Bulletin of the National Research Centre

RESEARCH

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The prevalence and determining factors of sleep disorders vary by gender in the Egyptian public officials: a large cross-sectional study

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Abstract

Background: Several studies have investigated sleep disorders in the general population. However, a few studies were conducted among the working population and none among the Egyptian workers. We aimed to assess the prevalence of sleep disorders and determine their associated factors. In a sample of 3143 Egyptian public officials, we collected, via a self-administered questionnaire, cross-sectional data on demographics, social, occupational, behavioral, and medical factors associated with sleep. The Jenkins sleep evaluation (JSEQ) questionnaire assessed four sleep disorders, and the logistic and linear regression models determined the associated factors.

Results: The prevalence of sleep disorders was 26.2% and 14.5% in female and male Egyptian public officials. Common factors associated with sleep disorders in men and women were age, BMI, job demands and control, and history of chronic disease and depression. However, other associated factors varied by gender. Urban residence (aOR = 1.54 (1.10–2.17), overtime work (aOR = 1.60 (1.16–2.23), and low perceived family social support (aOR = 1.63 (1.06–2.52) in males, while higher income (aOR = 3.64 (1.71–7.73) in females were positively associated with sleep disorders. Higher education levels were associated positively in females and inversely in males with sleep disorders. These factors predicted 28% and 39% of the total variance in the JSEQ score in females and males, respectively. Moreover, the associated factors varied by the type of sleep disorder.

Conclusions: The determinants of sleep disorders varied by gender. Worksite interventions to improve job control and income and reduce chronic physical and mental disease risk are recommended to enhance sleep quality.

Keywords: Sleep disorders, Determinants, Gender, Public officials, Egypt

Background

Sufficient time of good quality sleep is essential for the human body to recover and continue the required tasks of the next day. Poor sleep could be associated with adverse physical and mental health sequences (Fernandez-Mendoza and Vgontzas 2013).

Sleep disorders consist of abnormalities in sleep timing, quantity, and quality. The most common sleep disturbances in the general community are those defining insomnia, with difficulties initiating, restoring, or maintaining sleep, besides other symptomatology (Pilcher and Morris 2020). The prevalence of these sleep disorders could be estimated between 10 and 30% of the general population (Fernandez-Mendoza and Vgontzas 2013). However, this prevalence differed by ethnicity, sociodemographics, medical health status, lifestyle, family structure, and work environment of the studied populations (Ram et al. 2010; van de Straat and Bracke

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2015; Aragón-Arreola et al. 2016; Inoue 2016; Adams et al. 2017).

Considering the health hazards, poor productivity, and impaired safety of the workers (Pilcher and Morris 2020) with sleep disorders, determining the prevalence and correlates of these disorders among the working population is of utmost importance. However, a few studies were conducted among working people. The evidence came mainly from American (Yong et al. 2017) and Asian (Thach et al. 2020) workers whose characteristics and work environment vary significantly from those of other working populations.

In Egypt, the workforce exceeded 27 million adults in 2020 (The World Bank 2021). Unfortunately, there has been no study to determine the prevalence and correlates of poor sleep disorders in this large and vital sector of Egyptian society. The previous Egyptian studies investigated sleep disorders in small samples of students (Ismail 2017; Salama 2017) or chronically ill patients (Ibrahim and Wegdan 2011; Abd Elsadek et al. 2019; Mansour et al. 2020). Therefore, we aimed to estimate the prevalence and correlates of sleep disorders in Egyptian public officials using a large Egyptian sample of a joint bilateral project between Egypt and Japan (Eshak et al. 2022).

Methods

Study design and population

The design was a cross-sectional study. The staff members of the Public Health Department, Faculty of Medicine, Minia University, Egypt, collected data from Egyptian public officials from October 2019 to January 2020 to find differences between Egyptian and Japanese public officials regarding the work-family conflict-related health outcomes. Approval to the protocol of this joint project between Egypt and Japan was given by the Faculty of Medicine Research Ethics Committee (FMREC), Minia University (approval # 194:4/2019). Details of the Egyptian survey were published previously (Eshak et al. 2021; Abdelrehim et al. 2022; Eshak and Abdelrahman 2022).

The Egyptian team surveyed public officials in their workplaces by a self-administered questionnaire, including the Jenkins Sleep Evaluation Questionnaire (JSEQ) (Jenkins et al. 1988). The questionnaire was distributed to the public officials after explaining the aim of the study and obtaining written consent. The response rate was around 65%, as 3249 questionnaires were returned out of 5000 distributed questionnaires. The eligible number of questionnaires for further analysis was 3143, as 106 were excluded due to missing information on JSEQ.

The dependent variable (sleep disorders)

The JSEQ is a scale of items that assesses the types and intensity of common insomnia symptoms in the general community, i.e., delay of sleep start, difficulty continuing the sleep, waking up too early, or feeling tired after the usual amount of sleep (Jenkins et al. 1988). Hence, four common disorders were assessed regarding sleep initiation, maintaining, restoring, and being torn out after a usual amount of sleep. Frequency responses to these four sleep disturbances within the past 30 days were assessed on a 6-point Likert scale: 1 = not at all, 2 = 1–3 days, 3 = 4–7 days, 4 = 8–14 days, 5 = 15–21 days, and 6 = ≥ 22 days. The American Psychiatric Association indicated sleep disorders if the individual experienced any sleep disturbance for ≥ 3 nights per week within the preceding four weeks (American Psychiatric Association 2000). Therefore, we considered public officials who reported ≥ 15 days' experience of any of the four sleep disturbances to have sleep disorders (Eshak 2019).

Associated factors

The participants were asked to report their age, sex, area of residence, education, occupation, income, marital status, working status of the spouse, family structure, the level of social support provided by the family, number of family members and minors (< 14 years), working hours per day, shift work, extra jobs or overtime work, and levels of job demands, control, and social support at work. Participants were classified as never, former and current smokers of cigarettes and/or Shisha. The physical activity of the recruited public officials was estimated in units of the metabolic equivalent of energy expenditure (METs). The weight and height of the public officials were measured in standard procedures, and the body mass index (BMI) was calculated as weight in kilograms divided by the height in square meters. We also collected information on the history of physician-diagnosed chronic physical diseases (diabetes, hypertension, hypercholesterolemia, cardiovascular disease, and cancer) and mental disease (depression).

Statistical analysis

We used SAS software version 9.4 (SAS Institute Inc, Cary, NC, USA) for the analyses, and two-tailed p-values of less than 0.05 indicate statistical significance. We presented, gender-specifically, the median (interquartile range) and proportions of the public officials' characteristics. The Mann–Whitney and the Chi-square tests tested the statistical significance of the differences in these factors between public officials with and without sleep disorders. In addition, we described the gender-specific frequency scores for the four types of sleep disorders. The

logistic regression models calculated the univariate and multivariate odds ratios (ORs) and 95% confidence intervals (CIs) of having sleep disorders. The stepwise multiple linear regression estimated the slope and the standardized beta of the total score of the JSEQ as a dependent variable according to standardized unit changes of the studied factors. Further, we conducted subgroup analyses to test the factors associated with each type of the four sleep disorders. Since multiple comparisons can lead to a higher potential for type I error, the subgroup analyses should be interpreted as exploratory analyses.

Results

The prevalence of sleep disorders among 3143 Egyptian public officials was 20.5% overall, 26.2% in women, and 14.5% in men. Compared to those without sleep disorders, men and women with sleep disorders were younger, more likely to reside in urban areas, to work an extra job, and to have higher BMI, higher job demands, lower job control, lower social support, and histories of chronic physical and mental diseases. Higher proportions of university education, high income, professional occupation, and night shift work, but a lower proportion of employed spouses were observed among female public officials with sleep disorders. On the other hand, higher proportions of single and living alone males or with few family members were observed among male public officials with sleep disorders (Table 1).

Waking up tired after the usual amount of sleep for 15 days or more during the previous month was the most common sleep disorder reported by both genders; 17.8% in women and 7.6% in men. Waking up too early and having trouble falling asleep again was the second most common sleep disorder in women, 8.8%; while waking up several times per night but did not have difficulty falling asleep again ranked second among men, 5.7% (Table 2).

Table 3 shows gender differences in the univariate and multivariate associations of sleep disorders with several correlates. The odds of having sleep disorders increased in women and decreased in men educated to a university level or more in comparison to those maximally educated to a high school level; adjusted OR (95% CI) was 1.69 (1.03–2.76) in women and 0.59 (0.36–0.97) in men. Women's odds of having sleep disorders increased in the highest income category in reference to the lowest; adjusted OR = 3.64 (1.71–7.73). In men, the odds increased with urban residence [adjusted OR = 1.54 (1.10–2.17)], working an extra job [adjusted OR = 1.60 (1.16–2.23)], and low perceived family social support [adjusted OR = 1.63 (1.06–2.52)]. However, universal risk factors of sleep disorders in both genders were high BMI, high job demands, low job control, and histories of physical and mental diseases.

Moreover, the odds of having sleep disorders decreased with age in both genders. The factors mentioned above contributed to 28% and 39% of the total variance of the JSEQ score in women and men, respectively, as shown in the linear regression analyses of Tables 4 and 5.

We reported the gender-specific variabilities in the associations of the significant factors with each type of sleep disorder in Additional file 1: Tables 1, 2, and 3. Factors that determined women's difficulties in falling asleep were job demands and histories of physical and mental diseases, while men's were age, residence, shift work, and job demands. Women's interrupted sleep was determined by age, income, BMI, the number of minors in the family, job demands, and histories of physical and mental diseases. In contrast, men's interrupted sleep was associated with BMI, job control, and histories of physical and mental illnesses. Waking up too early in women was associated with BMI, the number of minors in the family, job demands and control, and histories of physical and mental diseases. This disorder in men was associated with BMI, working an extra job, and histories of physical and mental illnesses. The most common sleep disorder, waking up tired after the usual amount of sleep, was correlated with almost all the factors except the BMI and the number of minors in the family in women, and the BMI, job demands, and job control in men.

Discussion

Our cross-sectional study of Egyptian public officials showed a higher prevalence of sleep disorders among women than men. Moreover, the factors correlated with the total sleep disorders, and each specific disorder varied by gender. The family's income and the number of minors were associated with the overall and specific sleep disorders in women, while residence, working an extra job, shift work, and perceived social support from the family correlated with the men's total and specific sleep disorders. Age, job demands and control, and histories of chronic diseases and depression correlated with sleep disorders in both genders. Higher education was associated positively in women and inversely in men with the odds of having sleep disorders.

The estimated prevalence in our study is in line with those estimated in American and Asian working populations. An American study reported that the prevalence of sleep disorders was 19.2% among 6338 workers aged ≥ 18 who participated in the National Health and Nutrition Examination Survey (Yong et al. 2017). Among 464 Asian workers (64% Chinese) aged 21 years or more, the prevalence of poor sleep quality was 43.2% (Thach et al. 2020). The prevalence of poor sleep quality was 15.5% among 470 Iranian workers (Yazdi et al. 2014). However, a lower prevalence of 3.3% was indicated among 7112

Table 1 Gender-specific participants' characteristics according to the presence of sleep disorders

	Female public officials		*P* value[a]	Male public officials		*P* value[a]
	No sleep disorders, *n* = 1198	Sleep disorders, *n* = 425		No sleep disorders, *n* = 1300	Sleep disorders, *n* = 220	
Age, y[b]	38 (30–47)	35 (29–45)	< 0.01	45 (35–54)	38 (3–49)	< 0.01
Urban residence, %	58.7	65.4	0.01	34.8	48.0	< 0.01
Education,%			< 0.01			0.45
≤ High school	15.8	7.3		26.2	22.7	
Vocational	19.0	18.8		23.5	22.7	
University or above	65.2	73.9		50.3	54.6	
Occupation, %			< 0.01			0.40
Professional	63.6	72.7		47.1	51.8	
Clerk	25.1	18.6		35.3	33.2	
Manual or technical	11.3	8.7		17.6	15.0	
Household income, %			< 0.01			0.10
Lowest	26.7	20.2		23.7	17.4	
Middle	71.5	75.7		75.0	80.8	
Highest	1.8	4.1		1.3	1.8	
Smoking habit, %			0.91			0.71
Never	99.2	99.4		61.5	61.4	
Former	0.4	0.3		29.2	30.9	
Current	0.4	0.3		9.3	7.7	
Physical activity, METs unit[b]	45 (42–57)	45 (39–57)	0.62	49 (43–58)	50 (44–57)	0.73
Body mass index, Kg/m^{2} [b]	27.6 (24.6–31.3)	28.1 (25.9–32.0)	0.02	26.9 (24.8–29.0)	27.4 (25.0–30.1)	0.03
Marital status, %			0.82			< 0.01
Single	14.4	16.0		7.5	15.0	
Divorced	2.6	2.8		1.0	0.9	
Widowed	5.2	4.5		0.9	0.5	
Married	77.8	76.7		90.6	83.6	
Employed spouse, %	30.9	18.8	< 0.01	37.8	32.9	0.16
Family type, %			0.54			0.05
Nuclear	74.4	73.9		84.6	78.6	
Multigeneration	24.3	25.4		13.8	19.1	
Living alone	1.3	0.7		1.6	2.3	
Total family members, n[b]	3 (2–4)	3 (2–4)	0.70	4 (3–5)	3 (2–5)	< 0.01
Number of minors in the family, n[b]	1 (0–2)	1 (0–2)	0.29	1 (0–2)	1 (0–2)	0.89
Job hours, h/d[b]	6 (6–8)	6 (6–8)	0.71	8 (6–8)	8 (6–8)	0.97
Night shift job, %	15.1	19.5	0.03	21.5	26.4	0.11
Extra job, %	11.9	17.9	< 0.01	41.7	61.4	< 0.01
High job demands, %	51.4	74.6	< 0.01	52.2	72.3	< 0.01
Low job control, %	46.0	71.1	< 0.01	51.5	71.8	< 0.01
Low worksite social support, %	39.9	47.4	< 0.01	48.2	76.8	< 0.01
Low family social support, %	55.5	69.2	< 0.01	57.2	76.4	< 0.01
Chronic disease history, %	25.5	31.5	0.02	23.7	27.0	0.05
Depression history, %	12.5	21.9	< 0.01	7.2	18.6	< 0.01

A frequency of any sleep disorder of the Jenkins Sleep Evaluation Questionnaire of > 4 (> = 15 days per the previous month) was used to define the group of public officials with sleep disorders

[a] According to the Mann–Whitney or the Chi-square test

[b] Median (interquartile range), all such variables

Table 2 Frequency scores for the different sleep disorders (during the past month) of the Jenkins Sleep Evaluation Questionnaire among Egyptian female and male public officials

	Female public officials						Male public officials					
	Not at all	**1–3 days**	**4–7 days**	**8–14 days**	**15–21 days**	**22–30 days**	**Not at all**	**1–3 days**	**4–7 days**	**8–14 days**	**15–21 days**	**22–30 days**
"Have trouble falling asleep?"	746 (46.0%)	486 (29.9%)	193 (11.9%)	90 (5.5%)	48 (3.0%)	60 (3.7%)	926 (60.9%)	388 (25.5%)	115 (7.6%)	47 (3.0%)	22 (1.5%)	22 (1.5%)
"Wake up several times per night but did not have trouble falling asleep again?"	521 (32.1%)	626 (38.6%)	215 (13.2%)	131 (8.1%)	50 (3.1%)	80 (4.9%)	710 (46.7%)	502 (33.0%)	176 (11.6%)	46 (3.0%)	37 (2.5%)	49 (3.2%)
"Wake up one or more times per night (including waking far too early) and have trouble falling asleep again?"	644 (39.7%)	501 (30.9%)	222 (13.7%)	113 (6.9%)	80 (4.9%)	63 (3.9%)	822 (54.1%)	423 (27.8%)	141 (9.3%)	60 (3.9%)	32 (2.1%)	42 (2.8%)
"Wake up after your usual amount of sleep feeling tired or worn out?"	482 (29.7%)	425 (26.2%)	257 (15.8%)	170 (10.5%)	152 (9.4%)	137 (8.4%)	702 (46.2%)	393 (25.9%)	179 (11.8%)	124 (8.1%)	52 (3.4%)	70 (4.6%)

Table 3 Factors responsible for sleep disorders among Egyptian female and male public officials in a logistic regression model

	Female public officials		Male public officials	
	Univariate OR (95% CI)	Adjusted OR (95% CI)[a]	Univariate OR (95% CI)	Adjusted OR (95% CI)[a]
Age	0.98 (0.97–0.99)*	0.98 (0.97–1.00)*	0.96 (0.95–0.97)*	0.96 (0.95–0.98)*
Residence				
Rural (ref)	1.00	1.00	1.00	1.00
Urban	1.33 (1.06–1.68)*	1.24 (0.95–1.61)	1.73 (1.30–2.31)*	1.54 (1.10–2.17)*
Education				
≤ High school (ref)	1.00	1.00	1.00	1.00
Vocational	2.14 (1.35–3.38)*	1.74 (1.06–2.83)*	1.11 (0.73–1.69)	0.77 (0.49–1.23)
University or above	2.45 (1.64–3.66)*	1.69 (1.03–2.76)*	1.25 (0.88–1.78)	0.59 (0.36–0.97)*
Occupation				
Professional (ref)	1.00	1.00	1.00	1.00
Clerk	0.65 (0.49–0.86)*	0.93 (0.66–1.31)	0.86 (0.62–1.18)	0.92 (0.64–1.34)
Manual or technical	0.68 (0.46–1.00)*	0.94 (0.57–1.55)	0.77 (0.51–1.17)	0.81 (0.48–1.39)
Household income				
Lowest (ref)	1.00	1.00	1.00	1.00
Middle	1.40 (107–1.84)*	1.26 (0.92–1.71)	1.47 (1.02–2.14)*	1.34 (0.91–2.64)
Highest	3.08 (1.55–6.09)*	3.64 (1.71–7.73)*	1.91 (0.61–5.96)	1.65 (0.49–5.57)
Smoking				
Never (ref)	1.00		1.00	
Former	0.70 (0.08–6.31)		1.06 (0.77–1.45)	
Current	0.70 (0.08–6.31)		0.83 (0.49–1.43)	
METs unit of physical activity	1.00 (0.99–1.01)		1.01 (0.99–1.02)	
Body mass index	1.03 (1.01–1.06)*	1.03 (1.01–1.07)*	1.03 (1.03–1.05)*	1.02 (1.01–1.07)*
Marital status				
Married (ref)	1.00	1.00	1.00	1.00
Divorced	1.11 (0.56–2.18)	1.80 (0.67–4.80)	0.99 (0.22–4.40)	1.12 (0.21–5.57)
Widowed	0.88 (0.52–1.49)	1.45 (0.61–3.50)	0.58 (0.08–4.54)	0.99 (0.11–9.02)
Single	1.12 (1.83–1.53)	1.03 (0.48–2.20)	2.18 (1.43–3.33)*	1.10 (0.48–2.51)
Spouse employment				
No (ref)	1.00	1.00	1.00	1.00
Yes	0.52 (0.39–0.68)*	0.75 (0.53–1.08)	0.81 (0.60–1.09)	1.26 (0.89–1.79)
Family type				
Nuclear (ref)	1.00	1.00	1.00	1.00
Multigeneration	1.05 (0.82–1.36)	0.85 (0.43–1.69)	1.49 (1.02–2.17)*	0.86 (0.44–1.68)
Living alone	0.53 (0.15–1.84)	0.68 (0.16–2.86)	1.51 (0.56–4.07)	1.13 (0.33–3.83)
Total family members	0.94 (0.89–0.99)*	1.02 (0.95–1.10)	0.96 (0.91–1.02)	0.96 (0.87–1.06)
Minor family members	0.95 (0.88–1.03)		0.96 (0.88–1.03)	
Job hours	1.02 (0.96–1.09)	1.02 (0.94–1.11)	1.12 (1.06–1.20)*	1.04 (0.94–1.15)
Shift work				
No night shifts (ref)	1.00	1.00	1.00	1.00
Night shifts	1.36 (1.02–1.82)*	1.15 (0.86–1.96)	1.31 (0.94–1.82)	1.29 (0.90–1.94)
Extra job				
No (ref)	1.00	1.00	1.00	1.00
Yes	1.61 (1.19–2.18)*	1.20 (0.85–1.68)	2.22 (1.66–2.98)*	1.60 (1.16–2.23)*
Job demands				
Low (ref)	1.00	1.00	1.00	1.00
High	2.77 (2.17–3.55)*	1.50 (1.01–2.26)*	2.38 (1.74–3.27)*	1.61 (1.02–2.39)*
Job control				
High (ref)	1.00	1.00	1.00	1.00

Table 3 (continued)

	Female public officials		Male public officials	
	Univariate OR (95% CI)	Adjusted OR (95% CI)[a]	Univariate OR (95% CI)	Adjusted OR (95% CI)[a]
Low	2.88 (2.27–3.66)*	1.96 (1.31–2.94)*	2.40 (1.76–3.29)*	1.65 (1.09–2.74)*
Worksite social support				
High (ref)	1.00	1.00	1.00	1.00
Low	2.03 (1.62–2.54)*	1.08 (0.79–1.49)	2.16 (1.60–2.92)*	1.89 (0.56–3.42)
Family social support				
High (ref)	1.00	1.00	1.00	1.00
Low	1.80 (1.42–2.28)*	0.81 (0.57–1.16)	2.42 (1.74–3.37)*	1.63 (1.06–2.52)*
Chronic disease history				
No (ref)	1.00	1.00	1.00	1.00
Yes	1.35 (1.06–1.72)*	1.58 (1.19–2.10)*	1.32 (0.97–1.79)	1.47 (1.04–2.09)*
Depression history				
No (ref)	1.00	1.00	1.00	1.00
Yes	1.97 (1.48–2.63)	1.73 (1.27–2.36)*	2.97 (1.99–4.43)*	2.32 (1.49–3.61)*

* p value < 0.05 indicating a significant association

[a] Adjusted ORs (95%CIs) were estimated by a logistic regression model that simultaneously contained all the significant variables in the univariate analyses (variables that did not reach the level of statistical significance in the univariate analyses were excluded from the multivariable-adjusted model)

Table 4 Stepwise multiple linear regression for factors predicting the sleep disorders JSEQ score among Egyptian female public officials

Variables	Female public officials			
	B	SE	95% CI	Standardized β
Age	−0.04	0.01	−0.06, −0.02	−0.10
Education	0.05	0.02	0.02, 0.09	0.06
Body mass index	0.03	0.01	0.01, 0.05	0.02
Income	0.67	0.22	0.24, 1.10	0.08
Job demands	1.14	0.32	0.50, 1.78	0.14
Job control	−1.04	0.32	−1.67, −0.42	−0.13
Chronic disease history	0.98	0.24	0.51, 1.45	0.11
Depression history	0.12	0.03	1.00, 2.11	0.13

The stepwise linear regression started with a model including age, residence, education, occupation, household income, smoking, physical activity, marital status, spouse employment, family type, number of family members, number of minor family members, job hours, shift work, extra job, job demands, job control, worksite social support, family social support, chronic disease history, and history of depression

The R^2 of the final model = 0.28

Table 5 Stepwise multiple linear regression for factors predicting the sleep disorders JESQ score among Egyptian male public officials

Variables	Male public officials			
	B	SE	95% CI	Standardized β
Age	−0.03	0.01	−0.05, −0.01	−0.09
Residence	0.52	0.18	0.16, 0.87	0.58
Body mass index	0.02	0.01	0.01, 0.04	0.02
Education	−0.03	0.01	−0.05, −0.004	−0.07
Extra job	0.55	0.18	0.20, 0.91	0.08
Worksite social support	−0.82	0.20	−1.21, −0.43	−0.12
Family social support	−0.57	0.20	−0.97, −0.18	−0.08
Chronic disease history	0.77	0.20	0.38, 1.17	0.10
Depression history	1.95	0.32	1.34, 2.56	0.16

The stepwise linear regression started with a model including age, residence, education, occupation, household income, smoking, physical activity, marital status, spouse employment, family type, number of family members, number of minor family members, job hours, shift work, extra job, job demands, job control, worksite social support, family social support, chronic disease history, and history of depression

The R^2 of the final model = 0.39

paid workers who participated in the 2nd Korean Working Conditions Survey (Heo et al. 2013).

There was a higher prevalence of sleep disorders in females than male Egyptian public officials. Similarly, among 1171 daytime Korean workers, the prevalence of sleep disorders was 38.1% in women and 25.8% in men (Kim et al. 2018). In a large French longitudinal study of 21,378 workers, the prevalence of sleep disorders among women increased from 25.7% in 1990 to 29.4% in 1995, and that of men increased from 19.1% to 21.0% (Ribet and Derriennic 1999). The postulated mechanisms for the higher prevalence in women and the different correlates among both genders include the earlier and shorter females' circadian clock than males (Duffy et al. 2011) and the higher domestic burden on working women (Eshak 2019).

There is growing evidence that the risk of sleep disorders increases with age (Evans et al. 2021). However, age in our study was inversely associated with the odds of having sleep disorders in both genders, matching the findings among the Korean working population (Kim et al. 2018). The younger employees might consider sleep limiting their activities; thus, maintaining a regular sleep schedule was not a priority (Kim et al. 2018). Ribet and Derriennic indicated in their large longitudinal French study that the growing prevalence of sleep disorders with age was more attributed to a reduced rate of sleep disorders disappearance than to additional incidences with age (Ribet and Derriennic 1999).

In our study, sleep disorders increased among highly educated women and decreased among highly educated men, which adds to the discrepant association between education level and sleep disorders. Sleep disorders were attributed to lower educational attainment in some studies (Thach et al. 2020) and higher educational attainment in other studies (Yong et al. 2017). Heo et al. (2013) indicated both university or above-, and junior high school-educated Koreans had significantly more sleep disorders than high school graduates. With the possible gender discrimination at the worksite (Jayachandran 2014), highly educated female public officials may have significantly less job satisfaction than males. On the other hand, highly educated females who succeed in attaining a relatively higher employment status may have greater obligations to work, leading to long working hours and inadequate and poor sleep (Heo et al. 2013). This postulation was supported by the finding that women with a high income had significantly higher odds of having sleep disorders.

The association between BMI and sleep disorders is in tone with the previous literature. The elevated levels of cortisol, responsible for the desire to consume energy-dense foods in patients with obesity, were found to play a role in increasing the risk of nocturnal awakening and insomnia (Chan et al. 2018).

The associations between work environment (high job demands, low job control, working an extra job, and shift work) and sleep disorders found among the Egyptian public officials agree with those in other nationalities (Ribet and Derriennic 1999; Kim et al. 2018; Thach et al. 2020). Shift work can disrupt the circadian rhythm. In addition, stressful work environments could induce psychosocial stress, hormonal disturbance of melatonin, cortisol, and other hormones and may initiate/aggravate mental health problems, leading to poor sleep quality (Fernandez-Mendoza and Vgontzas 2013; Heo et al. 2013; Yazdi et al. 2014; Yong et al. 2017).

We found significant associations between physical and mental health statuses and sleep disorders. A consistent high prevalence of sleep disorders was reported in chronically ill patients (Ibrahim and Wegdan 2011; Abd Elsadek et al. 2019; Mansour et al. 2020); however, many longitudinal reports indicated sleep disorders as a risk factor for physical and mental health problems, suggesting bidirectional associations of sleep disorders and health status (Alvaro et al. 2013).

One of the current study's strengths is the subtype analyses of sleep disorders which gave a clear understanding of the correlates. For example, the number of minors in the family emerged to associate with the women's interrupted sleep and waking up too early, which is plausible considering the caregiving role of women in the family. Another example was that job demands were associated with all subtypes of sleep disorders in females. On the other hand, in men, job demands and shift work was associated with difficulties falling asleep, job control was associated with interrupted sleep, and working an extra job was associated with waking up too early and waking up tired. Some researchers pointed out that work overload and shift work could be the most significant occupational precipitating factors of insomnia (Heo et al. 2013; Pilcher & Morris 2020).

Study limitations that should be mentioned include the inability to infer causality for the observed associations between the studied factors and sleep disorders because this was a cross-sectional study. Second, the recruited participants were public officials; thus, we cannot guarantee the generalizability of the study findings to employees in the free enterprise. Third, we studied common self-reported sleep disorders of the JSEQ, which showed a high validity in Egyptians (Eshak 2019); however, JSEQ does not cover other sleep disorders such as sleep apnea syndrome, restless leg syndrome, and hypnotic medication use. Indeed, the prevalence of sleep disorders could vary by using different diagnostic tools to estimate sleep disorders. Longitudinal studies using polysomnography are recommended to confirm the observed associations.

Conclusions

There were gender differences in the prevalence of sleep disorders and the factors correlated with them in Egyptian public officials. Occupational factors were associated with sleep disorders in men and women, while the family's income and the number of minors were correlated in women more than in men. Sleep disorders could consume the employees' health and the organizations' economy; therefore, we recommend the Egyptian government improve the working environment and provide more efficient health coverage for the public officials' physical and mental health problems. Meanwhile, public officials should pay attention to their lifestyle and living arrangements to improve their sleep quality.

Abbreviations
BMI: Body mass index; CI: Confidence interval; JSEQ: The Jenkins sleep evaluation questionnaire; METs: Metabolic equivalent of energy expenditure; OR: Odds ratio.

Supplementary Information

The online version contains supplementary material available at https://doi.org/10.1186/s42269-022-00927-5.

Additional file 1: Table 1. Adjusted odds ratios and 95% confidence intervals of specific sleep disorders according to the studied factors. **Table 2.** Stepwise multiple linear regression for factors predicting the JSEQ score of each sleep disorder among Egyptian female public officials. **Table 3.** Stepwise multiple linear regression for factors predicting the JSEQ score of each sleep disorder among Egyptian male public officials.

Acknowledgements
We thank the Japan Society for the Promotion of Science (JSPS) for providing the research grant for this study. Our deep gratitude to all participating civil workers, the authorities in each visited public service institution, and to Drs. Hager A Zaki, Yasmine N Gaballah, Asmaa M Taha, Sara M Sayed, Shaza F Mohamed, Chrestina M Fekry, Amany M Reda, Nehal R Raouf, Shaimaa M Ahmed, and Maggi M. Ayad of Faculty of Medicine, Minia University. We also thank our colleagues from Osaka University Center of Medical Data Science, Advanced Clinical Epidemiology Investigator's Research Project, for providing their insight and expertise for our research.

Author contributions
ESE designed the research, supervised data collection, analyzed the data, wrote the draft, and provided a critical manuscript review. All authors read and approved the final manuscript.

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Funding
This study was supported by the Japan Society for Promotion of Science (JSPS) fund, grant-in-aid for basic research C general no 19K10621 (2019–2022) to ESE and 18H03057 to HY, Health and Labor Sciences research grants for Comprehensive Research on Cardiovascular and Lifestyle Related Diseases (H29-Junkankitou [Seishuu]-Ippan-003) from the Ministry of Health, Labor and Welfare to HY.

Availability of data and materials
Data are available upon reasonable request to the corresponding author.

Declarations

Ethics approval and consent to participate
According to the declaration of Helsinki, the ethical review boards in Osaka University, Japan (approval # 19501) and Minia University, Egypt (approval # 194:4/2019) approved this study. All participants provided written informed consent.

Consent for publication
Not applicable.

Competing interests
The authors declare that they have no competing interests.

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Received: 1 February 2022 Accepted: 16 August 2022
Published online: 03 September 2022

References

Abdelrehim MG, Eshak ES, Kamal NN (2022) The mediating role of work-family conflicts in the association between work ability and depression among Egyptian civil workers. J Public Health. https://doi.org/10.1093/pubmed/fdac061
Abd Elsadek S, Maabady M, Shafik M (2019) Sleep disorders in Egyptian MS patients: clinical and polysomnography study. Egypt J Hosp Med 75:2921–2929. https://doi.org/10.21608/ejhm.2019.33733
Adams RJ, Appleton SL, Taylor AW, Gill TK, Lang C, McEvoy RD, Antic NA (2017) Sleep health of Australian adults in 2016: results of the 2016 Sleep Health Foundation national survey. Sleep Health 3:35–42. https://doi.org/10.1016/j.sleh.2016.11.005
Alvaro PK, Roberts RM, Harris JK (2013) A systematic review assessing bidirectionality between sleep disturbances, anxiety, and depression. Sleep 36:1059–1068. https://doi.org/10.5665/sleep.2810
American Psychiatric Association (2020) Diagnostic and statistical manual of mental disorders. 4th Ed., text revision. American Psychiatric Association, Washington DC.
Aragón-Arreola JF, Moreno-Villegas CA, Armienta-Rojas DA, De la Herrán-Arita AK (2016) An insight of sleep disorders in Africa. eNurologicalSci 3:37–40. https://doi.org/10.1016/j.ensci.2016.02.006
Chan WS, Levsen MP, McCrae CS (2018) A meta-analysis of associations between obesity and insomnia diagnosis and symptoms. Sleep Med Rev 40:170–182. https://doi.org/10.1016/j.smrv.2017.12.004
Duffy JF, Cain SW, Chang AM, Phillips AJ, Munch MY, Gronfier C et al (2011) Sex difference in the near-24-hour intrinsic period of the human circadian timing system. Proc Natl Acad Sci USA 108:15602–15608. https://doi.org/10.1073/pnas.1010666108
Eshak ES (2019) Work-to-family conflict rather than family-to-work conflict is more strongly associated with sleep disorders in Upper Egypt. Ind Health 57:351–358. https://doi.org/10.2486/indhealth.2018-0091
Eshak ES, Abdelrahman TA (2022) Depression in public servants of Upper Egypt: gender-specific prevalence and determining factors. J Prev. https://doi.org/10.1007/s10935-022-00690-3
Eshak ES, Baba S, Yatsuya H, Iso H, Hirakawa Y, Mahfouz EM. et al (2022) Work and family conflicts, depression, and "Ikigai": A Mediation analysis in a cross-cultural study between Japanese and Egyptian civil workers. J Epidemiology [In pres].
Eshak ES, Elkhateeb AS, Abdellatif OK, Hassan EE, Mohamed ES, Ghazawy ER, Emam SA, Mahfouz EM (2021) Antecedents of work-family conflict among Egyptian civil workers. JOPH. https://doi.org/10.1007/s10389-021-01641-8
Evans MA, Buysse DJ, Marsland AL, Wright AGC, Foust J, Carroll LW, Kohli N, Mehra R, Jasper A, Srinivasan S, Hall MH (2021) Meta-analysis of age and actigraphy assessed sleep characteristics across the lifespan. Sleep. https://doi.org/10.1093/sleep/zsab088
Fernandez-Mendoza J, Vgontzas AN (2013) Insomnia and its impact on physical and mental health. Curr Psychiatry Rep 15:418. https://doi.org/10.1007/s11920-013-0418-8
Heo YS, Chang SJ, Park SG, Leem JH, Jeon SH, Lee BJ, Rhee KY, Kim HC (2013) Association between workplace risk factor exposure and sleep disturbance: analysis of the 2nd Korean Working Conditions Survey. Ann Occup Environ Med 25:41. https://doi.org/10.1186/2052-4374-25-41
Ibrahim JM, Wegdan OM (2011) Epidemiology of sleep disorders in patients with chronic renal disease in Cairo. Egypt J Egypt Public Health Assoc 86:68–72. https://doi.org/10.1097/01.EPX.0000399136.00486.4e
Ismail DM, Mahran DG, Zarzour AH, Shehata GA (2017) Sleep quality and its health correlates among Egyptian secondary school students. J Soc Behav Health Sci 11:67–79. https://doi.org/10.5590/JSBHS.2017.11.1.5
Inoue Y (2016) Asian specific feature of sleep habits and sleep disorders. Sleep Biol Rhythms 14:123–124. https://doi.org/10.1007/s41105-016-0054-x

Jayachandran S (2014) The roots of gender inequality in developing countries. Northwestern University, Evanston
Jenkins CD, Stanton BA, Niemcryk SJ, Rose RM (1988) A scale for the estimation of sleep problems in clinical research. J Clin Epidemiol 41:313–321. https://doi.org/10.1016/0895-4356[88]90138-2
Kim BI, Yoon SY, Kim JS, Woo KH, Cho SY, Lee H, An JM (2018) Factors related with quality on sleep of daytime workers. Ann Occup Environ Med 30:63. https://doi.org/10.1186/s40557-018-0271-7
Mansour AH, Ayad M, El-Khayat N, El Sadek A, Alloush TK (2020) Post-stroke sleep disorders in Egyptian patients by using simply administered questionnaires: a study from Ain Shams University. Egypt J Neurol Psychiatry Neurosurg. https://doi.org/10.1186/s41983-020-0148-x
Pilcher JJ, Morris DM (2020) Sleep and organizational behavior: implications for workplace productivity and safety. Front Psychol 11:45. https://doi.org/10.3389/fpsyg.2020.00045
Ram S, Seirawan H, Kumar SK, Clark GT (2010) Prevalence and impact of sleep disorders and sleep habits in the United States. Sleep Breath 14:63–70. https://doi.org/10.1007/s11325-009-0281-3
Ribet C, Derriennic F (1999) Age, working conditions, and sleep disorders: a longitudinal analysis in the French cohort E.S.T.E.V. Sleep 22:491–504
Salama AA (2017) Sleep quality in medical students, Menoufia University, Egypt. Egypt Family Med J 1:1–21. https://doi.org/10.21608/efmj.2017.67520
Thach TQ, Mahirah D, Dunleavy G, Zhang Y, Nazeha N, Rykov Y, Nah A, Roberts AC, Christopoulos GI, Soh CK, Car J (2020) Association between shift work and poor sleep quality in an Asian multi-ethnic working population: a cross-sectional study. PLoS ONE 15:e0229693. https://doi.org/10.1371/journal.pone.0229693
The world Bank. Labore force, total-Egypt, Arab Rep. Data from International Labour Organization, ILOSTAT database. 2021. The data retrieved on June 15, 2021. https://data.worldbank.org/indicator/SL.TLF.TOTL.IN?locations=EG (Accessed 13 January 2022).
van de Straat V, Bracke P (2015) How well does Europe sleep? A cross-national study of sleep problems in European older adults. Int J Public Health 60:643–650. https://doi.org/10.1007/s00038-015-0682-y
Yazdi Z, Sadeghniiat-Haghighi K, Loukzadeh Z, Elmizadeh K, Abbasi M (2014) Prevalence of sleep disorders and their impacts on occupational performance: a comparison between shift workers and nonshift workers. Sleep Disord 2014:870320. https://doi.org/10.1155/2014/870320
Yong LC, Li J, Calvert GM (2017) Sleep-related problems in the US working population: prevalence and association with shiftwork status. Occup Environ Med 74:93–104. https://doi.org/10.1136/oemed-2016-103638

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