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Full Length Research Paper

Sleep disorders in 45–69-year-old population in Russia/Siberia (Epidemiology study)

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The aim of the study was to elucidate the epidemiological characteristics of the sleep disturbances in population of Novosibirsk (Siberia, Russia). A randomized representative sample of 45–69-year-old residents of both genders (*n* = 4171) was studied in a framework of the HAPIEE study in Novosibirsk from 2003 to 2005. The sleep disturbances were studied by using the Jenkins Sleep Questionnaire (JSQ). The test was validated for the Russian population in the course of a large-scale epidemiological study performed in a framework of the WHO MONICA Program from 1984 to 1994. The incidence rate of the extreme and pronounced sleep disturbances was 21% of the population with female predominance (24% in women vs. 18% in men). The patterns of the sleep disturbances lasting 15 and more nights per month were as follows: frequent spontaneous sleep interruptions (20%); anxious thoughts while falling asleep (10%); unsatisfying sleep (10%); and disturbing dreams (7%). The rate of the disorders with the insufficient or excessive sleep duration was 7%. Sleep duration of less than 5 hours per night was found in 5% of population; sleep duration of more than 10 hours per night was detected in less than 2% of population. Extreme and pronounced abnormalities in the sleep duration were found in 61% of population. Data showed high prevalence of the sleep disturbances associated with a high level of psychosocial factors in the study population. The study demonstrated a great demand in prevention of the sleep disturbances in 45–69-year-old population.

Key words: Epidemiology, population study, sleep disorders, insomnia, sleep disturbances.

INTRODUCTION

Sleep disturbances represent one of the most common psychogenic conditions in humans. Insomnia and dysregulation of the sleep patterns and cycles are considered as the primary psychogenic disorders that stem from mental and emotional stress resulting in abnormal sleep quality, duration, and rhythm which are insufficient to sustain normal everyday activity. Other factors which can affect sleep include environmental stressors since Novosibirsk has sharp continental climate characterized by long cold winter and short warm summer together with characteristic drastic changes in the atmospheric pressures and temperatures which can suffer from chronic sleep disturbances (harvey & bruce, 2006) cause sleep disturbances.

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The scale of the problem is great: a total of 50 to 70 million adults in the USA which are associated with mental disorders, chronic diseases, traumas, and mortality (Harvey & Bruce, 2006; Ram et al., 2010). Long-term studies show moderate increase in the insomnia rates in England (Calem et al., 2012). Twelve-months study of new cases of insomnia demonstrated that 15% of insomnia-free population experienced the onset of sleep disorders associated with anxiety, depression, or pain within a year (Morphy et al., 2007). Similar tendency was found in 33-year-long observational study of the self-rated sleep duration (deviation from normal 7 to 8 hours) and sleep quality in the Finnish population (Kronholm et al., 2008). Unfortunately, the available literature does not provide any reports on similar population studies in Russia. In this regard, the purpose of our study was to elucidate the characteristics of the sleep disturbances in 45–69-year-old population of the city of Novosibirsk (Siberia, Russia).

MATERIALS AND METHODS

A prospective cohort study of Health, Alcohol and Psychosocial Factors in Eastern Europe (HAPIEE study) included a randomized representative sample of 45–69-year-old population (*n* = 4171; 1770 men [42.4%] and 2401 women [57.6%]) in two districts of Novosibirsk from 2003 to 2005. Distribution of various age groups in the population was as follows: 45–54-year-old individuals comprised 42.7% of men (*n* = 756) and 44.8% of women (*n* = 1076); 55–64-year-old participants comprised 39.3% of men (*n* = 696) and 37.7% of women (*n* = 906); and 65–69-year-old group consisted of 18.1% of men (*n* = 318) and 17.5% of women (n = 419). Mean age was 56.5 ± 7.01 years in men and 56.3 ± 7.07 years in women. The respondents were mailed written invitations to attend the screening according to the protocol of the study.6 Response rate was 61%. The sleep disturbances were studied via test designed by C. D. Jenkins et al. by using the 4-item Jenkins Sleep Questionnaire (JSQ) (Jenkins et al., 1988), validated for the Russian population during a large-scale epidemiological study performed in a framework of the World Health Organization (WHO) Multinational Monitoring of Trends and Determinants of Cardiovascular Disease Program (MONICA Program) and MONICA-Psychological Optional Study (MOPSY) (WHO MONICA, 1988; Kuulasmaa, 1990).Respondents were asked to answer the questions of the test: questions 1 to 4 were designed to evaluate the quality of sleep; question 5 was designed to assess the duration of sleep. Content of the questions was about the disturbances in the sleep quality and duration experienced during one month before the examination. The sleep quality scores were encoded as follows: undisturbed sleep throughout the whole month (score 0); disturbed sleep during 1 to 3 nights per month (score 1); disturbed sleep during 4 to 7 night per month (score 2); disturbed sleep during 8 to 14 nights per month (score 3); disturbed sleep during 15 to 21 nights per month (score 4); and disturbed sleep during 22 nights or more per month (score 5). Maximum possible score was 20. The scores from the questions 1 to 4 were summed up and assigned to four categories. A total score from 0 to 4 was assigned to category 1 (“Little”: mild sleep disorder); a total score from 5 to 9 corresponded to category 2 (“Moderate”: moderate sleep disorder); a total score from 5 to 9 was assigned to category 3 (“Much”: pronounced sleep disorder); and a total score from 15 to 20 corresponded to category 4 (“Extreme”: severe sleep disorder).

The sleep duration abnormalities were also assigned to four categories: category 4 (“Extreme”: sleeping less than 5 hours each night throughout the month); category 3 (“Much”: sleeping for 6 to 7 hours per night); category 2 (“Moderate”: sleeping for 8 to 9 hours per night); and category 1 (“Little”: sleeping for 10 hours or more per night).

The results were evaluated according to responses to questions (items 1 to 4) and according to the categories of sleep disturbances in regard to the sleep quality (items 1 to 4) and sleep duration (item 5).

Statistical analysis was carried out by using software SPSS 11.5 (Bühl & Zöfel, 2005) and Epi Info 7 (Centers for Disease Control and Prevention). To evaluate statistically significant differences between groups, Kruskal–Wallis one-way analysis of variance and Kruskal–Wallis H test, equivalent to Chi square test, were used. A value of $P< 0.05$ was considered statistically significant. The study was approved by the local biomedical research ethics committee (protocol # 4 from October 15, 2009).

RESULTS

Table 1 presents data on the sleep quality in the study population. Data showed that men stated more often than women that (1) they did not have or rarely had anxious thoughts while falling asleep (59% in men vs. 52% in women; P < 0.0000); (2) they did not have any disturbing dreams or had them for less than three nights per month (68% in men vs. 65% in women; *P*< 0.0000); (3) they had sound sleep (47% in men vs. 45% in women; *P*< 0.0034); and (4) they were able to get a good night's rest via the regular sleep (63% in men vs. 59% in women; *P*< 0.0004). At the same time, women stated more often than men that they had anxious thoughts while falling asleep (12%; *P*< 0.0000); they experienced this problem during 15 and more nights per month (9%). Women significantly more often than men indicated that they had problems with their sleep during 15 and more nights per month; women more often stated that (1) they were waking up during the night (22%; *P*< 0.0034) and (2) they were unable to get a good night's rest via the regular sleep (11% in women vs. 8% in men; *P*< 0.0004). Overall, individuals of both genders had the following problems during 15 and more nights per month: (1) anxious thoughts while falling asleep (10%); (2) disturbing dreams (7%); (3) interrupted sleep defined as two and more episodes of waking up during the night (20%); and (4) dissatisfaction with the regular sleep (10%).

The extreme and pronounced categories of sleep disturbances were found in 21% of individuals (Table 2). Men significantly less often had extreme and pronounced categories of sleep disorders than women (18% in men vs. 24% in women; *P*< 0.000041).

Seven percent of individuals had insufficient or excessive sleep during the last month before the study: 5% of people slept for less than 5 hours per night and 2% of individuals slept for 10 and more hours per night.

The categories of the sleep duration abnormalities, classified as “Extreme” and “Much”, were found in 61% of the study population. Men (59%) significantly less often than women (62%) stated that they slept less than 7

Table 1. Sleep disturbances in population aged 45 to 69 years.

How often have you had the following sleep problems during the last month:

1. Anxious thoughts while falling asleep

	Men		Women		Both genders	
	N	%	N	%	N	%
Never	437	24.7	446	18.6	883	21.2
1—3 nights	612	34.6	820	34.2	1432	34.3
4—7 nights	383	21.6	586	24.4	969	23.2
8—14 nights	178	10.1	263	11.0	441	10.6
15—21 nights	88	5.0	140	5.8	228	5.5
22 nights and more	72	4.1	146	6.1	218	5.2
Total	1770	100.0	2401	100.0	4171	100.0

Kruskal-Wallis one way analysis of variance, Kruskal-Wallis H (equivalent to Chi square) = 27.075. Degrees of freedom = 1. *P* = 0.000000.

2. Disturbing dreams

	Men		Women		Both genders	
	N	%	N	%	N	%
Never	618	34.9	717	29.9	1335	32.0
1—3 nights	588	33.2	856	35.7	1444	34.6
4—7 nights	341	19.3	446	18.6	787	18.9
8—14 nights	122	6.9	203	8.5	325	7.8
15—21 nights	60	3.4	86	3.6	146	3.5
22 nights and more	41	2.3	93	3.9	134	3.2
Total	1770	100.0	2401	100.0	4171	100.0

Kruskal-Wallis one way analysis of variance Kruskal-Wallis H (equivalent to Chi square) = 11.792. Degrees of freedom = 1. *P* = 0.000595.

3. Two and more spontaneous sleep interruptions throughout the night

	Men		Women		Both genders	
	N	%	N	%	N	%
Never	442	25.0	602	25.1	1044	25.0
1—3 nights	384	21.7	473	19.7	857	20.5
4—7 nights	435	24.6	531	22.1	966	23.2
8—14 nights	201	11.3	270	11.2	471	11.3
15—21 nights	135	7.6	244	10.2	379	9.1
22 nights and more	173	9.8	281	11.7	454	10.9
Total	1771	100.0	2401	100.0	4171	100.0

Kruskal-Wallis one way analysis of variance Kruskal-Wallis H (equivalent to Chi square) = 4.074. Degrees of freedom = 1. *P* = 0.043556.

4. Waking up tired and exhausted after the regular sleep

	Men		Women		Both genders	
	N	%	N	%	N	%
Never	606	34.2	741	30.9	1347	32.3
1—3 nights	511	28.9	681	28.4	1192	28.6
4—7 nights	367	20.7	468	19.5	835	20.0
8—14 nights	146	8.2	239	10.0	385	9.2
15—21 nights	66	3.7	123	5.1	189	4.5
22 nights and more	74	4.2	149	6.2	223	5.3
Total	1770	100.0	2401	100.0	4171	100.0

Kruskal-Wallis one way analysis of variance Kruskal-Wallis H (equivalent to Chi square) = 12. 218. Degrees of freedom = 1. *P* = 0.000473.

hours per night during the month, i.e. men less often had extreme and pronounced categories of the sleep duration abnormalities. Approximately 40% of men slept for 8 and more hours per night, i.e. they fell into the categories of the sleep duration abnormalities classified as “Moderate” and “Little”, which were documented in men significantly more often than in women (37%; *P*< 0.034).

The age-specific analysis of the categories of the sleep quality abnormalities among men showed that the sleep quality patterns remained approximately identical (P<0.94)

Table 2. Analysis of the categories of sleep disturbances in the population aged 45 to 69 years.

Sleep disturbances in the category of the sleep quality according to total score for the items 1–4 of the questionnaire							
Categories		Men		Women		Both genders	
Sleep quality	Score	N	%	N	%	N	%
1 Little	< 4	792	44.7	971	40.4	1763	42.3
2 Moderate	> 4 and ≤ 9	658	37.2	851	35.4	1509	36.2
3 Much	> 9 and ≤ 14	242	13.7	428	17.8	670	16.1
4 Extreme	> 14	78	4.4	151	6.3	229	5.5
	Total	1770	100.0	2401	100.0	4171	100.0
Kruskal-Wallis one way analysis of variance Kruskal-Wallis H (equivalent to Chi square) = 16.841. Degrees of freedom = 1. *P* = 0.000041.							
Sleep disturbances in the category of the sleep quality according to the item 5 of the questionnaire							
Categories		Men		Women		Both genders	
	Hours	N	%	N	%	N	%
4 Extreme	≤ 5	88	5.0	135	5.6	223	5.3
3 Much	6 – 7	966	54.6	1371	57.1	2337	56.1
2 Moderate	8 – 9	686	38.8	855	35.6	1541	36.9
1 Little	≥ 10	30	1.7	40	1.7	70	1.7
	Total	1770	100	2401	100	4171	100
Kruskal-Wallis one way analysis of variance Kruskal-Wallis H (equivalent to Chi square) = 4.469. Degrees of freedom = 1. *P* = 0.034510.							

in the groups of 45–54-, 55–64-, and 65–69-year-old individuals for all four categories (Table 3). About 18% of men had extreme and pronounced sleep disturbances. The analysis of the sleep duration categories revealed similar situation. The patterns for all four categories in the groups of 45–54-, 55–64-, and 65–69-year-old individuals were also approximately identical (*P*< 0.9): about 60% of men had the extreme and pronounced abnormalities of the sleep duration.

The analysis of the sleep quality categories revealed significant differences between age groups in women. The sleep quality improved with age: the categories, classified as “Extreme” and “Much”, comprised 21% of women in the senior age group (65–69 years) in comparison with 25% of women in 45–54-year-old group (*P*< 0.00134).

The age-specific analysis of the sleep duration categories in groups of 45–54-, 55–64-, and 65–69-year-old women showed that the patterns of the sleep duration were similar for all four categories with the upward trend in the older age groups (*P*< 0.0889). About 60% of 65–69-year-old women versus 65% of 45–54-year-old women had the sleep duration abnormalities fallen into the categories classified as “Extreme” and “Much”.

DISCUSSION

The analysis of data showed that 21% of individuals in the Russian/Siberian population had the sleep quality disorders fallen into the categories classified as “Moderate” (16%) and “Much” (5%). Prevalence rates for the sleep disturbances during 15 and more nights per month in the category of the sleep quality were as follows: frequent spontaneous sleep interruptions during the night (20%); anxious thoughts while falling asleep (10%); unsatisfying sleep (10%); and disturbing dreams (7%).

The sleep quality problems such as anxious thoughts while falling asleep and disturbing dreams occurred more often in Russia (79% and 68%, respectively) than in Great Britain (62% and 60%, respectively). However, the interrupted sleep and unsatisfying sleep were found more frequently in the British population than in Russian/Siberian population (77% and 75% vs. 70% and 68%, respectively). The trends in the sleep quality abnormalities were approximately identical in both populations even in view of the higher average age in our study in comparison with the British study (56 and 52 years, respectively).4 In our study, the disturbances of the sleep quality occurred more often in women (24%) than in men (18%).

In 2009, the results of the analysis of sleep disorders among the population of 12 states in the US were presented (Centers for Disease Control and Prevention, 2009). A total of 74,571 adult respondents were examined. Data showed that 35.3% of them slept less than 7 hours per 24-hour period. In our study, this rate was almost as twice as high: 61% of individuals slept less than 7 hours per 24-hour period.

The sleep duration abnormalities in the Russian/Siberian population occurred more often in women (62%) than in men (59%). The age-related analysis showed that the patterns of the sleep duration and sleep quality did not significantly change with age in the male population. In women, the sleep duration also did not significantly change with age, whereas the sleep quality analysis showed that the rate of the sleep disturbances fallen into the categories classified as “Extreme” and “Much” decreased in the senior age group. This observation is

Table 3. Analysis of the sleep disturbances in different age groups of 45–69-year-old population.

Sleep disturbances in the category of the sleep quality according to total score for the items 1–4 of the questionnaire							
Men							
		45–54		55–64		64–69	
Category	Score	N	%	N	%	N	%
1 Little	< 4	333	44.0	314	45.1	145	45.6
2 Moderate	> 4 and ≤ 9	291	38.5	257	36.9	110	34.6
3 Much	> 9 and ≤ 14	94	12.4	101	14.5	47	14.8
4 Extreme	> 14	38	5.0	24	3.4	16	5.0
Total		756	100	696	100	318	100
Kruskal-Wallis one way analysis of variance Kruskal-Wallis H (equivalent to Chi square) = 0.116. Degrees of freedom = 2. *P* = 0.943665.							
Women							
		45–54		55–64		64–69	
Category	Score	N	%	N	%	N	%
1 Little	< 4	403	37.5	364	40.2	204	48.7
2 Moderate	> 4 and ≤ 9	405	37.6	317	35.0	129	30.8
3 Much	> 9 and ≤ 14	199	18.5	163	18.0	66	15.8
4 Extreme	> 14	69	6.4	62	6.8	20	4.8
Total		1076	100	906	100	419	100
Kruskal-Wallis One Way Analysis of Variance Kruskal-Wallis H (equivalent to Chi square) =13.22. Degrees of freedom = 2. *P* = 0.001347.							
Sleep disturbances in the category of the sleep quality according to the item 5 of the questionnaire							
Men							
		45–54		55–64		64–69	
Category	Hours	N	%	N	%	N	%
4 Extreme	≤ 5	37	4.9	35	5.0	16	5.0
3 Much	6 – 7	418	55.3	374	53.7	174	54.7
2 Moderate	8 – 9	288	38.1	276	39.7	122	38.4
1 Little	≥ 10	13	1.7	11	1.6	6	1.9
Total	Total	756	100	696	100	318	100
Kruskal-Wallis one way analysis of variance Kruskal-Wallis H (equivalent to Chi square) = 0.201. Degrees of freedom = 2. *P* = 0.904601.							
Women							
		45–54		55–64		64–69	
Category	Hours	N	%	N	%	N	%
4 Extreme	≤ 5	59	5.5	50	5.5	26	6.2
3 Much	6 – 7	645	59.9	502	55.4	224	53.5
2 Moderate	8 – 9	357	33.2	333	36.8	165	39.4
1 Little	≥ 10	15	1.4	21	2.3	4	1.0
Total	Total	1076	100	906	100	419	100
Kruskal-Wallis One Way Analysis of Variance Kruskal-Wallis H (equivalent to Chi square) = 4.84. Degrees of freedom = 2. *P* = 0.088939.							

consistent with the results of other authors who evaluated the sleep duration (Centers for Disease Control and Prevention, 2009). It should be noted that the age related rates of the sleep duration abnormalities among the US population are significantly lower than those in the Russian/Siberian population (Centers for Disease Control and Prevention, 2009).

Based on data from our previous studies of Novosibirsk population (Gafarov et al., 2000)**,**we hypothesize that social stress, stress in the process of life, affects women more severely than men. The study of stress at workplace and in family showed that stress indicators were higher in the female population. At the same time, women had less opportunity to rest and relax at home after work. Presence of these factors can lead to more pronounced disturbances in sleep quality and duration in women than in men.

In our earlier studies, we evaluated the sleep disturbances by using the questionnaire, “Awareness and attitude towards one's own health”, employed in the WHO program, MONICA (Glazunovet al., 1973; Gostautas et al., 1984; WHO MONICA, 1988; Gagulin & Gafarov, 1994). In that study, to evaluate the sleep quality, the responses were assigned into the following categories: “very good”, “good”, “satisfactory”, “bad”, and “very bad”. More than 58% of men and 68% of women had the sleep

problems (response categories of “satisfactory”, “bad”, and “very bad”). We studied how the sleep problems influenced the risks of the development of myocardial infarction (MI), stroke, and arterial hypertension (AH) in individuals without past history of cardiovascular diseases(CVD) and diabetes for the periods of 5, 10, and 16 years.

Data showed that the risks of stroke and AH were significant in men with the sleep disturbances during the first5 years of the study. The ten-year MI risk was higher than the 5-year MI risk in individuals with the sleep disturbances and in 25–44-year-old groups in comparison with 45–64-year-old groups (Gafarov et al., 2000; 2002; 2006; 2008). Therefore, the high prevalence rates of the sleep disturbances in the categories of sleep quality and sleep duration in our population (almost twice as high as the same indicators in other populations) were associated with the high prevalence rates of the psychosocial factors (depression, anxiety, vital exhaustion, and hostility)and, as a consequence, with the high prevalence rates of CVD (Gagulin et al., 1994; Gafarov et al., 2000; 2002; 2006; 2008).

CONCLUSIONS

In our population, high prevalence of sleep disturbances in the categories of sleep quality and sleep duration was associated with high prevalence of psychosocial factors and, as a consequence, with significant rates of cardiovascular diseases. Comprehensive strategy in prevention and treatment of sleep disturbances in the study population might change this situation. One should recommend the medical practitioners to use more widely nocturnal polysomnography for clinical diagnostics of sleep disturbances (Engstrøm et al., 2013). It is absolutely necessary to take into account the problems with sleep when treating cardiovascular diseases, anxiety, and depression. On the other hand, it is necessary to give consideration to the awareness of general public and health authorities about the problems associated with sleep. Development of healthy behavior and normal sleep is essential for improvement of population health. Psychosocial testing should be performed during comprehensive examination of the population with aim to provide direct evaluation of the efficacy of the prevention programs; psychotherapeutic interventions should help individuals to change their attitudes to self, cardiovascular prophylactics, and to life in general.

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DISCLOSURES

Each of the authors declared no conflict of interest. No financial support was received. Authors declared no off-label or investigational use of drugs, biologics and medical devices.

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