1994–1995 – 15.2%, in 2003–2005 – 17.9%, in 2016–2018 – 22.8% ( $\chi^2=40.155$ ;  $v=12$ ;  $p<0.001$ ).

In the older age group (55–64 years), the level of sleep disorders among men in 1988–1989 was 20.8%, in 1994–1995 – 12.1%, in 2003–2005 – 11.8%, in 2015–2018 – 19.7% ( $\chi^2=41.093$ ;  $v=12$ ;  $p<0.001$ ). In women aged 55–64, the level of sleep disorders in 1988–1989 was 35.8%, in 1994–1995 – 27%, in 2003–2005 – 21.8%, in 2016–2018 – 24.9% ( $\chi^2=22.01$ ;  $v=12$ ;  $p<0.001$ ).

In the age group of 25–64 years, the level of sleep disorders among men in 1988–1989 was 11%, in 1994–1995 – 8.6%; in the age group of 45–64 years old in 2003–2005 – 12.2%; in the age group of 25–44 years in 2013–2016 – 4.2%; in the age group of 35–64 years in 2016–2018 – 13.1% ( $\chi^2=122.061$ ;  $v=16$ ;  $p<0.001$ ); in women of the age group of 25–64 years in 1988–1989 – 21.8%, in 1994–1995 – 16.6%, in the age group of 45–64 years old in 2003–2005 – 19.7%; in the age group of 25–44 years in 2013–2016 – 10.8%; in the age group of 35–64 years in 2016–2018 – 20.5% ( $\chi^2=230.626$ ;  $v=16$ ;  $p<0.001$ ).

**Discussion.** According to our data, in the age group of 25–64 years old, the level of sleep disorders was high and had the following trend: from 1988–1989 to 1994–1995 – a decrease, in 2003–2018 – growth, which was mainly due to the older age groups (45–64 years old). Our results on the increase in sleep disorders in 2003–2018 agree with the data of other authors. M. Calem et al. [10] conducted three cross-sectional studies of mental health in the UK in 1993, 2000 and 2007, which showed that the prevalence of sleep disorders among adults in England is slowly but steadily increasing. It was reported that in the United States the prevalence of insomnia or sleep problems in the adult population clearly increased between 2002 and 2012 [11]. In addition, from 1999 to 2010, in the United States the number and percentage of outpatient visits due to sleep problems increased significantly, as did the number of prescriptions for sleeping pills [12]. In Norway, between 1999 and 2010, the prevalence of several different symptoms associated with sleep disorders, as well as clinical cases of insomnia and the use of sleep medications among the adult population, clearly increased [13]. In Finland, from the mid-1990s to the late 2000s, there was a twofold increase in the number of symptoms associated with insomnia and daytime fatigue [14].

Nevertheless, some of the results were unexpected, namely, a decrease in the level of sleep disturbances in 1994–1995 (screening III). In order to explain the seemingly paradoxical findings, we turned to our previous works concerning trends in self-assessment of health. It was during this period that many people lost their jobs, closed in the family circle, were looking for a new job, and this could affect the nature of sleep [15, 16]. But the fact of a decrease in the level of sleep disorders during this period does not mean that it was a healthier sleep, since we received a decrease in the number of responses «very good sleep» and an increase in the number of responses «satisfactory». The increase in the prevalence of sleep disorders in 2003–2015 is due to changes in social and economic conditions: new socio-economic factors (income, education level and employment status – having more than one job due to a lack of material resources, the need to work in a shift mode, a shift in the time of falling asleep) led to sleep disorders [17]. Adequate, uninterrupted night sleep is becoming rare, especially in 24/7 communities [5]; short sleep duration (<6 hours per night) is increasingly observed, particularly in full-time workers [6].

Sleep disorders prevalence among the 25–64 years old population in 1988–2018, *n* (%)

Answers to the question: «How do you sleep?»	Period	Respondents' group				Age 55–64				Age 25–64*			
		Age 25–34		Age 35–44		Age 45–54		men		men		men	
		men	women	men	women	men	women						
1. Very good	1988–1989	35 (17.2)	10 (5.5)	16 (8)	8 (3.9)	10 (5.8)	6 (3.3)	8 (5.4)	4 (2.9)	69 (9.5)	28 (3.9)		
2. Good		101 (49.5)	75 (41)	91 (45.7)	67 (32.4)	59 (34.1)	37 (20.2)	42 (28.2)	14 (10.2)	293 (40.5)	193 (27.2)		
3. Satisfactory		57 (27.9)	73 (39.9)	73 (36.7)	95 (45.9)	85 (49.1)	96 (52.5)	68 (45.6)	70 (51.1)	283 (39)	334 (47.1)		
4 Bad		10 (4.9)	23 (12.6)	17 (8.5)	31 (15)	15 (8.7)	33 (18)	30 (20.1)	46 (33.6)	72 (9.9)	133 (18.7)		
5 Very bad		1 (0.5)	2 (1.1)	2 (1)	6 (2.9)	4 (2.3)	11 (6)	1 (0.7)	3 (2.2)	8 (1.1)	22 (3.1)		
Total...		204 (100)	183 (100)	199 (100)	207 (100)	173 (100)	183 (100)	149 (100)	137 (100)	725 (100)	710 (100)		
		$\chi^2=24.08$ ; $v=4$ ; $p=0.001$		$\chi^2=15.1$ ; $v=4$ ; $p=0.01$		$\chi^2=16.4$ ; $v=4$ ; $p=0.001$		$\chi^2=19.2$ ; $v=4$ ; $p=0.001$		$\chi^2=66.6$ ; $v=4$ ; $p=0.001$			
1. Very good	1994–1995	9 (5.4)	8 (6.3)	11 (6.4)	5 (3.2)	8 (5.6)	3 (6.5)	8 (4.8)	1 (1.6)	36 (5.6)	17 (4.3)		
2. Good		97 (58.1)	54 (42.5)	72 (41.9)	47 (30.3)	55 (38.5)	11 (23.9)	75 (45.5)	9 (14.3)	299 (46.2)	121 (31)		
3. Satisfactory		55 (32.9)	55 (43.3)	73 (42.4)	72 (46.5)	66 (46.2)	25 (54.3)	62 (37.6)	36 (57.1)	256 (39.6)	188 (48.1)		
4 Bad		5 (3)	7 (5.5)	14 (8.1)	29 (18.7)	13 (9.1)	6 (13.0)	17 (10.3)	14 (22.2)	49 (7.6)	56 (14.3)		
5 Very bad		1 (0.6)	3 (2.4)	2 (1.2)	2 (1.3)	1 (0.7)	1 (2.2)	3 (1.8)	3 (4.8)	7 (1)	9 (2.3)		
Total...		167 (100)	127 (100)	172 (100)	155 (100)	143 (100)	46 (100)	165 (100)	63 (100)	647 (100)	391 (100)		
		$\chi^2=8.35$ ; $v=4$ ; $p>0.05$		$\chi^2=11.89$ ; $v=4$ ; $p<0.05$		$\chi^2=3.902$ ; $v=4$ ; $p>0.05$		$\chi^2=23.577$ ; $v=4$ ; $p<0.001$		$\chi^2=32.202$ ; $v=4$ ; $p=0.001$			
1. Very good	2003–2005					10 (3.3)	23 (4.2)	10 (3.7)	11 (2.1)	20 (3.5)	34 (3.2)		
2. Good						104 (34.2)	107 (19.3)	73 (26.8)	88 (16.9)	177 (30.7)	195 (18.2)		
3. Satisfactory						152 (50)	325 (58.7)	157 (57.7)	308 (59.2)	309 (53.6)	633 (58.9)		
4 Bad						37 (12.2)	94 (17)	29 (10.7)	108 (20.8)	66 (11.5)	202 (18.8)		
5 Very bad						1 (0.3)	5 (0.9)	3 (1.1)	5 (1)	4 (0.7)	10 (0.9)		
Total...						304 (100)	554 (100)	272 (100)	520 (100)	576 (100)	1074 (100)		
		$\chi^2=22.62$ ; $v=4$ ; $p=0.001$		$\chi^2=20.9$ ; $v=4$ ; $p=0.001$		$\chi^2=5.72$ ; $v=4$ ; $p=0.221$							
1. Very good	2013–2016	25 (15.2)	29 (13.7)	28 (10.7)	30 (9.1)					53 (12.4)	59 (10.8)		
2. Good		78 (47.6)	105 (49.5)	126 (48.3)	137 (41.4)					205 (48)	243 (44.3)		
3. Satisfactory		54 (32.9)	66 (3.1)	96 (36.8)	117 (35.3)					151 (35.4)	187 (34.1)		
4 Bad		6 (3.7)	11 (5.2)	10 (3.8)	42 (12.7)					16 (3.7)	53 (9.7)		
5 Very bad		1 (0.6)	1 (0.5)	1 (0.4)	5 (1.5)					2 (0.5)	6 (1.1)		
Total		164 (100)	212 (100)	261 (100)	331 (100)					427 (100)	548 (100)		
		$\chi^2=0.836$ ; $v=4$ ; $p=0.933$		$\chi^2=16.918$ ; $v=4$ ; $p=0.002$						$\chi^2=14.425$ ; $v=4$ ; $p=0.006$			
1. Very good	2016–2018					3 (3.7)	1 (0.7)	0	4 (2.6)	9 (3.3)	11 (2.8)		
2. Good						35 (43.2)	45 (32.1)	35 (28.7)	33 (21.6)	102 (37.1)	121 (31.1)		
3. Satisfactory						39 (48.1)	62 (44.3)	63 (51.6)	78 (51)	128 (46.5)	178 (45.6)		
4 Bad						4 (4.9)	31 (22.1)	24 (19.7)	35 (22.9)	36 (13.1)	76 (19.5)		
5 Very bad						0	1 (0.7)	0	3 (2.0)	0	4 (1)		
Total						81 (100)	140 (100)	122 (100)	153 (100)	275 (100)	390 (100)		
		$\chi^2=0.396$ ; $v=3$ ; $p>0.05$		$\chi^2=14.606$ ; $v=4$ ; $p<0.01$		$\chi^2=7.304$ ; $v=4$ ; $p>0.05$				$\chi^2=8.646$ ; $v=4$ ; $p>0.05$			
In total...		$\chi^2=14.858$ ; $v=8$ ; $p<0.01$	$\chi^2=24.715$ ; $v=8$ ; $p<0.001$	$\chi^2=12.67$ ; $v=12$ ; $p<0.05$	$\chi^2=21.177$ ; $v=12$ ; $p<0.001$	$\chi^2=14.280$ ; $v=12$ ; $p<0.05$	$\chi^2=40.155$ ; $v=12$ ; $p<0.001$	$\chi^2=41.093$ ; $v=12$ ; $p<0.001$	$\chi^2=22.01$ ; $v=12$ ; $p<0.001$	$\chi^2=122.061$ ; $v=16$ ; $p<0.001$	$\chi^2=230.626$ ; $v=16$ ; $p<0.001$		

Sleep disorders were noted twice as often in women as in men. This is consistent with the results obtained in the studies of other authors [18]. According to our data, frequency of sleep disorders increases with age, which is also emphasized by other authors [19, 20].

Some age groups demonstrated trends that differed from the general one. Thus, in the age groups of 25–34 and 35–44 years, women showed a tendency towards a decrease in sleep disorders. In 2013–2016 there was a decrease in sleep disorders in men aged 35–44 years. This is understandable, since the frequency of sleep disturbance also depends on psychosocial factors [21]. It was found that over the 22-year period (from 1994 to 2016), the level of hostility, life exhaustion, and low level of social support among women aged 25–44 have significantly decreased. In men aged 35–44 years, the levels of social support also significantly decreased [16, 22].

**Conclusion.** We found that among the population aged 25–64 years, the level of sleep disorders in the study period was

high and had the following trends: from 1988–1989 to 1994–1995 – a decrease (men – 11% and 8.6%, women – 21.8% and 16.6%, respectively); then growth in 2003–2018 (men – 13.1%, women – 20.5%, respectively). The increase in the prevalence of sleep disorders in 2003–2018 mainly occurred at the expense of older age groups (45–64 years old).

We found that sleep disturbances were twice as common in women as in men in all age groups during the period from 1988 to 2018. Incidence of sleep disorders increased with age, reaching its maximum in the age group of 55–64 years (men: in 1988–1989 – 20.8%, in 1994–1995 – 12.1%, in 2016–2018 – 19.7%; women: 35.8%; 21.8% and 24.9%, respectively).

We also noted that in women of the age groups of 25–44 years old in the period of 1988–2018 and in men 35–44 years old in 2013–2016, the tendencies different from the general trend were observed: the frequency of sleep disorders decreased (women 25–34 years old – 13.7%; 7.9%; 5.7%; 35–44 years old – 17.9%; 20%; 14.2%; 10.3 %, respectively; men – 9.5%; 9.3%; 4.2%; 11%, respectively).

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