

Gender differences in sleep complaints and health-related quality of life: 10-year follow-up

Nusiskundimai miegu ir su sveikata susijusi gyvenimo kokybė: lyčių skirtumai 10 metų laikotarpyje

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SUMMARY

Purpose. To analyze gender differences in sleep complaints and health-related quality of life during 10-year period.

Methods. The sample (N=931) of randomly selected citizens of Palanga, 35–84 years, was investigated in 2003 and 2013. Sleep complaints were assessed by Basic Nordic Sleep Questionnaire, health-related quality of life (HRQoL) – by SF-36. HRQoL was analyzed in different domains: physical functioning, social functioning, role limitations due to physical problems, role limitations due to emotional problems, mental health, energy-vitality, pain, and general health perception.

Results. Female gender has statistically significant negative impact on difficulties falling asleep, excessive sleepiness in the morning; and regular use of sleeping pills; while male gender has statistically significant negative impact on napping during the daytime, and breathing pauses during sleep. Sleep efficiency among males was higher, as compared to females. Multivariate linear mixed model revealed that a worsening of physical functioning was influenced by female gender, age and poor sleep quality; while a decrease in physical role limitation – only by age and poor sleep quality. The 10-year follow-up period had positive influence on mental health and general health perception; while poor sleep quality negatively influenced on mental health and general health perception.

Conclusions. There was shown that during 10-year follow-up an increase of insomnia symptoms were characteristic for females; while breathing disturbances during sleep – for males.

Keywords. Sleep complains, health-related quality of life

SANTRAUKA

Tikslas. Išanalizuoti nusiskundimų miegu ir su sveikata susijusios gyvenimo kokybės skirtumus tarp moterų ir vyrų 10 metų laikotarpyje.

Metodai. 2003 ir 2013 m. buvo ištirti atsitiktinai atrinkti Palangos gyventojai (35–84 metų) (N = 931). Nusiskundimai miegu vertinti Šiaurės šalių miego klausimynu, su sveikata susijusi gyvenimo kokybė (HRQoL) - SF-36 klausimynu. HRQoL buvo analizuojama įvairiose srityse: fizinis funkcionavimas, socialinis funkcionavimas, veiklos apribojimai dėl fizinių problemų, veiklos apribojimai dėl emocinių problemų, psichinė sveikata, energetinis gyvybingumas, skausmas ir bendras sveikatos suvokimas.

Rezultatai. Moteriška lytis turėjo statistiškai reikšmingą neigiamą poveikį užmigimo laikui; migdomųjų vartojimui; o vyriška lytis turėjo statistiškai reikšmingą neigiamą poveikį mieguistumui dienos metu ir kvėpavimo pauzėms o miego metu. Miego efektyvumas buvo didesnis vyrams nei moterims. Daugiamatis linijinis mišrus modelis parodė, kad sumažėjusį fizinį aktyvumą įtakoja moteriška lytis, amžius ir prasta miego kokybė, o sumažėjusią Veiklos apribojimas dėl fizinių problemų – tikrai amžius ir prasta miego kokybė. 10 metų stebėjimo laikotarpiu turėjo teigiamą poveikį psichinei sveikatai ir bendram sveikatos suvokimui; o bloga miego kokybė neigiamai paveikė psichinę sveikatą ir bendrą sveikatos suvokimą.

Išvados. Per 10 metų stebėjimą buvo parodyta, kad moterims padidėjo nemigos simptomai, o vyrams padažnėjo kvėpavimo sutrikimai miego metu.

Raktiniai žodžiai: Nusiskundimai miegu, su sveikata susijusi gyvenimo kokybė

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INTRODUCTION

The prevalence of sleep complaints in the general populations of different countries is varying from country to country. For example, a Finnish study demonstrated that 11.9% of the population complained about difficulties in falling asleep, while 31.6% had difficulties maintaining sleep, 11.0% reported early morning awakenings, 7.9% had non-restorative sleep, and 11.9% of the population were not satisfied with their sleep [1]. In a sample representative of the general population in Portugal, global dissatisfaction with sleep was reported by 10.1% of the sample, while 21.0% complained about difficulties maintaining sleep [2]. In a representative sample taken in Germany, 7% of the population reported global sleep dissatisfaction [3]. In a representative sample of the population in Canada, 19.8% were dissatisfied with their sleep [4]. Difficulties falling asleep affected 11.1% of the Japanese population, while maintaining sleep was an issue for 22.9% of Japanese people [5]. A study in South Korea demonstrated that 19.4% of people had difficulties falling asleep, while 21.7% had difficulties in maintaining sleep [6]. A Finnish longitudinal cohort study lasting 33 years demonstrated a decrease in self-reported sleep duration of approximately 18 minutes and a significantly increased prevalence of sleep complaints [7].

Longitudinal population studies performed in the cohorts of individuals of middle age and older have demonstrated that poor sleep is related to chronic diseases, such as type 2 diabetes, a worsened health-related quality of life, and an increased risk of all-cause mortality [8,9].

There is a gap in the literature of the effect of poor sleep on the separate domains of health-related quality of life (HRQoL). Follow-up sleep complaint studies in representative samples of general populations allow for the possibility to observe prevalence trends of sleep complaints specific to a country and provide scientifically-based proof for the need of cost-effective preventive measures, improving HRQoL, for the population. As examples of such studies, the 10-year trend of insomnia prevalence study in the adult populations of Norway [10] and England [11] both demonstrated a gradually increasing prevalence of insomnia and gave recommendations for health policy makers to implement preventive measures in order to avoid further sleep quality worsening. However, there is a lack of data on association of sleep complaints and different domains of HRQoL stratified by gender.

The first attempt to investigate sleep complaints in the general population carried out in Lithuania was in 2003 when the prevalence of sleep complaints in relation to HRQoL [12] and psycho-emotional status [13] was assessed in a randomly selected sample in the Lithuanian city of Palanga. Poor sleep was more prevalent among females than males in the 2003 survey, a finding which is supported by data collected in other countries [14]. The question arises what is the trend of sleep complaints during 10-year period and how it affects the HRQoL in women and men.

The aim of this study was to investigate gender differences in the prevalence of sleep complaints and health-related quality of life in the randomly selected sample of citizens of middle age or older during 10-year follow-up.

METHODS

Citizens of Palanga were chosen as the subject of the

investigation because they represented a close community, which was reflective of the population of the Western part of Lithuania.

We performed two surveys, the first in 2003, and the second one in 2013. The representative random stratified sample, consisting of 2500 citizens of Palanga, was drawn in 2003 by the Residents' Register Service. Baseline assessment was completed in the sample of 1602 persons (62.5% females), response rate 64.1%. The sample of 1602 persons represented a 4.9% bias in distribution according to age and gender in the population of Palanga.

Ten years later, in 2013, the same people who participated in the first survey were invited for the second investigation. From the baseline sample, which consisted of 1602 persons, 158 died (9.9%), 47 (2.9%) changed their address, 20 (1.2%) declined to participate in the second survey, 11 (0.7%) had serious health problems and had no possibility to participate, 435 (27.2%) did not respond to the invitation, which was sent at least twice neither answered phone calls. More than a half (58.1%) of the 2003-year survey participants ($n=931$, 65.4% females) were investigated repeatedly in 2013. We analyzed the data of both surveys participants ($N=931$), did not include those who participated only in one survey.

The first and the second surveys were approved by the Bioethics Committee of Lithuania (2002-12-03 No 90 and 2012-06-14 No BE-2-25). Informed consent was obtained from all participants during both surveys.

Questionnaires

The Basic Nordic Sleep Questionnaire [15] was used to assess the frequency of sleep complaints over a 3-month period in both the first and second surveys. The self-administered questionnaire included questions about problems falling asleep, awakenings during the night and too early in the morning, self-rated sleep quality, excessive sleepiness during the daytime, the effect of sleep on the ability to work, napping during the daytime, the regular use of sleeping pills and the use of alcohol to initiate sleep, as well as and breathing pauses during sleep. According to Basic Nordic Sleep Questionnaire's item "How well have you been sleeping during past three months" [15], respondents were classified to the two groups: poor and good sleepers. Poor sleepers' group consisted from responders who considered their sleep quality as neither well nor badly, rather badly or badly. Good sleepers' group responders considered their sleep as well or rather well. Cronbach's alpha was used to evaluate the internal consistency of the scales. Basic Nordic Sleep Questionnaire's Cronbach's alpha was 0.773 and 0.854 in 2003 and 2013, respectively.

The Short Form-36 (SF-36) [16] was used to assess health-related quality of life. It is a 36-item questionnaire that measures 8 multi-item dimensions of health: physical functioning, social functioning, role limitations due to physical problems, role limitations due to emotional problems, mental health, energy-vitality, pain, and general health perception. For each dimension item scores are coded, summed, and transformed on to a scale from 0 (worst possible health state) to 100 (best possible health state). Cronbach's alpha was 0.836 and 0.812 in 2003 and 2013, respectively.

The General Data and Self-Perceived Health Questionnaire [17] was used to collect information about the family status,

Research reports

education and employment of the respondents, information about the diseases (chronic or acute cardiovascular diseases, cancer, pulmonary or gastrointestinal disorders, nervous system disorders) diagnosed or treated during the previous 12 months.

Statistical analysis

Descriptive statistics were used to describe the characteristics of sleep complaints, sleep parameters and health-related quality of life in 2003 and 2013 samples; Chi-square test and Fisher's test were used to evaluate the significance of the association between the categorical variables in separate years, which were also presented as raw numbers and percentages. Differences in health-related quality of life scores between 2003 and 2013 samples were tested using the Student's t-test. Data were presented using mean (95% CI) expression.

We used Benjamini-Hochberg adjustment for multiple comparisons in the sleep complaints and sleep parameters, health-related quality of life domain, setting a critical value for a false discovery rate of 0.10 [18].

Direct standardization by age and sex was performed by weighting the cases according to the population distribution of gender and age to correct for divergence between the sample and the distribution of age and gender in the general population of Lithuania. A weighted logistic regression analysis using an enter method was used to investigate if Baseline/10-year follow-up period, gender, age were related to different sleep complaints (Model 1) and additionally adjusted by family status; education; employment; self-perceived health; frequent stressful events; depression mood; alcohol used; smoking; illness during past 12 month; and obesity (Model 2).

Linear mixed-effect models were conducted to examine the

differences of individual domains of Sf-36 between baseline and 10-year period.

All of the data was analysed using SPSS (version 21.0; SPSS Inc., Chicago, IL, USA). A p-value of <0.05 was considered to be statistically significant.

RESULTS

The study sample consisted of 931 persons (65.4% females) participated in both surveys, in 2003 and 2013. The mean age of the participants during the first survey was 53.9 years, during the second one 63.8 years; the mean age did not differ significantly between males and females.

The differences in sleep complaints between males and females in 2003

Females more often than males complained about the difficulties falling asleep ($p < 0.001$), excessive sleepiness in the morning ($p = 0.002$) and used sleeping pills regularly ($p = 0.030$) (Table 1). The mean of sleep latency period on work days was significantly higher in females, as compared to males ($p < 0.001$), as well as on weekends ($p < 0.001$). Self-perceived need of sleep was significantly higher in females, as compared to males ($p = 0.006$).

Males more often than females declared napping during the daytime ($p = 0.031$), had breathing pauses during sleep ($p = 0.001$). Males demonstrated significantly higher sleep efficiency, as compared to females, on workdays ($p = 0.020$) and on weekends ($p = 0.001$).

The differences in sleep complaints between males and females in 2013

Females more often than males complained about the

Table 1. Prevalence of sleep complaints and sleep parameters among males and females in 2003 and 2013

Variables	2003			2013		
	Females, n=609 n (%)	Males, n=322 n (%)	p	Females, n=609 n (%)	Males, n=322 n (%)	p
Sleep complaints						
Difficulties falling asleep	86 (14.1)	20 (6.2)	<0.001*	130 (21.4)	28 (8.7)	<0.001*
Difficulties maintaining sleep	263 (43.2)	128 (39.8)	0.347	313 (51.4)	150 (46.6)	0.184
Awakenings too early in the morning	77 (12.6)	40 (12.4)	0.994	130 (21.4)	48 (14.9)	0.019
Poor self-perceived sleep	298 (48.9)	146 (45.3)	0.330	342 (56.2)	138 (42.9)	<0.001*
Excessive sleepiness in the morning	124 (20.4)	39 (12.1)	0.002*	73 (12.0)	29 (9.0)	0.194
Inability to work due to disturbed sleep	26 (4.3)	6 (1.9)	0.066	26 (4.3)	10 (3.1)	0.477
Napping during the daytime	55 (9.0)	45 (14.0)	0.031*	57 (9.4)	56 (17.4)	0.001*
Regular use of sleeping pills	37 (6.1)	9 (2.8)	0.030*	86 (14.1)	18 (5.6)	<0.001*
Alcohol use to initiate sleep	9 (1.5)	8 (2.5)	0.417	28 (4.6)	7 (2.2)	0.077
Excessive sleepiness during the daytime	107 (17.6)	47 (14.6)	0.280	56 (9.2)	23 (7.1)	0.337
Breathing pauses during sleep	8 (1.3)	18 (5.6)	0.001*	22 (3.6)	30 (9.3)	0.001*
Sleep parameters	mean (95% CI)	mean (95% CI)		mean (95% CI)	mean (95% CI)	
Sleep latency on work days (min)	22.5 (20.6–24.4)	17.0 (15.4–18.5)	<0.001*	28.6 (26.6–30.6)	19.5 (17.7–21.2)	<0.001*
Sleep latency on weekends (min)	23.2 (21.3–25.1)	17.7 (16.1–19.3)	<0.001*	30.5 (27.0)	20.9 (19.1–22.7)	<0.001*
Sleep duration (hours)	7.3 (7.2–7.4)	7.3 (7.2–7.5)	0.295	7.2 (7.1–7.3)	7.3 (7.2–7.4)	0.166
Self-perceived need of sleep (hours)	8.1 (8.0–8.2)	7.9 (7.8–8.0)	0.006*	7.9 (7.8–8.0)	7.7 (7.6–7.9)	0.021*
Napping duration (min)	50.0 (45.7–54.3)	52.4 (46.9–57.9)	0.496	46.0 (43.4–48.7)	49.8 (45.6–53.9)	0.138
Sleep efficiency on work days (%)	94.2 (93.1–95.3)	96.3 (94.9–97.8)	0.020*	90.3 (89.1–91.4)	93.2 (91.8–94.8)	0.002*
Sleep efficiency on weekends (%)	89.8 (88.6–90.9)	93.1 (91.6–94.6)	0.001*	87.3 (85.1)	90.4 (88.7–92.1)	0.001*

p female versus male

*statistically significant (significance of p values in prevalence of sleep complaints and sleep parameters domains are adjusted to Benjamini-Hochberg correction for multiple comparisons).

Table 2. Result from regression analyses in which time, gender, age are regressed on sleep complaints

Independent variable	Model 1 OR (95% CI)		p	Model 2 OR (95% CI)		p
	Difficulties falling asleep					
Time 2003(1)/2013(2)	1.32	(0.96–1.80)	0.086	1.35	(0.95–1.91)	0.099
Gender: M(1)/ F(2)	2.92	(2.10–4.05)	<0.001	2.62	(1.80–3.84)	<0.001
Age	1.04	(1.03–1.05)	<0.001	1.02	(1.00–1.04)	0.070
	Difficulties maintaining sleep					
Time 2003(1)/2013(2)	0.89	(0.72–1.10)	0.277	0.91	(0.72–1.41)	0.409
Gender: M(1)/ F(2)	1.25	(1.03–1.53)	0.023	1.16	(0.93–1.46)	0.188
Age	1.05	(1.04–1.05)	<0.001	1.04	(1.02–1.01)	<0.001
	Awakenings too early in the morning					
Time 2003(1)/2013(2)	1.31	(0.98–1.76)	0.065	1.28	(0.94–1.76)	0.123
Gender: M(1)/ F(2)	1.26	(0.96–1.65)	0.092	1.07	(0.79–1.47)	0.653
Age	1.02	(1.01–1.04)	<0.001	1.02	(1.00–1.03)	0.083
	Poor self-perceived sleep					
Time 2003(1)/2013(2)	0.96	(0.78–1.18)	0.715	1.08	(0.85–1.37)	0.530
Gender: M(1)/ F(2)	1.35	(1.12–1.63)	0.002	1.14	(0.90–1.44)	0.269
Age	1.02	(1.01–1.03)	<0.001	1.00	(0.99–1.02)	0.819
	Excessive sleepiness in the morning					
Time 2003(1)/2013(2)	0.71	(0.53–0.95)	0.021	0.75	(0.54–1.04)	0.083
Gender: M(1)/ F(2)	1.50	(1.14–1.97)	0.004	1.53	(1.11–2.10)	0.009
Age	0.98	(0.97–1.00)	0.009	0.97	(0.95–0.99)	<0.001
	Inability to work due to disturbed sleep					
Time 2003(1)/2013(2)	0.97	(0.53–1.77)	0.908	1.08	(0.55–2.14)	0.819
Gender: M(1)/ F(2)	2.09	(1.12–3.89)	0.020	1.53	(0.76–3.11)	0.236
Age	1.03	(1.01–1.06)	0.009	1.01	(0.97–1.04)	0.786
	Napping during the daytime					
Time 2003(1)/2013(2)	0.61	(0.43–0.86)	0.005	0.57	(0.39–0.82)	0.003
Gender: M(1)/ F(2)	0.62	(0.46–0.85)	0.003	0.53	(0.37–0.76)	0.001
Age	1.07	(1.06–1.09)	<0.001	1.07	(1.05–1.09)	<0.001
	Regular use of sleeping pills					
Time 2003(1)/2013(2)	1.55	(0.98–2.47)	0.062	1.59	(0.96–2.62)	0.071
Gender: M(1)/ F(2)	3.72	(2.27–6.11)	<0.001	3.02	(1.74–5.26)	<0.001
Age	1.07	(1.06–1.09)	<0.001	1.05	(1.02–1.08)	0.001
	Alcohol use to initiate sleep					
Time 2003(1)/2013(2)	1.47	(0.76–2.84)	0.253	1.44	(0.71–2.93)	0.316
Gender: M(1)/ F(2)	1.40	(0.77–2.54)	0.272	1.25	(0.62–2.49)	0.536
Age	1.04	(1.01–1.07)	0.003	1.03	(0.99–1.07)	0.124
	Excessive sleepiness during the daytime					
Time 2003(1)/2013(2)	0.42	(0.30–0.58)	<0.001	0.44	(0.31–0.62)	<0.001
Gender: M(1)/ F(2)	1.32	(0.98–1.77)	0.071	1.38	(0.98–1.95)	0.065
Age	1.02	(1.00–1.03)	0.015	1.01	(0.99–1.03)	0.337
	Breathing pauses during sleep					
Time 2003(1)/2013(2)	1.65	(0.96–2.83)	0.069	1.67	(0.94–2.97)	0.080
Gender: M(1)/ F(2)	0.31	(0.19–0.51)	<0.001	0.31	(0.18–0.55)	<0.001
Age	1.03	(1.00–1.05)	0.019	1.02	(0.98–1.05)	0.345

OR, odds ratio; CI, confidence interval

Model 2 – Adjusted by year, gender, age, family status; education; employment; self-perceived health; frequent stressful events; depression mood; alcohol used; smoking; illness during past 12 month, obesity.

difficulties falling asleep ($p<0.001$), awakenings too early in the morning ($p=0.019$), and perceived their sleep as poor ($p<0.001$) (Table 1). Females more often than males used sleeping pills regularly ($p<0.001$). They had significantly longer sleep latency period than males on work days ($p<0.001$) and on weekends ($p<0.001$). Self-perceived need of sleep was significantly higher in females, as compared to males ($p=0.021$).

Males more often than females in 2013 had napping during

the daytime ($p=0.001$) and breathing pauses during sleep ($p=0.001$). Sleep efficiency on workdays was significantly higher in males, as compared to females ($p=0.002$), as well as on weekends ($p=0.001$).

The differences in sleep complaints between males and females during 10-year follow-up

The results from the logistic regression analyses of different sleep complaints are presented in Table 2. From 2003 to the

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Table 3. Determinants in linear mixed models analyses in which time, gender, age, sleep quality are regressed on life quality domains

Independent variable	Univariate Estimate (95%CI)	p	Multivariate Estimate (95%CI)	p
Physical functioning				
Time	-5.34 (-7.21 to -3.46)	<0.001	3.09 (1.06 to 5.13)	0.003
Gender: M(1)/F(2)			-7.54 (-9.71 to -5.38)	<0.001
Age			-0.67 (-0.79 to -0.55)	<0.001
Sleep: good(1)/poor(2)			-5.69 (-7.57 to -3.81)	<0.001
Physical role limitations				
Time	-7.97 (-11.32 to -4.61)	<0.001	0.40 (-3.09 to 3.89)	0.821
Gender: M(1)/F(2)			-1.73 (-5.40 to 1.94)	0.355
Age			-0.40 (-0.60 to -)	<0.001
Sleep: good(1)/poor(2)			-6.02 (-9.21 to -2.82)	<0.001
Emotional role limitations				
Time	-1.65 (-5.02 to 1.71)	0.334	3.76 (0.11 to 7.41)	0.043
Gender: M(1)/F(2)			-1.21 (-5.04 to 2.61)	0.534
Age			-0.22 (-0.43 to -0.01)	0.037
Sleep: good(1)/poor(2)			-6.13 (-9.46 to -2.80)	<0.001
Social functioning				
Time	-1.10 (-3.12 to 0.92)	0.284	2.86 (0.77 to 4.94)	0.007
Gender: M(1)/F(2)			-1.36 (-3.54 to 0.83)	0.224
Age			-0.14 (-0.26 to -0.02)	0.020
Sleep: good(1)/poor(2)			-4.90 (-6.81 to -3.00)	<0.001
Mental health				
Time	3.08 (1.54 to 4.62)	<0.001	4.16 (2.60 to 5.73)	<0.001
Gender: M(1)/F(2)			0.87 (-0.77 to 2.52)	0.299
Age			0.05 (-0.04 to 0.15)	0.255
Sleep: good(1)/poor(2)			-4.25 (-5.69 to -2.80)	<0.001
Energy-vitality				
Time	0.47 (-1.13 to 2.07)	0.561	3.36 (1.76 to 4.95)	<0.001
Gender: M(1)/F(2)			-2.23 (-3.92 to -0.55)	<0.001
Age			-0.09 (-0.18 to 0.01)	0.066
Sleep: good(1)/poor(2)			-2.88 (-4.36 to -1.41)	<0.001
Pain				
Time	-0.32 (-2.35 to 1.71)	0.756	3.94 (1.83 to 6.06)	<0.001
Gender: M(1)/F(2)			-5.09 (-7.31 to -2.87)	<0.001
Age			-0.22 (-0.34 to -0.10)	<0.001
Sleep: good(1)/poor(2)			-7.80 (-9.74 to -5.86)	<0.001
General health perception				
Time	1.63 (0.19 to 6.07)	0.026	5.20 (3.73 to 6.67)	<0.001
Gender: M(1)/F(2)			-0.42 (-1.97 to 1.13)	0.595
Age			-0.18 (-0.27 to -0.10)	<0.001
Sleep: good(1)/poor(2)			-3.86 (-5.21 to -2.51)	<0.001

CI, confidence interval

Multivariate – adjusted by family status; education; employment; self-perceived health; frequent stressful events; depression mood; alcohol used; smoking; illness during past 12 month, obesity.

time of the second survey in 2013, the prevalence changed as follows (reported odds ratios [ORs] are from the adjusted regression analyses). During 10-year period a statistically significant decrease of napping during the daytime changed from 11.5% to 9.4% (OR, 0.57, 95% CI: 0.39–0.82, $p=0.003$) and excessive sleepiness during the daytime changed from 16.1% to 8.2% (OR, 0.44, 95% CI: 0.31–0.62, $p<0.001$); while other symptoms changed non-significantly: difficulties falling asleep; difficulties maintaining sleep; awakenings too early in the morning; poor self-perceived sleep; inability to work due to disturbed sleep; regular use of sleeping pills; alcohol use to initiate sleep; and breathing pauses during sleep.

Across the two surveys during the 10-year period there was an increase in sleep complains, except a decrease of napping during daytime. Female gender has negative impact on several sleep complaints: difficulties falling asleep (OR, 2.62, 95% CI: 1.80–3.84, $p<0.001$); excessive sleepiness in the morning (OR, 1.53, 95% CI: 1.11–2.10, $p=0.009$); and regular use of sleeping pills (OR, 3.02, 95% CI: 1.74–5.26, $p<0.001$). Male gender has negative impact on napping during the daytime (OR, 0.53, 95% CI: 0.37–0.76, $p=0.001$); and breathing pauses during sleep (OR, 0.31, 95% CI: 0.18–0.55, $p<0.001$).

Age was positively associated with an increase of difficulties maintaining sleep (OR, 1.04, 95% CI: 1.02–3.84,

$p < 0.001$); napping during the daytime (OR, 1.07, 95% CI: 1.05–1.09, $p < 0.001$); and regular use of sleeping pills (OR, 1.05, 95% CI: 1.02–1.08, $p = 0.001$) and negatively associated with excessive sleepiness in the morning (OR, 0.97, 95% CI: 0.95–0.99, $p < 0.001$).

The differences in health-related quality of life domains during 10-year follow-up

A decrease of the scores of physical functioning and physical role limitation (from 76.5, 95% CI: 75.4–77.6 till 71.2, 95% CI: 69.7–72.7 (the estimate -5.34 , $p < 0.001$) and 65.1, 95% CI: 63.0–67.2 till 57.1, 95% CI: 54.5–59.8 (the estimate -7.97 , $p < 0.001$), correspondingly) was found during 10-year period (Table 3). An increase of mental health score and general health perception (from 65.2, 95% CI: 64.2–66.2 till 68.3, 95% CI: 67.1–69.4 (the estimate 3.08 , $p < 0.001$) and from 49.4, 95% CI: 48.5–50.3 till 51.1, 95% CI: 50.0–52.2 (the estimate 1.63 , $p = 0.026$), correspondingly) was observed. The differences in scores of other domains of quality of life were statistically insignificant.

Multivariate linear mixed model revealed that a worsening of physical functioning during 10-year period was associated by female gender, age and poor sleep quality; while a decrease in physical role limitation – only by age and poor sleep quality. The 10-year period had positive influence on mental health and general health perception; while poor sleep quality negatively influenced on mental health and general health perception. The age was negatively influenced only general health perception (Table 3).

Table 3 demonstrates that age has negative impact on emotional role, social functioning, and pain domain; female gender on energy vitality of life quality. The pain domain was affected by all of them – time period, gender, age and sleep quality.

DISCUSSION

The results of our study demonstrated that complaints about difficulties falling asleep and use of sleeping pills were common in females in 2003 and 2013. It was consistent with the findings of earlier studies demonstrating higher rates of difficulties falling asleep and the use of sleeping pills among females, as compared to males [14,19].

Sleep efficiency in our study was lower among females, as compared to males. This finding could be explained by the changes in women’s sleep structure, which usually occur along with ageing, especially in social isolation [20]. Polysomnographic data [21] indicated that older age females, as compared to males, had less NREM sleep and were more predisposed to REM sleep, that is why females had at least a 40% increased risk for developing insomnia, as compared to males.

We found significant gender differences regarding the complaints about breathing pauses during sleep. These complaints were more common in males in 2003 and 2013, than in females. Obstructive sleep apnea syndrome (OSAS) characterizing by breathing pauses during sleep is very common among the older adult persons, especially males [22]. OSAS occurs when there is a repeated obstruction of the upper airway during sleep for 10 seconds or longer, accompanied by oxyhemoglobin desaturation, causing micro-arousals and

awakenings. Our study demonstrated that breathing pauses during sleep and napping during daytime symptoms of OSAS were more prevalent among males, as compared to females during both surveys in 2003 and 2013.

There was shown that insomnia is associated with lower mental and physical HRQoL scores compared to patients without this diagnosis [20]. However, gender differences in the association between poor sleep and health-related quality of life in the sample of older adults in general population is an issue which has been investigated rarely in scientific literature. There have been a few studies published recently [23–26] which have analyzed associations between poor sleep and health-related quality of life, but these ones did not emphasize gender differences. The results of our study shown that female gender demonstrates more sleep complaints and worsening physical functioning, energy vitality and pain domains of HRQoL in a 10-year period. Interesting finding of our study was that poor sleep quality did not worsen HRQoL among males in the domains of physical functioning and pain. This finding could be explained, that significantly greater part of females, as compared to males, had at least one disease diagnosed or treated around the time of the research. The findings of earlier studies [27,28] have clearly demonstrated close relationships between sleep quality and comorbidities. The domain of physical functioning had the highest scores in both surveys, independently of gender and sleep quality. On the other hand, domains of mental health and general health perception had the lowest scores in males and females, independently of sleep quality. This finding was in line with the results of a longitudinal study in which 952 older females (aged over 70) participated, demonstrating an independent association between poor sleep in the baseline study and an increased risk (OR=1.19) of worsening depressive symptoms [29]. Another study also demonstrates association between poor sleep and social isolation in older adults [30].

Recently published study results have concluded that insomnia predicted cumulative incidence of several physical and mental conditions [31], and also that mental health domain of HRQoL appeared to be the strongest risk factor for persistent insomnia symptoms. The close links between physical and mental symptoms with poor sleep quality that has major negative long term impact on health also was shown in young people [32].

Concluding the results, should be pointed that during the 10-year period females more often than males reported difficulties falling asleep, excessive sleepiness in the morning, perceived their sleep as poor and used sleeping pills. Males more often than females had snoring, breathing pauses during sleep and reported napping during daytime; however, sleep efficiency among males was higher, as compared to females.

Female gender has negative impact on physical functioning, energy-vitality domains of health-related quality of life, which also negatively affected by poor sleep quality and age.

Study limitations

The methodological limitations of our study were related to its comparatively small sample. A potential limitation of our study is that the citizens of Palanga had since moved to another location, mostly outside of country, meaning that the sample during the second study for which survey data of

sleep complaints and health-related quality of life data may be incomplete.

Our findings demonstrating high prevalence of sleep complaints and use of sleeping pills among elderly supported the idea indicating that surveillance of sleep disorders is an important public health issue [33] and that prevention and health educational initiatives should be launched in the general population in order to promote a better quality of sleep.

Conflicts of interest

All authors declare no potential conflict of interest regarding the authorship and publication of this study and have no financial disclosures to report.

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