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Prevalence and correlates of sleep disorder symptoms in psychiatric disorders

Aditi Hombali[a,*], Esmond Seow[a], Qi Yuan[a], Shi Hui Sherilyn Chang[a], Pratika Satghare[a], Sunita Kumar[b], Swapna Kamal Verma[c], Yee Ming Mok[c], Siow Ann Chong[a], Mythily Subramaniam[a]

[a] Research Division, Institute of Mental Health, Buangkok Green Medical Park, 10 Buangkok View, 539747, Singapore
[b] Division of Pulmonary and Critical Care Medicine, Loyola University, Chicago, IL 60660, USA
[c] Department of General Psychiatry, Institute of Mental Health, 539747, Singapore

ABSTRACT

Difficulty falling asleep or maintaining sleep, poor sleep quality, nightmares, and excessive daytime sleepiness are some of the key clinical symptoms of sleep disturbances observed among individuals with psychiatric illnesses. This study aimed to determine the prevalence of symptoms of sleep disorders including parasomnia, narcolepsy, obstructive sleep apnea, circadian rhythm disorder and restless leg syndrome/periodic limb movement (RLS/PLMS) and its correlates in patients with psychiatric diagnoses. Patients aged 21–65 years (n = 400) attending the outpatient clinics with a primary diagnosis of either schizophrenia, mood or anxiety disorder based on ICD-9 criteria were included in this cross-sectional study. Sociodemographic information was collected and screening questions pertaining to specific symptoms of sleep disorders were administered by a study team member. The overall prevalence of symptoms of sleep disorders in the psychiatric outpatient sample was 40.75% (163/400). The prevalence for symptoms of narcolepsy, sleep breathing disorder, PLMS/RLS, circadian rhythm disorder and parasomnia were 12.5%, 14.5%, 14.8%, 4.5%, and 13.8% respectively. These symptoms were associated with age, low physical activity, and anxiety disorder. Results highlight the high prevalence of symptoms of sleep disorders in psychiatric patients. Present study findings should be confirmed using diagnostic interviews and objective measures.

1. Introduction

Sleep disturbances are commonly observed in the general population and in individuals with psychiatric illnesses. In fact, the highest prevalence of insomnia is observed in psychiatric patients (Ford and Kamerow, 1989). Those suffering from sleep disorders often present with symptoms of discontent with regard to quality of sleep, timing and sleep quantity (APA, 2013) and these symptoms have adverse impact on function and quality of life (McCall et al., 2000; Szentkiralyi et al., 2009). Epidemiological data from the Western populations suggest that the prevalence of various sleep disorders in the general population ranges from 0.047% to 50.5%. The most prevalent disorder was insomnia followed by sleep disordered breathing, restless leg syndrome, nightmares, sleep talking, sleep walking and narcolepsy (Kim et al., 2004; Nowicki et al., 2016; Ohayon et al., 1999; Ohayon et al., 2002; Schrader et al., 1993; Spoormarker and Bout, 2005; Tison et al., 2005). Further, Benca and colleagues have found in their meta-analysis that sleep disturbances were highly prevalent in psychiatric disorders (Benca et al., 1992) and associated with greater mental health service use (Kaufmann et al., 2011).

Difficulty falling asleep or maintaining sleep, poor sleep quality, nightmares, and excessive daytime sleepiness are some of the key clinical symptoms of sleep disturbances observed in people with major depression, generalized anxiety disorder, bipolar disorder and post-traumatic stress disorder (APA, 2013; McCall et al., 2000; Monti and Monti, 2000, 2005). For instance, up to 90% of patients with depression have reported sleep disturbances (McCall et al., 2000), 23% to 78% of patients with bipolar disorder have reported symptoms of hypersomnia (Harvey, 2008) and 60%–70% of the patients with generalized anxiety disorder and panic disorder have reported prominent sleep disturbances (Arriaga et al., 1996; Fuller et al., 1997). These sleep disturbances can have a negative impact on the course and treatment of psychiatric illness, increase the risk of relapse of depressive episodes (Asnis et al., 1999); suicidal ideation (Agargun et al., 1997; Sjostrom et al., 2007); and development of mania in bipolar disorder or psychotic episode in schizophrenia (Chemerinski et al., 2002; Wehr, 1991).

A number of studies suggest that psychiatric medications have positive as well as negative effects on sleep and have the potential to precipitate certain sleep disorders. For example, some antidepressants may cause or exacerbate periodic limb movement/restless leg syndrome

* Corresponding author.
E-mail address: Aditi_HOMBALI@imh.com.sg (A. Hombali).

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(Hoque and Chesson, 2010), while some improve sleep onset and sleep continuity (Winokur et al., 2000); antipsychotics enhance sleep, but also cause weight gain which may be a risk factor for developing sleep disordered breathing, restless legs syndrome and periodic limb movements (Krystal et al., 2008). However, very few studies have concomitantly investigated the prevalence of various sleep disorders among those with psychiatric disorders.

Regardless of the fact that sleep disorders have been documented to coexist in patients with psychiatric disorders, the data available on the prevalence of symptoms of specific sleep disorders such as narcolepsy, parasomnia, circadian rhythm disorders, restless leg syndrome/periodic limb movement in sleep and obstructive sleep apnea in patients with psychiatric illness is limited. Talih et al. reported that 18% of hospitalized psychiatric patients in Lebanon had restless leg syndrome (Talih et al., 2016) whereas Sansa et al. observed that 5.1% patients with schizophrenia reported cataplexy-like experience; 9% experienced sleep paralysis and 21.3% experienced hypnagogic/hypnopompic hallucinations (Sansa et al., 2016). A cross-sectional study in psychiatric outpatients estimated a lifetime prevalence of sleep-walking, sleep-related eating disorder, rapid eye movement behaviour disorder and sleep-related injury to be 8.5%, 4.0%, 21.0%, 3.6% and 5.8% respectively (Lam, 2008). High rates of obstructive sleep apnea have also been observed in patients with severe mental illness (Alam et al., 2012).

As there is a paucity of data on the prevalence of symptoms of specific sleep disorders in patients with psychiatric disorders, our study aimed to determine the prevalence of symptoms of sleep disorders such as parasomnia, narcolepsy, obstructive sleep apnea, circadian rhythm disorder and restless leg syndrome/periodic limb movements of sleep (RLS/PLMS) and their socio-demographic variables correlates among patients with psychiatric illnesses in an outpatient clinic.

2. Methods

2.1. Study design

The study protocol was approved by the institutional research committee and National Healthcare Group-Domain Specific Review Board. The cross-sectional study was conducted in the Institute of Mental Health (IMH), Singapore from September 2015 to April 2016. Participants (N = 400) who completed the survey were Singapore citizens or permanent residents aged between 21 and 65 years who had a primary diagnosis of schizophrenia spectrum or mood (bipolar and depressive disorder) or anxiety disorder (generalized anxiety disorder, obsessive compulsive disorder, post-traumatic stress disorder and panic disorder) based on International Classification of Diseases (ICD-9) criteria. These were patients seeking treatment at the outpatient clinics of IMH. Participants had to be able to read and understand English. Individuals with intellectual disability, dementia and other significant cognitive impairment were excluded. Written informed consent was obtained from the eligible participants. All participants were reimbursed for their time.

2.2. Data collection

Participants completed two sets of questionnaires; one set was self-administered and the second set was administered by study staff. The self-administered questionnaires collected information on socio-demographic variables such as age, gender, ethnicity, educational attainment, and employment. For physical activity level, participants were first asked to recall the number of days and for how long each day they engaged in activities that increased their heart rate and/or made them breathe hard some of the time in an average week, based on which the patients categorized themselves to be either “physically active” or “not physically active”. Duration of primary psychiatric illness and body mass indices were obtained from electronic medical records. We classified participants into obese (≥ 27.5) and not obese (< 18.5 – 27.4) based on the Asian body mass index (BMI) cut-off points (Consultation, 2004).

2.2.1. Insomnia severity index (ISI)

The ISI is a self-report measure designed to assess the perceived severity of insomnia. It consists of 7-items on a 5-point Likert scale from 0 (not at all satisfied/worried/interfering) to 4 (very much satisfied/worried/interfering). Total scores range from 0–28, with higher scores indicating greater insomnia severity. A cut-off score of 14 demonstrated a sensitivity of 94% and a specificity of 94% in distinguishing individuals diagnosed with primary insomnia from controls with good sleep (Smith and Trinder, 2001).

2.2.2. Screening symptoms of sleep disorder(s)

The British Association of Psychopharmacology (BAP) (Wilson et al., 2010) has developed guidelines for reliable and appropriate diagnosis of insomnia, parasomnia and circadian-rhythm disorders by psychiatrists and primary care physicians. A study team member administered the questions suggested by BAP to assess the symptoms of sleep disorders within the past 12 months, other than insomnia. The questions pertaining to narcolepsy, circadian sleep rhythm disorder, parasomnia, sleep breathing disorder, and restless leg syndrome/periodic limb movements of sleep (RLS/PLMS) were asked to the participant as part of a structured interview. Participants were asked questions such as ‘do you sometimes fall asleep in the daytime completely without warning?’ (narcolepsy); ‘are you a heavy snorer?’ (obstructive sleep apnea); ‘do your legs often twitch or can't keep still in bed?’ (restless leg syndrome/periodic limb movements in sleep); ‘do you tend to sleep well but just at the “wrong times”?’ (circadian rhythm sleep disorder); ‘do you have unusual behaviours associated with your sleep that trouble you or that are dangerous?’ (parasomnia); if participants responded affirmatively to any of the questions, supplementary questions were asked for eliciting more information about their symptoms of sleep disorder. A confirmation of the presence of symptoms of sleep disorder was made if the answer was “yes” to lead question and one of the supplementary questions (See Appendix 1 for more detailed questions).

2.3. Data analyses

Descriptive analysis was conducted for all sociodemographic variables. The continuous variables were presented as mean and standard deviation (SD) and categorical variables were presented as frequency and percentage. Multiple logistic regressions were conducted for symptoms of narcolepsy, sleep breathing disorder, restless leg syndrome/periodic limb movements of sleep (RLS/PLMS), parasomnia, and having symptoms of any of the five sleep disorders (=1 if showing symptoms of at least one of the five disorders; = 0 otherwise), with the demographics (i.e. age group, gender, ethnicity, marital status, education level, employment status), body mass index, physical activity, clinical diagnosis, duration of illness and insomnia as the independent variables. Due to the small number of patients presenting with symptoms of circadian rhythm in the study sample, this data was excluded from the logistic regression analysis. The level of significance for the analysis was set at two-sided $p = < 0.05$. All data analysis were conducted using Statistical Analysis Software (SAS) 9.3.

3. Results

3.1. Participant characteristics

The socio-demographic characteristics of the participants are presented in Table 1. Participants primarily belonged to a younger age group (21–39 years) (55%), Chinese ethnicity (37.8%), were not married (73.5%) and not obese (60.3%). Majority of the respondents had secondary or below education (45.5%) and were employed (54.8%).

Table 1
Sociodemographic and clinical characteristics of sample.

Variable name	Frequency	Percentage
Gender		
Male	210	52.5
Female	190	47.5
Age group		
21–39	220	55.0
40–65	180	45.0
Ethnicity		
Chinese	151	37.8
Malay	105	26.3
Indian/others	144	36.0
Marital status		
Not married	294	73.5
Married	106	26.5
Education level		
Secondary or below	182	45.5
Post-secondary to pre-university	164	41.0
Tertiary or above	54	13.5
Employment status		
Employed	219	54.8
Unemployed (unemployed/student/housewife/retired)	181	45.3
BMI		
Not obese (<18.5 – 27.4)	241	60.3
Obese (≥27.5)	159	39.8
Physical activity		
High	215	53.8
Low	185	46.3
Type of illness		
Schizophrenia spectrum disorder	120	30.0
Mood disorder	180	45.0
Anxiety disorder	100	25.0
Duration of illness		
<2 years	61	15.3
≥2 years	339	84.8
Meets criteria for Insomnia on ISI		
No	136	34.3
Yes	263	65.8

BMI: Body Mass Index; ISI: Insomnia severity index.

Our sample consisted of slightly more males (52.5%) than females (47.5%). A large proportion of the participants were diagnosed with mood disorders (45.0%), followed by schizophrenia spectrum disorder (30.0%) and anxiety disorder (25.0%).

3.2. Prevalence (s)

The prevalence of symptoms of sleep disorders in our psychiatric outpatient sample was 40.8% (163/400). The estimated prevalence for subjects with symptoms of narcolepsy, sleep breathing disorder, restless leg syndrome/periodic limb movements of sleep (RLS/PLMS), circadian rhythm disorder, and parasomnia were 12.5%, 14.5%, 14.8%, 4.5%, 13.8% respectively. Symptoms of two sleep disorders co-existed in 26.3% (43/163) and symptoms of three sleep disorders co-existed in 10.4% (18/163) of the patient population. None of the participants had coexisting symptoms of four or five sleep disorders. About 65.8% of them reported having symptoms of insomnia. The distribution of symptoms of various sleep disorders among different psychiatric groups is presented in Table 2.

3.3. Sociodemographic and clinical correlates of symptoms of sleep disorder (s)

Logistic regression analysis suggested that ethnicity, education, physical activity level and insomnia were associated with symptoms of any sleep disorder. Indians and other ethnic groups (OR = 2.224, $p = 0.002$) were significantly more likely to have symptoms of sleep disorder as compared to those of Chinese ethnicity. Participants with post-secondary to pre-university level education level were less likely to have symptoms of sleep disorder (OR = 0.538, $p = 0.017$) as compared to those with secondary or below education. Individuals with higher physical activity (OR = 0.505, $p = 0.003$) were significantly less likely to have symptoms of any sleep disorder. Individuals with insomnia are at higher risk of having symptoms of any sleep disorders (OR = 3.366, $p = < 0.001$) as compared to those who did not have insomnia (Table 3).

Symptoms of restless leg syndrome/periodic limb movements of sleep (RLS/PLMS) were significantly less likely to occur in older adults (40–65) (OR = 0.322, $p = 0.001$) as compared to younger adults (21–39) and in individuals with pre-university or post-secondary education level as compared to secondary or below education (OR = 0.495, $p = 0.046$). Participants who were obese were significantly more likely have sleep breathing disorder (OR = 2.464, p = 0.004) as compared to non-obese participants. Participants with high physical activity were significantly less likely to have symptoms of sleep breathing disorder (OR = 0.453, p = 0.011) as compared to those with low physical activity levels. Symptoms of narcolepsy (OR = 2.368, $p = 0.030$), PLMS/RLS (OR = 4.616, $p = < 0.001$) and parasomnia (OR = 3.317, $p = 0.006$) were significantly more likely to occur in individuals with insomnia as compared those who did not have insomnia.

Table 2
Prevalence of symptoms of sleep disorder.

Sleep disorder	Schizophrenia (n = 120)	Mood (n = 180)	Anxiety (n = 100)	Total (n = 400)
Any sleep disorder	41 (34.1%)	74 (41.1%)	48 (48.0%)	163 (40.8%)
Narcolepsy	12 (10.0%)	24 (13.3%)	14 (14.0%)	50 (12.5%)
PLMS/RLS	17 (14.1%)	24 (13.3%)	18 (18.0%)	59 (14.8%)
Parasomnia	11 (9.1%)	25 (13.8%)	19 (19.0%)	55 (13.8%)
Sleep breathing disorder	14 (11.6%)	28 (15.5%)	16 (16.0%)	58 (14.5%)
Circadian	6 (5.0%)	4 (2.2%)	8 (8.0%)	18 (4.5%)

PLMS/RLS: Periodic limb movements of sleep/restless leg syndrome.

4. Discussion

DSM-5 recognizes that psychiatric and sleep disorders are mutually interactive and bi-directional; it also emphasizes the need for independent assessment of sleep disorders regardless of the underlying medical conditions. This paradigm shift could be of utmost importance in psychiatric practice as it could aid in early recognition as well as in planning and management of sleep disorders to ensure optimal outcomes. This study aimed to establish the prevalence and correlates of symptoms of sleep disorders in patients seeking treatment for mental illness in a tertiary psychiatric hospital in Singapore. The study findings suggest that 40% of the patients presented with symptoms of various sleep disorders such as narcolepsy, sleep breathing disorder, parasomnia, circadian rhythm disorder and restless leg syndrome/periodic limb movements of sleep (RLS/PLMS). Symptoms of any sleep disorder was independently associated with sociodemographic variables (ethnicity, education), physical activity level and insomnia while age, education, BMI, physical activity levels and insomnia were significantly associated with symptoms of restless leg syndrome/periodic limb movements of sleep (RLS/PLMS), sleep breathing disorder, and parasomnia.

The prevalence of symptoms of specific sleep disorder in an adult Dutch population that was assessed using the SLEEP-50 questionnaire was found to be 2.7%, 5.7%, 6.2%, 3.5% and 7.2% for narcolepsy, sleep breathing disorder, restless leg syndrome/periodic limb movements of sleep (RLS/PLMS), circadian rhythm disorder and parasomnia respectively (Spoormarker and Bout, 2005). A study conducted in an outpatient department of a tertiary mental health care center in India also found that the sleep disorders were prevalent in three-fourth of their

Table 3
Logistic regression of socio-demographic correlates and clinical correlates of symptoms of sleep disorders.

	Narcolepsy				Sleep breathing disorder				PLMS/RLS				Parasomnia				Any SD			
	OR	95% CI		P	OR	95% CI		P	OR	95% CI		P	OR	95% CI		P	OR	95% CI		P
Gender																				
Male	Ref				Ref				Ref				Ref				Ref			
Female	0.924	0.489	1.746	0.806	1.311	0.704	2.438	0.393	0.906	0.485	1.694	0.757	1.425	0.766	2.652	0.263	1.172	0.743	1.848	0.495
Age group																				
21–39	Ref				Ref				Ref				Ref				Ref			
40–65	0.933	0.465	1.875	0.846	1.037	0.531	2.025	0.915	0.322	0.157	0.659	**0.001**	1.193	0.600	2.373	0.614	0.677	0.411	1.116	0.125
Ethnicity																				
Chinese	Ref				Ref				Ref				Ref				Ref			
Malay	0.676	0.281	1.626	0.382	1.300	0.584	2.893	0.520	1.176	0.537	2.575	0.685	1.377	0.638	2.971	0.415	1.109	0.626	1.964	0.723
Indian/Others	1.503	0.743	3.043	0.257	1.966	0.956	4.045	0.066	1.546	0.762	3.138	0.227	1.297	0.627	2.683	0.483	2.224	1.316	3.757	**0.002**
Marital Status																				
Not married	Ref				Ref				Ref				Ref				Ref			
Married	0.970	0.462	2.033	0.934	1.678	0.874	3.221	0.120	0.807	0.381	1.710	0.576	0.846	0.410	1.745	0.651	0.883	0.519	1.504	0.648
Education Level																				
Secondary or below	Ref				Ref				Ref				Ref				Ref			
Post-secondary to pre-university	0.834	0.422	1.648	0.602	0.581	0.289	1.168	0.127	0.495	0.248	0.989	**0.046**	0.765	0.380	1.542	0.454	0.538	0.323	0.895	**0.017**
Tertiary or above	0.377	0.104	1.360	0.136	0.961	0.380	2.434	0.933	1.130	0.465	2.748	0.787	0.656	0.238	1.809	0.415	0.609	0.299	1.243	0.173
Employment Status																				
Employed	Ref				Ref				Ref				Ref				Ref			
Unemployed	1.052	0.561	1.971	0.874	1.491	0.814	2.730	0.195	0.923	0.502	1.695	0.794	1.332	0.720	2.466	0.361	1.057	0.673	1.661	0.808
BMI																				
Not obese	Ref				Ref				Ref				Ref				Ref			
Obese	1.262	0.668	2.384	0.474	2.464	1.324	4.584	**0.004**	0.774	0.408	1.467	0.432	0.751	0.395	1.427	0.381	1.185	0.745	1.886	0.473
Physical Activity																				
Low	Ref.				Ref				Ref				Ref				Ref			
High	0.823	0.438	1.545	0.544	0.453	0.244	0.838	**0.011**	1.268	0.687	2.343	0.447	0.553	0.296	1.036	0.064	0.505	0.321	0.793	**0.003**
Psychiatric Diagnosis																				
Schizophrenia Spectrum	Ref.				Ref				Ref				Ref				Ref			
Mood Disorder	1.249	0.577	2.701	0.572	1.399	0.662	2.958	0.378	0.771	0.371	1.599	0.484	1.162	0.524	2.581	0.711	1.064	0.622	1.820	0.820
Anxiety Disorder	1.531	0.633	3.700	0.344	2.049	0.863	4.865	0.103	1.206	0.536	2.714	0.650	2.196	0.927	5.202	0.073	1.820	0.970	3.413	0.062
Duration of Illness																				
< 2years	Ref																			
≥ 2 years	0.838	0.360	1.949	0.681	1.313	0.525	3.286	0.560	1.306	0.564	3.026	0.533	0.814	0.360	1.840	0.621	0.813	0.434	1.522	0.517
Insomnia Status																				
No	Ref																			
Yes	2.368	1.086	5.164	**0.030**	1.474	0.731	2.971	0.278	4.616	1.961	10.866	**<0.001**	3.317	1.384	7.112	**0.006**	3.366	2.032	5.576	**<0.001**

Due to the small number of cases for Circadian Rhythm sleep disorder, logistic regression was not conducted for this sleeping disorder.
CI: Confidence interval; PLMS/RLS: Periodic limb movements of sleep/restless leg syndrome; SD: Sleep disorder

population with insomnia being the most common finding (Mondal et al., 2018). Previous research suggests also that individuals with an underlying psychiatric disorder are at a higher risk of presenting with sleep symptoms as compared to the general population (Benca et al., 1992; Fuller et al., 1997; Waller et al., 1989). We found a higher prevalence of symptoms of sleep disorders when compared to previous literature. Due to the fact that symptoms of various sleep disorders overlap with the symptoms of various psychiatric conditions and the reliance on self-reported symptoms of sleep disorders, we could have overestimated the prevalence of symptoms of sleep disorders among our sample. For instance, the patient would not have distinguished nocturnal panic attacks from night terrors (Hauri et al., 1989), psychosis of narcolepsy from schizophrenia (Kishi et al., 2004), excessive daytime sedation which is a side effect of anti-psychotic medication from excessive day time sleepiness/hypersomnia (Krystal et al., 2008), and medication induced akathisia from RLS (Benes et al., 2007) when presented with preliminary questions of sleep disorders. Future studies on prevalence should consider detailed clinical assessment and examination by a physician with comprehensive knowledge and training in sleep medicine along with objective assessments to distinguish and confirm the presence of symptoms of sleep disorders from psychiatric disorders.

Individuals who had insomnia were at a higher risk of having symptoms of any sleep disorder, narcolepsy, parasomnia, periodic limb movements of sleep (PLMS) and restless leg syndrome (RLS) as compared to those who did not have insomnia. A local study conducted by Wong et al. (2015) retrospectively reviewed polysomnography (PSG) records of chronic insomnia patients at a multidisciplinary sleep disorder clinic. The study found that 42.5% had obstructive sleep apnea (OSA) and 4.7% had periodic limb movement disorder (PLMD) upon PSG. Additionally, 36.6% were diagnosed with an underlying psychiatric disorder (Wong and Ng, 2015).

Age was significantly associated with symptoms of any sleep disorder, specifically with symptoms of restless leg syndrome/periodic limb movement of sleep (RLS/PLMS). Younger adults (21–39 years) were more likely to have symptoms of restless leg syndrome/periodic limb movements of sleep (RLS/PLMS) as compared to older adults (40–65 years). These findings are in line with previous research in general population where in the symptoms of sleep disorder such as nightmares, waking early, difficulty falling asleep, difficulty staying asleep and too much sleep were proportionately higher in young adults aged between 20–49 years of age and this finding was attributed to lifestyle differences (Karacan et al., 1976). However, this finding should be interpreted with caution, as we have not distinguished the symptoms of periodic limb movements of sleep (PLMS) and restless leg syndrome (RLS) in our study population and the screening questions are only suggesting that individuals may have symptoms of periodic limb movements of sleep (PLMS) or restless leg syndrome (RLS). Further research should explore the symptoms of periodic limb movements of sleep (PLMS) and restless leg syndrome (RLS) separately in patients with psychiatric disorders using standard diagnostic criteria.

Lower physical activity was associated with symptoms of any sleep disorders and with symptoms of sleep breathing disorder. We also found that obesity was independently associated with sleep breathing disorder, which is in agreement with findings in previous reports in psychiatric population (Stubbs et al., 2016). Recent meta-analysis indicated that people with severe mental illness were more sedentary than the healthy controls and higher body mass index was associated with low physical activity levels (Vancampfort et al., 2017). It is important to note that lack of physical activity, sedentary lifestyle and psychotropic medications may be mediating the increased risk of obesity in patients with psychiatric disorders (Gupta and Simpson, 2015; Krystal et al., 2008; Lam, 2008; Mizuno et al., 2004; Nikolakaros et al., 2015; Ong et al., 2009). Evidence from epidemiological studies have demonstrated that regular exercise reduces the risk of sleep disorders through its antidepressant, thermogenic, anxiolytic effects and its effect on the circadian phase-shifting (Kredlow et al., 2015; Sherrill et al., 1998; Singh et al., 1997). Although there are limited numbers of interventional studies that have explored exercise as a means to prevent and treat sleep disorders despite its protective effects, a few uncontrolled and controlled trials found improvements in sleep architecture, apnea symptoms, and restless leg symptoms with supervised moderate-intensity aerobic and resistance exercise (Aukerman et al., 2006; Esteves et al., 2009; Kline et al., 2011; Norman et al., 2000). This finding highlights the importance and the pressing need for addressing the modifiable risk-factors such as sedentary behaviour in the current patient population either by promoting physical activity or by implementing supervised exercise program as part of routine care.

With respect to differences in levels of education, we observed that individuals with higher education (post-secondary to pre-university) were significantly less likely to have symptoms of any sleep disorder as compared to those with lower education levels (secondary or below). This finding has been observed and documented in previous studies (Bixler et al., 1979; Karacan et al., 1976). Various explanations have been proposed for this finding. First, there is a higher incidence of mental disturbance in cohorts with lower education levels. Secondly, individuals with higher education have better awareness of sleep hygiene practices and are more likely to implement these strategies to improve sleep (Arber et al., 2009; Bixler et al., 1979).

This is one of the first studies to explore symptoms of five different sleep disorders concurrently in a given population; thus providing evidence on the prevalence of these symptoms in those diagnosed with psychiatric disorder. The symptoms of sleep disorders were established based on a clearly defined screening questionnaire pertaining to specific sleep disorder occurring in the last one year, based on the guidelines recommended by the British Association of Psychopharmacology.

Limitations

This cross-sectional study was conducted only among outpatients at a tertiary hospital in Singapore; and adopted a convenient sampling strategy. Hence this study finding is not generalizable to a large proportion of psychiatric population. Further we could not establish causal relationships between psychiatric disorder and symptoms of sleep disorder due to the cross-sectional nature of the study. Our inclusion criterion was limited to patients diagnosed with mood disorder, anxiety disorder and schizophrenia and therefore the findings may not be applicable to patients with other psychiatric disorders. The questionnaire that was administered by the team was apt for screening the mere presence or absence of symptoms of sleep disorders in the past 12 months. Further, the prevalence estimates are limited by the reliance on self-reported symptoms of various sleep disorders and the effect of recall bias. Psychiatric medications are known to exacerbate or trigger symptoms of sleep disorders. Due to heterogeneity in our sample, patients were prescribed different psychotropic medications which would be difficult to control for. Hence we were not able to examine the association between psychotropic medication and symptoms of sleep disorders. Lastly, the symptoms of sleep disorders in patients diagnosed with psychiatric disorders was assessed using a questionnaire that is comprehensive and has clinically relevant screening questions yet psychometric properties of this questionnaire are not well established. Inclusion of clinical examination and polysomnographic evaluation would have ruled out false-positive responses and improved the rigor of the methodology.

Conclusion

Our study has highlighted that the symptoms of sleep disorders are not uncommon in psychiatric patients. The participants were recruited from a specialized center for psychiatric care and hence the findings can be applicable in similar psychiatric settings. Identifying and addressing sleep disorders in early stages may have a positive impact on the

prognosis and quality of life of a psychiatric patient. Further we recommend large-scale prospective studies to confirm the findings of this study among those with different mental illnesses.

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Supplementary materials

Supplementary material associated with this article can be found, in the online version, at doi:10.1016/j.psychres.2018.07.009.

Appendix 1.

Algorithm to screen for symptoms of sleep disorders other than Insomnia by the British Association of Psychopharmacology

1. Narcolepsy
   a. **Do you sometimes fall asleep in the daytime completely without warning?**
   b. Is it literally impossible to resist 'sleep attacks' during the day?
   c. Do you have collapses or extreme muscle weakness triggered by extreme emotion?
   d. Do you have visual hallucinations, either just as you fall asleep or when you wake in the morning?
   e. Are you paralyzed and unable to move when you wake up from your sleep?

   [Possible narcolepsy: 1a = "TRUE" AND (1b OR 1c OR 1d OR 1e = "TRUE")]

2. Sleep breathing disorder
   a. **Are you a very heavy snorer?**
   b. Does your partner say that you sometimes stop breathing?
   c. Do you often wake up gasping for a breath?
   d. Are you often excessively sleepy during the day or fall asleep without wanting to?

   [Possible sleep breathing disorder: 2a = "TRUE" AND (2b OR 2c OR 2d = "TRUE")]

3. Periodic limb movements of sleep/Restless leg syndrome (PLMS/RLS)
   a. **Do your legs often twitch or jerk or can't keep still in bed?**
   b. Is it very difficult to get to sleep because of repeated muscle jerks?
   c. Do you frequently wake from sleep with sudden jerky movements or with a compulsion to move your legs?
   d. Do you simply have to get out of bed and pace around to get rid of these feelings?

   [Possible PLMS/RLS: 3a = "TRUE" AND (3b OR 3c OR 3d = "TRUE")]

4. Circadian rhythm sleep disorder
   a. **Do you tend to sleep well but just at the "wrong times"?**
   b. Can you sleep well enough, but only if you stay up very late?
   c. Are you in a very sound sleep at normal waking time and could sleep on for hours more?
   d. Can you sleep well enough, but only if you go to bed very early?
   e. Do you wake very early, bright and alert and no longer sleepy?

   [Possible CRSD: 4a = "TRUE" AND EITHER (4b AND 4c = "TRUE") OR (4d AND 4e = "TRUE")]

5. Parasomnia
   a. **Do you have unusual behaviours associated with your sleep that trouble you or that are dangerous?**
   b. Do you sleepwalk frequently and run the risk of injuring yourself or others?
   c. Do you have frequent night terrors when you are extremely distressed but not properly awake?
   d. Do you act out your dreams and risk injuring yourself or others?
   e. Do you have terrible recurring nightmares?

   [Possible parasomnia: 5a = "TRUE" AND EITHER (5b OR 5c OR 5d OR 5e = "TRUE"

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