

Risk of insomnia and hypnotics use among emergency physicians

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Abstract: This study investigated the risk of insomnia and hypnotics use among emergency physicians. This cross-sectional study recruited physicians working in Taiwanese hospitals in 2015 and the general population as the participants. Data from 1,097 emergency physicians obtained from the National Health Insurance Research Database were grouped into the case group, whereas 14,112 nonemergency physicians and 4,388 people from the general population were categorized into the control groups. This study used logistic regression and conditional logistic regression to compare the risks of insomnia between emergency and nonemergency physicians and between emergency physicians and the general population, respectively. The prevalence of insomnia among emergency physicians, nonemergency physicians and general population was 5.56%, 4.08%, and 1.73%, respectively. Compared with nonemergency physicians and the general population, emergency physicians had a significantly higher risk of insomnia. The proportions of emergency physicians, nonemergency physicians, and general population using hypnotics were 19.96%, 18.24%, and 13.26%, respectively. Among emergency physicians who used hypnotics, 49.77%, 25.57%, and 24.66% used only benzodiazepines, only nonbenzodiazepines, and both benzodiazepines and nonbenzodiazepines, respectively. Nonpharmacological interventions to improve insomnia and reminder of safe use of hypnotics to emergency physicians can serve as references for hospitals in developing health-promoting activities.

Key words: Emergency physicians, Insomnia, Hypnotics, Prevalence, Risk factors

Introduction

Emergency physicians are required to do shift work and are exposed to high stress levels and burnout, which makes them prone to insomnia. Studies have shown that emergency physicians doing shift work experience poor sleep quality and sleepiness^{1–4}. Burnout is markedly

common among physicians. In fact, of all specialized physicians, emergency physicians have the highest burnout rate (frequently over 50%)^{5–7}. Studies have indicated that emergency physicians perceive considerable stress in their work, and such occupational stress is the cause of high burnout prevalence among them^{8, 9}. Handel *et al.* found that many emergency medicine resident physicians have difficulty falling asleep due to workplace-related stress¹⁰.

Insomnia can lead to deteriorating health, increased health care use, absence from work, reduced productivity, nonmotor-vehicle accidents, and poorer quality of life^{11, 12}. The

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health of physicians is important not only to the physicians themselves but also to ensure the provision of high-quality health care¹³).

Pharmacologic treatment is commonly used for insomnia disorders. Studies have found that emergency physicians or resident emergency physicians frequently experience sleep problems before and after shifts and that they generally use drugs to help them fall asleep. Francis *et al.* pointed out that 67% of emergency physicians had used pharmacologic sleep aids¹⁴); Ferguson *et al.* reported that 34% of emergency physicians used medication to help fall asleep³); Shy *et al.* noted that 38% of emergency medicine residents used sedative agents to help fall asleep¹⁵); Handel *et al.* stated that 55.7% of emergency medicine residents used pharmaceuticals, homeopathic remedies, and alcohol to help fall asleep¹⁰).

Hypnotics are the most commonly used drugs to treat patients with insomnia. However, they have certain side effects. Benzodiazepines (BZDs) and new-generation non-BZDs (also called Z drugs) are 2 commonly used prescription drugs to treat insomnia. Nevertheless, use of hypnotics increase the risks of excess mortality, infection, cancer, depression, automobile crashes, falls, other accidents, and hypnotics withdrawal insomnia¹⁶). A previous review reported that using hypnotics for insomnia may lead to cognitive and behavioral changes and sometimes serious hazard¹⁷).

Understanding the risk of insomnia and hypnotics use among emergency physicians can serve as a reference for promoting health promotion activities in the workplace. In contrast to studies that used questionnaires that required participants to self-report their insomnia or use of sleep aids, this study compiled a large amount of effective reliable data from the National Health Insurance Research Database (NHIRD)^{18, 19}). This study determined the diseases and drugs used from the physician-confirmed diagnoses based on the International Classification of Diseases (ICD) codes and the prescribed hypnotics. Additionally, this study recruited a total of 1,097 emergency physicians who practiced in Taiwan in 2015 as the study participants. This number was considerably larger than that in other studies that presented the limitation of small sample sizes¹).

Subjects and Methods

Data sources

Implemented in 1995, Taiwan's National Health Insurance is a publicly-run, single insurer-based system. In 2015, 99.9% of the 23.74 million people in Taiwan were covered

by the National Health Insurance. The NHIRD is managed by the Department of Statistics; and NHIRD data are provided by the National Health Insurance Administration (of the Ministry of Health and Welfare). The NHIRD contains medical records such as the clinical diagnoses of outpatients, hospitalized patients, and emergency room patients and the pharmacologic and medical treatment provided to such patients. All diagnoses were made according to the ICD-9-CM (before 2016) and ICD-10 (after 2016) diagnostic codes. The personal data in NHIRD are de-identified before releasing them for research use. To use such data for research purposes, applications approved by an institutional review board (IRB) and in compliance with relevant review regulations must be submitted to the Health and Welfare Data Science Center (of the Department of Statistics, Ministry of Health and Welfare). This study was approved by the IRB of Jen-Ai Hospital (JAH-IRB-201850).

Study subjects and definition

In this study, emergency physicians were defined as those who actually provided emergency services in 2015 as opposed to those with specialist certificates. The following criteria were used to assess the physicians' specialties and determine their eligibility for inclusion in this study: 1. The medical specialties that the physicians practiced the most (based on the appointments made by patients) were considered the physicians' specialties; 2. The physicians must have practiced as physicians for 12 months in 2015; and 3. The medical specialties that the physicians practiced the most for the most number of months were considered their specialties (for example, a physician may have practiced internal medicine the most for 2 months, general medicine the most for 3 months, and emergency medicine the most for 7 months. For such a physician, his/her medical specialty would be emergency medicine). Physicians who practiced in clinics, had less than 12 patient visits per month (i.e., less than 3 patient visits per week), and whose genders were unknown were excluded. Finally, 1,097 emergency physicians and 14,112 nonemergency physicians serving in hospitals were recruited. To investigate whether emergency physicians were exposed to a higher risk of insomnia than the control group, this study divided the control group into internal and external groups; the internal group comprised 14,112 nonemergency physicians, and the external group comprised 4,388 people from the general population. The 4,388 people were age- and sex-matched through propensity-score matching at a selection ratio of 1:4. This study obtained demographic variables (i.e., age and sex) of physicians and the general population

from the Registry for Beneficiaries, variables (i.e., physician specialty, insomnia, and comorbidity) from the “ambulatory care expenditure by visits”, and related variables (i.e., hypnotics usage) from the “ambulatory care expenditure by visits” and “details of ambulatory care orders”.

Definition of the variables

The participants were confirmed to experience insomnia if their outpatient primary or secondary diagnoses contained the ICD-9 codes 307.41, 307.42, or 780.52 at least 3 times in 2015. Additionally, they were confirmed to have comorbidities if their primary or secondary diagnoses contained at least 2 of the following ICD-9 codes at least 3 times in 2015: (a) depression (ICD-9 codes: 296.2, 296.3, 300.4, or 311), (b) anxiety (ICD-9 code: 300.00), (c) diabetes (ICD-9 code: 250), (d) hypertension (ICD-9 codes: 401–405), (e) gastrointestinal diseases (ICD-9 codes: 531–537), (f) asthma (ICD-9 code: 493), (g) cancer (ICD-9 codes: 140–239), and (h) urinary problems (ICD-9 codes: 580–599). This study included participants with comorbidities because comorbidities are also a risk factor of insomnia. Hypnotics use data were obtained from the NHIRD, in which the hypnotics were divided into 2 categories: prescribed BZDs and non-BZDs. Prescribed BZDs included alprazolam, bromazepam, brotizolam, chlordiazepoxide, clobazam, clonazepam, diazepam, estazolam, fludiazepam, flunitrazepam, flurazepam, lorazepam, medazepam, nitrazepam, nordazepam, oxazepam, oxazolam, and triazolam. Prescribed non-BZDs included eszopiclone, zaleplon, zopiclone, and zolpidem. To understand hypnotics use among emergency physicians, this study first analyzed the proportion of emergency physicians who used them and later divided the emergency physicians into 3 categories: those who used only BZDs, those who used only non-BZDs, and those who used both BZDs and non-BZDs.

Statistical analysis

This study conducted a χ^2 test and t-test to determine whether the demographic characteristics and comorbidities differed between emergency physicians and the control groups. Logistic regression was employed to compare the risk of insomnia between emergency physicians and nonemergency physicians, whereas conditional logistic regression was employed to compare the risk of insomnia between emergency physicians and the general population. Next, a descriptive statistical analysis was performed to investigate the hypnotics use proportions among the different participant groups as well as the types of hypnotics that the emergency physicians used.

Results

The participants of this study comprised 1,097 emergency physicians, 14,112 nonemergency physicians, and 4,388 people from the general population. The 4,388 people were recruited by matching in terms of age and sex through propensity matching at a selection ratio of 1:4 (Table 1). The average age of the emergency physicians was 43.81 yr and that of the nonemergency physicians was 48.71 yr ($p<0.001$). The emergency physicians aged 39–48 yr accounted for the highest percentage (39.38%), whereas nonemergency physicians aged ≥ 49 yr accounted for the highest percentage (47.84%); the differences in age group between the 2 groups were significant ($p<0.001$). Approximately 89.97% of emergency physicians were male, whereas 83.74% of nonemergency physicians were male; the difference between the 2 groups was significant ($p<0.001$). Compared with nonemergency physicians, fewer emergency physicians had hypertension (11.58% vs. 17.82%, $p<0.001$), gastrointestinal diseases (4.65% vs. 8.12%, $p<0.001$), asthma (0.82% vs. 1.63%, $p=0.038$), cancer (1.82% vs. 4.09%, $p<0.001$), and urinary problems (1.09% vs. 2.56%, $p=0.003$). Compared with the general population, a lower percentage of emergency physicians had cancer (1.82% vs. 3.03%, $p=0.030$) and urinary problems (1.09% vs. 3.01%, $p<0.001$).

The prevalence of insomnia among emergency physicians, nonemergency physicians, and the general population was 5.56%, 4.08%, and 1.73%, respectively. A logistic regression analysis that controlled for age, sex, depression, anxiety, diabetes, hypertension, gastrointestinal diseases, asthma, cancer, and urinary problems revealed that emergency physicians had a significantly higher risk of insomnia than nonemergency physicians did (odds ratio [OR]: 1.586; 95% confidence interval [CI]: 1.189–2.118). A conditional logistic regression analysis that controlled for depression, anxiety, diabetes, hypertension, gastrointestinal diseases, asthma, cancer, and urinary problems revealed that emergency physicians had a significantly higher risk of insomnia than the general population did (OR: 4.443; 95% CI: 2.899–6.810) (Table 2).

Regarding hypnotics use, 219 emergency physicians (19.96%), 2,574 nonemergency physicians (18.24%), and 582 individuals among the general population (13.26%) used them (Table 3).

Among emergency physicians who used hypnotics, 49.77% used only BZDs, 25.57% used only non-BZDs, and 24.66% used both (Table 4).

Table 1. Characteristics of study participants

	Emergency physicians		Nonemergency physicians		<i>p</i>	Emergency physicians		General population		<i>p</i>
	n=1,097		n=14,112			n=1,097		n=4,388		
	n	%	n	%		n	%	n	%	
Age					<0.001					0.999
≤38	362	33.00	2,728	19.33		362	33.00	1,451	33.07	
39–48	432	39.38	4,633	32.83		432	39.38	1,727	39.36	
≥49	303	27.62	6,751	47.84		303	27.62	1,210	27.58	
Age (mean ± SD)	43.81 ± 8.48		48.71 ± 10.42		<0.001	43.81 ± 8.48		43.80 ± 8.46		0.962
Sex					<0.001					1.000
Male	987	89.97	11,818	83.74		987	89.97	3,948	89.97	
Female	110	10.03	2,294	16.26		110	10.03	440	10.03	
Comorbidity										
Depression										
Yes	11	1.00	95	0.67	0.206	11	1.00	61	1.39	0.313
Anxiety										
Yes	21	1.91	253	1.79	0.771	21	1.91	59	1.34	0.159
Diabetes										
Yes	53	4.83	888	6.29	0.053	53	4.83	256	5.83	0.198
Hypertension										
Yes	127	11.58	2,515	17.82	<0.001	127	11.58	445	10.14	0.164
Gastrointestinal diseases										
Yes	51	4.65	1,146	8.12	<0.001	51	4.65	258	5.88	0.114
Asthma										
Yes	9	0.82	230	1.63	0.038	9	0.82	34	0.77	0.878
Cancer										
Yes	20	1.82	577	4.09	<0.001	20	1.82	133	3.03	0.03
Urinary problems										
Yes	12	1.09	361	2.56	0.003	12	1.09	132	3.01	<0.001

Table 2. Comparison of risk for insomnia between emergency physicians and control groups

	Number	%	OR	95% CI
Emergency physicians (n=1,097)	61	5.56	1.586 ^a	1.189–2.118
Nonemergency physicians (n=14,112)	576	4.08	1.00	
Emergency physicians (n=1,097)	61	5.56	4.443 ^b	2.899–6.810
General population (n=4,388)	76	1.73	1.00	

^a: Logistic regression was used to compare the risk for insomnia between emergency physicians and nonemergency physicians after adjusting for age, sex, depression, anxiety, diabetes, hypertension, gastrointestinal diseases, asthma, cancer, and urinary problems.

^b: Conditional logistic regression was used to compare the risk for insomnia between emergency physicians and general population after adjusting for depression, anxiety, diabetes, hypertension, gastrointestinal diseases, asthma, cancer, and urinary problems.

OR: odds ratio; CI: confidence interval.

Table 3. Proportions of using hypnotics among different participant groups

Groups	n	%
Emergency physicians (n=1,097)	219	19.96
Nonemergency physicians (n=14,112)	2,574	18.24
General population (n=4,388)	582	13.26

Table 4. Types of using hypnotics in the emergency physicians

Category	n	%
BZDs	109	49.77
non-BZDs	56	25.57
BZDs and non-BZDs	54	24.66

BZDs: benzodiazepine; non-BZDs: non-benzodiazepines.

Discussion

This is the first study to use physician-confirmed diagnoses through ICD codes and prescribed hypnotics to explore the risk of insomnia and hypnotics use among emergency physicians. The prevalence of insomnia among emergency physicians, nonemergency physicians, and general population was 5.56%, 4.08%, and 1.73%, respectively. Compared with nonemergency physicians and the general population, emergency physicians had a significantly higher risk of insomnia. Regarding hypnotics use, emergency physicians used them the most, followed by nonemergency physicians and the general population. Emergency physicians who used only BZDs accounted for the highest percentage, followed by those who used only non-BZDs and those who used both.

The prevalence of insomnia significantly differed between studies that defined insomnia differently, studies with different populations, and studies with different research methodologies, with a prevalence between 4.4% and 48%²⁰. A study that used Taiwan's NHIRD to assess the long-term insomnia trend of the general population found that from 2002 to 2009, the prevalence of insomnia increased yearly from 2.47% to 4.17%²¹. In the current study, the prevalence of insomnia in the general population was 1.73%, which was lower than that reported in the study conducted by Hsu *et al.*; this was because in the current study, insomnia was defined as meeting the ICD code requirement 3 times as opposed to only one²¹. Moreover, in the current study, 27.58% of the people in the general population were ≥ 49 yr old, whereas 35.6% of the people in the general population were ≥ 50 yr old in the study by Hsu *et al.*²¹; that is, the percentage of people aged 49 yr or older was relatively low in this study. Epidemiological studies have shown that the prevalence of insomnia increased with age and that nearly 50% of older adults over 65 yr of age experienced insomnia²⁰. The prevalence of insomnia in emergency and nonemergency physicians was 5.56% and 4.08%, respectively, which were higher than that in the general population. Presently, studies that investigate insomnia among emergency physicians are limited, and most of these studies used self-reporting questionnaires to obtain the insomnia situations of emergency physicians; these studies presented limitations of low questionnaire recovery rates and small sample sizes. The percentage of emergency physicians experiencing sleep problems ranged from 7% to 84%. In a study, 84% of emergency physicians reported having experienced insomnia¹⁴. Ferguson *et al.* highlighted that 75% of

emergency physicians had sleep disturbances due to shift work³. Handel *et al.* demonstrated that 38% of emergency medicine residents were excessively sleepy and that 7% was severely sleepy¹⁰; Alhifzi *et al.* remarked that 83.8% of emergency physicians experienced daytime sleepiness¹.

This study demonstrated that emergency physicians had a significantly higher risk of insomnia than nonemergency physicians and the general population did. These results are consistent with a study that used Taiwan's NHIRD and found that all specialized physicians had significantly higher odds of insomnia than the general population did²². The reasons that emergency physicians have a higher risk of insomnia than the general population does include working shifts and being exposed to high stress levels and burnout. Kuhn discovered that emergency physicians doing shift work experienced a disrupted circadian rhythm, which in turn negatively affected their bodies and emotions²³. Another study asserted that shift work disrupts the circadian rhythm, which subsequently reduces the secretion of melatonin and cortisol, weakens the homeostasis of glucose and lipids, and causes clock gene rhythm loss, leading to poorer sleep quality and health²⁴. Vela-Bueno *et al.* reported that physicians who are severely burnt out exhibit a high prevalence of insomnia and poor sleep quality²⁵. Additionally, a study affirmed that in Croatia, emergency medicine physicians experienced more stress than health center physicians did²⁶. Utsugi *et al.* declared that occupational stress is a risk factor of insomnia²⁷. Insomnia has a serious effect on the health and lives of people. Many studies have demonstrated that sleep deprivation and shift work are associated with unfavorable health, motor vehicle accidents, increased alcohol and drug use, and serious medical errors among resident physicians²⁸.

To date, all studies on emergency physicians' use of hypnotics have obtained their hypnotics use data from questionnaires. However, the study participants and questionnaire designs differed. Studies have indicated that emergency physicians or resident emergency physicians used hypnotics such as BZDs and/or non-BZDs to help fall asleep before and after shifts^{3, 10, 14, 15}. In contrast to studies that used self-reported-based questionnaire surveys, this study defined emergency physicians as using hypnotics when they were confirmed by physicians and were prescribed hypnotics. Among the 1,097 emergency physicians, 19.96% used hypnotics; emergency physicians who used only BZDs accounted for the highest percentage, followed by those who used only non-BZDs and those who used both. Although several studies have used data from the NHIRD to analyze participants' insomnia

and hypnotics use, they reported different results because of the differing research groups, observation periods, and definitions established. Sang *et al.* stated that from 2004 to 2008, 13.2% of Taiwanese nurses obtained BZD prescriptions through psychiatric outpatient department care, the use of BZDs during the 5 yr period showed an increasing trend, and those who used BZD frequently were exposed to the risk of comorbidities²⁹). The results of the present study differed from those of Lan *et al.*, whose 2000–2009 analysis results revealed that 29% of the general population used hypnotics and that among those who used hypnotics, those who used a mix of hypnotics accounted for the highest percentage, followed by those who used non-BZDs and those who used BZDs³⁰). In this study, emergency physicians were determined to experience insomnia when the disease code for insomnia was listed in their primary or secondary diagnosis. This approach allowed us to acquire more complete samples and interpret whether emergency physicians were indeed experiencing insomnia. Finally, when individuals visit a physician because of diseases other than insomnia, the physician might not instruct them to take hypnotics despite insomnia being listed in secondary diagnosis. This might result in the lower hypnotics usage proportion observed in this study compared with that of Lan *et al.* in addition to the reason that the research period of our study was shorter³⁰). A study reported that from 2002 to 2008, among patients with insomnia, 10.8% used hypnotics without Chinese medicine; the most frequently prescribed hypnotics were BZDs, and due to changes in physicians' prescribing habits, zopiclone became more popular than barbiturate as the coprescribed drug to treat insomnia³¹). Chen *et al.* found that from 2002 to 2007, among patients with long-term insomnia, those who used non-BZDs accounted for the highest percentage, followed by those who used BZDs and those who used a mix of both. Long-term hypnotics use increases the risk of dementia³²). Although BZDs and non-BZDs are the first choice in treating insomnia, their adverse effects include motor vehicle accidents, falls leading to fractures, dementia, infections, pancreatitis, respiratory disease exacerbation, and cancer³³). The emergency physicians' hypnotics use and the type of hypnotics used should be assessed, which can help remind them of the side effects of such hypnotics.

This study had the following limitations. 1. Because of the characteristics of NHIRD data, this study was unable to determine the participants' occupational status such as whether they worked in shifts, their burnout and stress situations, and their sociodemographic determinants (e.g.,

marital status, income, and education), all of which could be confounding factors of insomnia. 2. This study investigated emergency physicians' hypnotics use and the types of hypnotics used; however, the reasons why these hypnotics were prescribed by physicians were unknown, which may be explored in future studies. 3. This study observed the participants for only 1 yr, which may be insufficient. Longer observation periods may be chosen in the future.

Conclusion

The prevalence of insomnia among emergency physicians is higher than that among nonemergency physicians and the general population. Additionally, the risk of insomnia is significantly higher in emergency physicians than in nonemergency physicians and the general population. Approximately 20% of emergency physicians use hypnotics; among them, those who use only BZDs account for the highest percentage. Nonpharmacological interventions to improve insomnia and reminder of safety of hypnotics use to emergency physicians can serve as references for hospitals in developing health-promoting activities for emergency physicians.

Conflicts of Interest

The authors declare no conflicts of interest.

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