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Insomnia: prevalence and its impact on excessive daytime sleepiness and psychological well-being in the adult Taiwanese population

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Abstract
Objectives This study examined the national age- and sex-specific prevalence rates of insomnia and excessive daytime sleepiness (EDS), the associations of insomnia symptoms with daytime consequences, and the impact of insomnia on EDS and psychological well-being.
Methods Data of 36,743 men and women aged 18 years and above from the 2005 Survey of Social Development Trends—Health Security in Taiwan were analyzed.
Results Over 25% of the Taiwanese adults experienced insomnia. Difficulty initiating sleep (14.6%) was the most common type of insomnia, followed by early morning awakening (13.9%) and difficulty maintaining sleep (13.4%). The risk of EDS was three times as high for individuals with insomnia as for those without (95% confidence interval of odds ratio: 2.77–3.71). Insomnia status predicted poor psychological well-being even after controlling for sociodemographic factors and health status.
Conclusions Taiwanese adults had a high prevalence of insomnia. Insomnia contributed at least partially to an individual's psychological well-being.

Keywords Difficulty initiating sleep · Difficulty maintaining sleep · Early morning awakening · Excessive daytime sleepiness · Insomnia · Psychological well-being

Abbreviations

EDS	Excessive daytime sleepiness
EMA	Early morning awakening
DIS	Difficulty initiating sleep
DMS	Difficulty maintaining sleep
NT	Taiwanese dollar
OR	Odds ratio
χ^2	Chi-square test

Insomnia is one of the most prevalent psychological health problems in Western countries. The prevalence of insomnia symptoms that occur on a regular basis was 9% in the USA [1], 29% in France [2], and 37.6% in Finland [3]. Prevalence of insomnia has also been reported in Asian countries. Insomnia symptoms occurring at least three nights per week were reported by 17% of individuals surveyed in the Korean general population [4], whereas the overall prevalence of insomnia in the Japanese general population was 21.4% [5]. Although information regarding the national insomnia prevalence rate is lacking in Taiwan, a cross-sectional survey of insomnia in Asian countries revealed that the age-adjusted prevalence of insomnia was 10.3% in Taiwan, which was higher than that in Japan (4%) or Korea (9.9%) [6].

The problem most frequently reported by insomniacs was difficulty maintaining sleep (DMS), followed by

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difficulty initiating sleep (DIS) and early morning awakening (EMA) [4, 5, 7, 8]. Although both the International Classification of Sleep Disorders-Revised [9] and the International Classification of Disorders, 10th edition [10] specify that insomnia may interfere with daytime functioning, the question of whether insomniacs have excessive daytime sleepiness (EDS) remains unanswered.

One may argue that insomnia is a symptom rather than a primary diagnosis, but untreated insomnia will lead not only to increased psychological distress, but also to such clinical conditions as anxiety and depression. Of late, the impact of various sleep difficulties on health outcomes has gained a lot of attention. Insomnia has been demonstrated consistently across studies to be a predictor of depression, anxiety disorders, or other psychological disorders [11]. Although evidence remains inconclusive, it has been suggested that insomnia is a risk factor for cardiovascular disease and mortality [11]. Thus, from the standpoint of public health, it is important to investigate the national prevalence rate of insomnia. The physiological consequences of insomnia have been well studied. However, the impact of insomnia on psychological well-being has received less attention. Moreover, a sex difference in the prevalence of insomnia has been shown consistently across countries [8, 12, 13], with insomnia being more common in women than in men. A female predominance of EDS has also been demonstrated [14]. Thus, studying the national sex-specific prevalence of both insomnia and EDS is of importance. Furthermore, information about the association between various symptoms of insomnia and daytime consequences may aid health care providers in prescribing appropriate treatments for their insomniac patients. Therefore, the objectives of the study were to examine (1) the national age- and sex-specific prevalence rates of insomnia and excessive daytime sleepiness, (2) the association between sleep variables and daytime consequences (i.e., fatigue and excessive daytime sleepiness), and (3) the impact of insomnia on EDS and on psychological well-being.

Methods

This study analyzed data of a nationally representative sample of resident Taiwanese citizens aged 18 years or older. The data were based on the 2005 Survey of Social Development Trends—Health Security conducted by the Directorate-General of Budget, Accounting, and Statistics, Executive Yuan, Taiwan [15]. This cross-sectional survey utilized a stratified two-staged clustered sampling scheme. The target population for the original survey was individuals aged 15 years or older whose households were registered in any one of the 23 counties or cities in Taiwan. The primary sampling unit of the first stage was the neighborhood (or village) within each city and that of the second stage was the household. A total of 870 neighborhoods (or villages) and 13,035 households were sampled, resulting in a 2‰ sampling rate. The original study population was all people over age 15 years living in the sampled households. Trained interviewers collected data through face-to-face interviews. To achieve the designated number of household respondents, a "random sample with replacement" method was used. When respondents refused or could not be reached because of a bad address a replacement household with similar background was selected. There were no missing data. The final sample size for the current analysis was 36,473 (18,081 men, 18,392 women).

Measurements

The original Insomnia Self-Assessment Inventory was developed by the Taiwanese 2001 social trend survey [16], and consists of 13 questions. One of the questions was eliminated from the scale, resulting in a total of 12 questions. The Insomnia Self-Assessment Inventory measures difficulty initiating sleep (DIS), difficulty maintaining sleep (DMS), early morning awakening (EMA), sleep-related worry, restless legs/limb movements, nonrestorative sleep complaints, and daytime fatigue as a result of poor sleep during the past month. There were two DIS questions, one of which asks the subject to identify the occurrence of difficulty in falling asleep as a sleep problem and the other question asks the subjects to indicate the occurrence of taking more than 1 h to fall asleep at night. There were also two DMS questions, one of which asks the subjects to indicate the occurrence of difficulty in falling back to sleep once awake and the other question asks the subjects to indicate the occurrence of waking up more than three times during the night. The EMA question asks the subjects to indicate the occurrence of waking up too early in the morning as a sleep problem.

The questions regarding nonrestorative sleep complaints ask the subjects to indicate the likelihood of reporting the following four problems: (1) difficulty in getting started in the morning, (2) feeling tired upon awakening, (3) feeling that sleep is not refreshing, and (4) feeling unrested despite enough time in bed.

Each question was scored with a five-point (1–5) Likert-type scale with 1 indicating "never," 2 indicating "seldom," 3 indicating "sometimes," 4 indicating "usually," and 5 indicating "all the time." A score of 4 and above ("usually" or "all the time") for each of these questions was used to define the occurrence of the respective problem.

Daytime sleepiness was measured by the Daytime Sleepiness Self-Assessment Inventory. The scale consists of eight questions that assess the likelihood of dozing off or falling asleep during various situations. Each question was

scored with a four-point (1–4) Likert-type scale, with 1 indicating "never," 2 indicating "seldom," 3 indicating "sometimes," and 4 indicating "usually," with a maximal total score of 24. The higher the score, the more severe the daytime sleepiness. Individuals with EDS were determined by those who had a score 15 and above on the Daytime Sleepiness Self-Assessment Inventory [16]. The eight-item Daytime Sleepiness Self-Assessment Inventory had good internal consistency and few redundancies among items. The reliability coefficient was 0.86 in this study sample. Item-total score correlation coefficients ranged from 0.55 to 0.81 and item-item correlation coefficients ranged from 0.28 to 0.7, which were within acceptable ranges.

Psychological well-being was measured by five questions that assessed (1) the level of meaningfulness in life, (2) the level of perceived joyfulness in life, (3) the level of perceived happiness, (4) the level of satisfaction with life, and (5) the level of optimism about future. Each question was scored with a four-point (1–4) Likert-type scale. With the exception of one question—the level of perceived happiness—a higher score indicates a lower level of psychological well-being. Before summing the total score (minimum 5, maximum 20), the score of the inversely scored question was transformed. The Cronbach's alpha of the five-item scale was 0.83. Item-total score correlation ranged from 0.67 to 0.8, suggesting that the internal homogeneity of the instrument was good. Item-item correlation coefficients ranged from 0.36 to 0.58, indicating no redundancy among items.

Perceived health status/level of independence in daily living during the past 3 months was assessed by a single question. The question was rated on a scale of 1–4, with a higher score indicating worse health status and lower level of independence.

Demographic variables including age, sex, marital status, employment status, educational level, and personal annual income in 1,000 Taiwan dollars (NT, 1 US dollar equals 30 NT) were included in the current analysis.

Data recoding and grouping

Data from the 2005 Survey of Social Development Trends—Health Security were recoded and variables were redefined according to the specific aims of the current study. Subjects were classified in terms of the type of insomnia (i.e., DIS, DMS, and EMA). Subjects with DIS were defined as those who scored 4 and above ("usually" or "all the time") on either one the DIS questions. Subjects with DMS were defined as those who scored 4 and above ("usually" or "all the time") on either one of the DMS questions. Subjects with EMA were defined as those who scored 4 and above on the question that inquired about the occurrence of waking up too early in the morning as a sleep problem.

Insomniacs were defined as having at least one of the three types of insomnia symptoms (DIS, DMS, or EMA) whereas those without any insomnia symptom were classified as noninsomniacs.

Statistical procedures

Descriptive analyses were used to determine the age- and sex-specific prevalence rates of different subtypes of insomnia. The chi-square test (χ^2) was used to compare the incidence of different subtypes of insomnia between sexes across all age groups. The proportions of subjects with daytime fatigue and EDS in individuals reporting each insomnia variable were also calculated and odds ratio (OR) was determined using the χ^2 test. The differences in the level of daytime sleepiness and psychological well-being between insomniacs and noninsomniacs were assessed using the *t*-test. The impact of insomnia status on the incidence of EDS, adjusted for age, education level, personal income, perceived health status/level of independence, and sleep duration, and stratified by sex, was assessed using a multivariate logistic regression model. The impact of insomnia status on psychological well-being adjusted for age, education level, personal income, perceived health status/level of independence, and daytime sleepiness, and stratified by sex, was assessed using a multivariate linear regression model.

Results

Sociodemographic data

The age distribution, sex, marital status, employment status, educational level, and personal annual income of the study population are presented in Table 1. As can be seen in Table 1, there were approximately equal numbers of men and women. Most of the study subjects had an educational level of high school or below.

Prevalence of insomnia

Among the whole study sample, 9,298 subjects (25.5%) had at least one insomnia symptom (DIS, DMS, or EMA) and were classified as insomniacs. The insomnia prevalence rate was 13.9%, 24.3%, and 44.3% in the 18–39 years old, 40–59 years old, and ≥60 years old groups, respectively. In men, the prevalence of insomnia was 12%, 21.5%, and 40.8% in the 18–39 years old, 40–59 years old, and ≥60 years old groups, respectively. Among women, the insomnia prevalence rate was 15.3%, 27%, and 47.7% in the 18–39 years old, 40–59 years old, and ≥60 years old groups, respectively.

Table 1 Sociodemographic data of the study population

Variable	*n* (%)
Age distribution (years)	
18–39	13,277 (36.4)
40–59	13,944 (38.2)
≥60	9,252 (25.4)
Sex	
Male	18,081 (49.6)
Female	18,392 (50.4)
Marital status	
Married	22,866 (62.7)
Not married	13,607 (37.3)
Employment status	
Employed	20,315 (55.7)
Not employed	16,158 (44.3)
Education level	
High school and below	27,147 (74.4)
College	8,529 (23.4)
Graduate and above	797 (2.2)
Personal income (1,000 NT/year)	
<200	18,736 (51.4)
≥200 < 400	9,929 (27.3)
≥400 < 1,000	7,170 (19.7)
≥1,000	628 (1.7)

1,000 NT = 33.3 USD

Prevalence of three insomnia symptoms

Among the three insomnia symptoms, DIS (14.6%) was the most frequently reported type of insomnia, followed by EMA (13.9%) and DMS (13.4%). In both the 18–39 years old and the 40–59 years old groups, DIS (7.8% and 14.0%, respectively) was the most common type of insomnia, followed by EMA (6.2% and 12.8%, respectively) and DMS (5.8% and 11.9%, respectively). However, in the group aged 60 years and above, DMS was the most frequently reported type of insomnia, followed by EMA and DIS. The prevalence rates of DIS, DMS, and EMA appeared to increase with age and reached 25.4%, 26.6%, and 26.4% in individuals 60 years of age or older, respectively. Across all age groups, females had a higher prevalence of all insomnia symptoms than males (all $P < 0.05$ by χ^2, Table 2).

Prevalence of excessive daytime sleepiness (EDS)

Among the entire sample 2.8% scored 15 or above on the Daytime Sleepiness Self-Assessment Inventory and were classified as having EDS. The prevalence of EDS increased with advancing age; only 1.1% of the individuals aged 18–39 years experienced EDS and the prevalence of EDS reached 6% in individuals aged 60 years and above. Among males, 2.7% experienced EDS whereas, 2.8% of females had EDS; the prevalence of EDS increased with advancing age in both sexes (Table 2).

Prevalence of sleep variables and associations with daytime consequences

Early morning awakening, the report of feeling the sleep is unrefreshed, feeling tired upon awakening, the report of difficulty in falling asleep, feeling unrested despite enough time in bed, and sleep-related worry were the top six reported sleep variables. Sleep duration 5 h or less was reported by 3.2% of the sample, and was the least commonly reported sleep complaint. Of the sample 9.3% reported daytime fatigue as a result of poor sleep. As can be seen from Table 3, the sleep variables most likely to be associated with daytime fatigue were feeling unrested despite enough time in bed (OR = 85.2), followed by feeling the sleep is unrefreshed (OR = 68.4), feeling tired upon awakening (OR = 45.2), and worry about not getting enough sleep (OR = 16.9). Sleep duration of 5 h or less (OR = 4.8) was least associated with daytime fatigue. Restless legs/limb movements (OR = 8.4) was the variable most likely to be associated with EDS, followed by feeling unrested despite enough time in bed (OR = 8.0), feeling the sleep is unrefreshed (OR = 7.4), feeling tired upon awakening (OR = 6.5), and worry about not getting enough sleep (OR = 6.5). Again, sleep duration of 5 h or less (OR = 3.3) was least associated with EDS.

Impact of insomnia on excessive daytime sleepiness

Insomniacs had a significantly higher sleepiness score than did noninsomniacs (14.5 ± 4.9 versus 11.8 ± 3.6; $t = 47.6$, $P < 0.001$). Univariate analyses revealed that age group, marital status, employment status, education level, personal income level, perceived health status/level of independence, and shorter sleep duration (≤5 h) were significantly related to the incidence of EDS (all $P < 0.0001$ by χ^2 or Fisher's exact test). Sex, however, was not significantly related to incidence of EDS ($P = 0.483$). Because marital status was significantly related to age distribution ($P < 0.0001$), and employment status was significantly related to the level of personal income ($P < 0.0001$), marital status and employment status were not entered into the logistic regression model. Multivariate logistic regression analysis with EDS as a binary dependent variable revealed that insomnia status, worse perceived health status/level of independence, older age, and shorter sleep duration independently predicted incidence of EDS (Table 4).

Table 2 Age-specific prevalence of three subtypes of insomnia and excessive daytime sleepiness in Taiwanese men and women

	Men (n = 18,081)				Women (n = 18,392)			
	18–39 years (%)	40–59 years (%)	≥60 years (%)	Total (%)	18–39 years (%)	40–59 years (%)	≥60 years (%)	Total (%)
DIS	5.22	9.10	15.47	9.32	6.10	11.83	23.51	12.68
DMS	2.52	5.79	18.37	7.82	5.24	9.72	21.24	10.98
EMA	5.55	11.41	24.44	12.62	6.74	14.22	28.44	15.07
EDS	1.3	2.1	5.5	2.7	1.0	2.3	6.4	2.8

DIS, Difficulty initiating sleep; DMS, difficulty maintaining sleep; EMA, early morning awakening; EDS, excessive daytime sleepiness

Table 3 Prevalence of sleep variables and association with daytime consequences (n = 36,473)

Variables	Prevalence (%)	Proportion with daytime fatigue (%) (odds ratio)	Proportion with EDS (%) (odds ratio)
Nighttime sleep complaints (A–C)			
(A) Difficulty initiating sleep			
Reporting difficulty falling asleep	12.3	38.9 (11.7)*	9.0 (5.2)*
Sleep latency > 60 min	11.0	40.4 (11.7)*	9.1 (5.0)*
(B) Difficulty maintaining sleep			
Awakening > 3 times/night	9.4	37.7 (8.9)*	10.6 (6.0)*
Difficulty falling back to sleep once awake	9.1	42.2 (11.4)*	10.9 (6.2)*
(C) Early morning awakening	13.9	27.1 (5.4)*	8.9 (5.4)*
(D) Worry about not getting good sleep	11.1	45.8 (16.9)*	10.6 (6.5)*
(E) Restless legs/limb movement	5.7	43.0 (9.6)*	14.9 (8.4)*
(F) Sleep duration ≤ 5 h	3.2	31.3 (4.8)*	8.0 (3.3)*
Nonrestorative sleep complaints (G–J)			
(G) Difficulty in getting started in the morning	7.9	43.5 (11.3)*	10.0 (5.1)*
(H) Feeling tired upon awakening	12.3	56.1 (45.2)*	10.2 (6.5)*
(I) Reporting feeling that sleep is not refreshing	12.9	58.5 (68.4)*	10.7 (7.4)*
(J) Feeling unrested despite enough time in bed	11.8	63.9 (85.2)*	11.5 (8.0)*
(K) Daytime fatigue	9.3		
(L) EDS	2.8		

EDS, Excessive daytime sleepiness

* All $P < 0.0001$

Impact of insomnia on psychological well-being

The insomniacs had significantly higher psychological well-being scores than did noninsomniacs (13.8 ± 2.7 versus 12.5 ± 2.4, $t = 40.3$, $P < 0.001$), suggesting that insomniacs had poor psychological well-being. Daytime sleepiness score significantly correlated to psychological well-being ($r = 0.22$; both $P < 0.01$). Univariate analyses revealed that age, sex, marital status, employment status, educational level, personal income level, health status, and hours of sleep per day were significantly associated with psychological well-being (data not shown). Multivariate regression analysis with psychological well-being as the dependent variable revealed that insomnia status ($P < 0.0001$), higher daytime sleepiness score ($P < 0.0001$), shorter sleep duration ($P = 0.0001$), worse perceived health status/level of independence ($P < 0.0001$), lower educational level ($P < 0.0001$), younger age ($P < 0.0001$), and being female ($P = 0.003$) independently predicted poor psychological well-being ($R^2 = 0.14$, $P < 0.0001$, Table 5).

Discussion

Over one-quarter of the adult Taiwanese population experienced insomnia that occurred on a regular basis. Among three subtypes of insomnia, DIS was reported by almost 15% of the subjects and was the most common type of insomnia in the Taiwanese adult population. The prevalence of insomnia increased with age and the proportion of older Taiwanese adults (≥60 years) who reported DIS, DMS, or EMA as a sleep problem was sizable (over 40%). Females had a higher prevalence of all types of insomnia than men in this survey. The current analysis revealed that the national

Table 4 Determinants of excessive daytime sleepiness from the multivariable logistic regression model

Variable	Coefficient (β)	SE	OR (e^{β})	95% CI of OR	*P*
Insomnia	1.165	0.074	3.21	2.77–3.71	<0.001
Health[a]					
Health (1)	1.157	0.111	3.18	2.56–3.95	<0.001
Health (2)	1.751	0.125	5.76	4.05–7.37	<0.001
Health (3)	2.937	0.222	14.08	10.39–19.91	<0.001
Age[b]					
Age (1)	0.293	0.102	1.341	1.10–1.64	<0.001
Age (2)	0.622	0.012	1.863	1.56–2.28	<0.001
Sleep deprivation	0.484	0.118	1.622	1.29–2.05	<0.001

CI, Confidence interval; OR, odds ratio; SE, standard error

Health = perceived health status/level of independence

Sleep deprivation = ≤5 h of sleep per day

[a] Reference = in good health; (1) = on average; (2) = not healthy but independent in daily living; (3) = not healthy and dependent in daily living

[b] Reference = 18–39 years; (1) = 40–59 years; (2) = ≥60 years

Table 5 Determinants of psychological well-being from the multiple linear regression model

Variable	Coefficient (β)	SE	*P*
Insomnia	0.092	0.032	<0.0001
Sleepiness score	0.116	0.003	<0.0001
Sleep duration (h)	−0.023	0.011	<0.0001
Health	0.258	0.020	<0.0001
Education	−0.065	0.027	<0.0001
Age (years)	−0.021	0.001	<0.0001
Sex	−0.014	0.025	0.003

$R^2 = 0.14$, $F = 810.59$, $P < 0.0001$

SE, standard error; Insomnia, insomnia status; Health, level of perceived health status/independence; Education, level of education

prevalence rate of EDS in Taiwan was 2.8% and was comparable between sexes; the prevalence of restless-legs syndrome in the Taiwanese adult population was 5.7%.

Findings from this study revealed that individuals reported nonrestorative sleep complaints, such as feeling unrested despite enough time in bed, feeling the sleep is unrefreshed, and feeling tired upon awakening, and sleep-related worry were more likely to suffer from daytime fatigue and EDS than were individuals with difficulty in initiating sleep or fragmented sleep, or those who slept less than 5 h day. These findings coincide with the results from a previous study in that nonrestorative sleep caused greater daytime impairment than difficult initiating or maintaining sleep [17].

Of notice is that health status was the variable with the greatest impact on EDS. Similarly, health status was the variable that had the greatest impact on poor psychological well-being. Nevertheless, this study confirmed the significant impact of insomnia on daytime sleepiness as we found that insomnia status independently predicted the incidence of EDS with a high OR and a narrow confidence interval for OR even after controlling for the effects of socioeconomic factors and perceived health status. The risk of EDS was three times as high for individuals with insomnia as for those without insomnia. The association between poor psychological well-being and insomnia has been previously demonstrated [18]. Findings from this study also confirmed the notion that poor sleep and its consequences impact on an individual's psychological status as we found that both the insomnia status and sleepiness score significantly impacted on an individual's psychological well-being, even after controlling for the effects of socioeconomic factors and perceived health status.

Similar to previous studies [4, 8], prevalence of insomnia in Taiwan increased with advancing age. Although changes in sleep patterns occur with the normal aging process, the higher prevalence of insomnia in the elderly could be due to poor health status and/or increased comorbidities [19]. Given the impact of insomnia on an individual's psychological well-being and the high prevalence of insomnia in the elderly population, finding strategies to combat poor sleep is of utmost importance in the efforts to improve the quality of life of the elderly people. Similar to previous surveys [8, 12, 16], females had a higher prevalence in all types of insomnia in this survey. A prior survey of the Taiwanese population demonstrated that the differences in social roles only partly explain the sex discrepancy in insomnia [16]. Thus, the insomnia epidemic in women and reasons for the higher level of insomnia warrants further investigation.

The prevalence of restless-legs syndrome in the Taiwanese adult population was 5.7%, which was much lower than that reported by a US poll [20]. Consistent with findings from the National Sleep Foundation Sleep in America 2005 poll, in which patients reporting symptoms of restless-legs syndrome experienced significantly more daytime problems [20], in this study restless legs or limb movements had a strong association with EDS. Although the pathophysiology of restless-legs syndrome is still poorly defined, it has been consistently reported to be associated with daytime consequences. Given the impact of restless-legs syndrome on daytime functioning, health care providers must not underplay the clinical significance of restless-legs syndrome.

Consistent with previous findings [6], prevalence of insomnia in the adult Taiwanese general population was higher than that of the South Korean general population [4]

or that of the Japanese general population [5] but was lower than that reported by European national surveys [2, 3]. Moreover, the prevalence rates of DIS, DMS, and EMA in the Taiwanese adult population were higher than those of other populations in Asian regions, such as South Koreans [4] and Hong Kong Chinese [7]. These differences could be explained by increasing Westernization of lifestyles in Taiwan.

Findings from this study revealed that the daytime sleepiness score was significantly higher in insomniacs than in noninsomniacs and that the insomnia status significantly predicted the incidence of EDS, supporting the notion that daytime sleepiness is a symptom frequently encountered by individuals with insomnia. Therefore, insomnia and associated daytime consequences call for more research efforts in finding effective care if not cure. Findings from this study also reveal that both insomnia status and sleepiness score significantly impacted an individual's psychological well-being even after controlling for the effects of socioeconomic factors and perceived health status. Health care providers must reconsider insomnia as not just a symptom but rather a clinical entity that may require medical attention. Nevertheless, bear in mind that health status was the variable with the most important contribution to an individual's psychological well-being.

Limitations of the study

It has been consistently demonstrated in previous studies that people tend to subjectively overestimate their sleep difficulties [21–24] possibly due to misperception of sleep. Thus, a primary limitation of this study is the use of subjective estimates of insomnia and daytime sleepiness. A second limitation of the study is the cross-sectional nature of the analyses. Although we found that insomnia status independently predicted both incidence of EDS and perception of psychological well-being, we were unable to discern the causal direction of these relationships. Lastly, people with comorbidities and poor health status could be very likely taking medications that might adversely affect sleep and/or cause EDS. As information on medications was not available for analysis, one cannot rule out the confounding effect of medication use on EDS.

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