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Prevalence, correlates and outcomes of insomnia in patients with first episode psychosis from a tertiary psychiatric institution in Singapore

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ABSTRACT

Objectives: The study aimed to evaluate the prevalence of insomnia in patients with first episode psychosis (FEP) and to explore the relationship between insomnia and socio-demographic and clinical variables as well as quality of life (QOL) and functioning in Singapore.

Methods: Data on sleep, smoking, alcohol habits, QOL and socio-demographics were collected from 280 FEP patients who were enrolled in the Early Psychosis Intervention Programme (EPIP) within 3 months of joining the programme. Multiple logistic regression analyses were performed to determine the socio-demographic and clinical correlates of insomnia. The association of insomnia with QOL as well as functioning was examined using multiple linear regression analyses.

Results: The prevalence of clinical insomnia was 22.6%. Older age and higher dosage of antipsychotic medication were significantly associated with a lower risk of insomnia while hazardous alcohol use, current smoking and a longer duration of untreated psychosis were significantly associated with a higher risk of insomnia. Insomnia was associated with significant decreases in all QOL domains assessed in the study even after adjusting for confounders.

Conclusions: FEP patients with insomnia must be screened for hazardous alcohol use and smoking. Patients must be referred concurrently for treatment of insomnia, smoking cessation as well as brief intervention for hazardous alcohol use when needed.

1. Introduction

Insomnia, which is characterised by symptoms of difficulty in falling asleep or staying asleep, early morning wakening, sleep dissatisfaction, as well as daytime consequences such as tiredness [1], is one of the most prevalent health complaints among the general population and is a significant public health concern. According to a statement by the National Institutes of Health, USA, the prevalence of insomnia is 10% if the definition includes daytime distress or impairment [2]. Based on a consensus of population-based studies, it is suggested that approximately 30% of the diverse adult samples drawn from different countries report one or more of the symptoms of insomnia [3]. Insomnia has a significant negative impact on daily functioning and is associated with work absenteeism, difficulty performing work and work related accidents [4], causing considerable impairment in quality of life (QOL) [5], and increased resource utilisation and medical costs [6].

The female sex, advanced age, and depressed mood, have been consistently identified as risk factors of insomnia. [7,8] In a community based sample, Taylor et al. [9] found that people with insomnia were about 10 and 17 times more likely to have clinically significant depression and anxiety respectively as compared to those without insomnia. In a community sample of adolescents, Johnson et al. [10] found that in 69% of the cases, insomnia preceded comorbid depression, while an anxiety disorder preceded insomnia 73% of the time [10]. Prospective population-based data from the Nord-Trøndelag Health Studies (HUNT2 in 1995–97 and HUNT3 in 2006–08) were used to study insomnia as a risk factor for incidence of mental conditions. Insomnia in HUNT2 was a significant risk factor for mental conditions at HUNT3 conducted 11 years later. Even after adjusting for confounding factors, insomnia remained a significant risk factor for both

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depression [odds ratio (OR): 2.38] and anxiety (OR: 2.08) [11]. Studies further suggest that 50 to 80% of those seeking psychiatric treatment suffer from insomnia [12], highlighting the significant comorbidity of the two conditions. Analysis of the Sequenced Treatment Alternatives to Relieve Depression (STAR*D) study data showed that among patients with major depressive disorder (MDD), insomnia symptoms were very common and were associated with more severe depression [13].

Sleep disturbances are also prevalent in those with schizophrenia. The Clinical Antipsychotic Trials of Intervention Effectiveness (CATIE) study reported that 16–30% of patients across treatment arms reported insomnia [14] while a study by Palmese et al. [15] conducted among 175 outpatients with schizophrenia or schizoaffective disorder found that 44% of them met criteria for clinical insomnia using the Insomnia Severity Index (ISI). A meta-analysis of polysomnography studies in 321 patients who were not on neuroleptic medications and 331 controls reported that the schizophrenia group experienced increased sleep latency, decreased total sleep time, increased wake after sleep onset and reduced sleep efficiency compared to healthy controls [16]. Sleep architectural changes have also been reported in individuals who were not on medication at psychosis onset, characterised by shorter rapid eye movement sleep and less slow-wave sleep [17].

Sleep disturbances in schizophrenia have been linked to severity of symptoms and antipsychotic use. Ritsner et al. [18] found no significant relationship between insomnia and either positive or negative psychotic symptoms in clinically stable schizophrenia patients, while other studies have found that insomnia was inversely associated with severity of symptoms [19,20]. Antipsychotics have sedative effects that are attributed to their anti-histaminergic, anti-adrenergic and anticholinergic properties [21], therefore treatment of patients with schizophrenia with several first or second-generation antipsychotics is usually associated with an improvement in sleep efficiency and sleep quality. It is also suggested that part of this effect is related to the reduction of symptoms of psychosis [21].

The World Health Organization (WHO) defines QOL as 'individuals' perception of their position in life, in the context of the culture and value systems in which they live, and in relation to their goals, expectations, standards, and concerns' [22]. A number of studies have found that poor sleep quality is associated with a lower QOL among patients with schizophrenia [18,20,23]. A study by Mulligan et al. [24] found that both objective and subjective sleep disturbance predicted reduced next-day functioning among patients with schizophrenia.

The first episode of psychosis (FEP) refers to patients who are in the early stages of their psychotic illness [25]. These patients are free of confounders such as prolonged treatment with medications and polypharmacy that are seen in chronic patients and thus provide an opportunity to better understand the relationship between insomnia and psychosis. Early identification of sleep-related problems lends itself to treatment using psychological/behavioural approaches [26], and early identification and treatment could not only improve sleep in these patients but also improve their functioning and QOL. However, few studies have examined the prevalence and correlates of insomnia among patients with FEP as well the effects of insomnia on QOL and functioning especially in Asian samples. The objectives of this study were to evaluate the prevalence of insomnia in patients with first episode psychosis and to explore the relationship between insomnia and sociodemographic and clinical variables as well as QOL and functioning.

2. Methods

The data was collected for a study examining sleep, smoking and alcohol habits among FEP patients who were enrolled in the Early Psychosis Intervention Programme (EPIP) and seeking treatment at the Institute of Mental Health (IMH) or its satellite clinics. EPIP is a patient-centered programme led by a multidisciplinary team of psychiatrists, psychologists, case managers, social workers, and occupational therapists who seek to manage those with FEP [27]. It is a nationwide programme, and was launched in 2001 at the Institute of Mental Health and Woodbridge Hospital. Patients in this programme meet the following criteria: i) an age between 15 and 40 years, ii) first episode psychotic disorder with no prior or minimal treatment, defined as, < 12 weeks of antipsychotic medications, iii) no current history of substance abuse, and iv) no history of major medical or neurological illness. The programme enrols about 200 new patients every year.

Patients aged 15–40 years, who were enrolled in the EPIP programme, were able to read and understand English and those who were considered clinically stable to participate in a research study were included in the study. The definition of "clinically stable" was modified slightly from that used by Fleischhacker et al. [28] and established as, 'patients judged to be symptomatically stable, as judged by the treating physician, receiving a stable dose of an antipsychotic drug for at least 2 weeks, in good general physical health' and capable of participating in the research. The current data is from the baseline visit wherein the patients were interviewed within 3 months of joining the EPIP programme from Feb 14 to Nov 16. All participants provided written informed consent. Parental consent was also obtained for participants below the age of 21 years. Ethics approval was obtained from the National Healthcare Group Domain Specific Review Board.

2.1. Measures

All measures except the clinical scales were self-administered on an iPad. Those who were not comfortable handling an iPad were given an option of using the hard-copy version of the questionnaires.

2.1.1. Socio-demographic questionnaire

Data on age, gender, marital status, ethnicity, years of education, employment status, and religion were collected. Data on smoking was collected by asking participants if they had ever smoked. Options provided to them included – 'Yes', 'No', 'Social smoker' and 'Ex-smoker'. Those who reported that they had 'ever smoked' as well as those who declared themselves to be 'social smokers' were then asked about the number of days they had smoked in the past month; those who endorsed smoking every day or had smoked on some days were classified as 'current smokers'. Patients who reported that they were 'ex-smokers' were asked about the last time they had smoked and those who stated that they had smoked a cigarette at least one month before the day of the interview were classified as 'ex-smokers' [29].

2.1.2. Insomnia severity index (ISI)

The seven-item ISI [30] was used to assess the severity and impact of insomnia. The ISI consists of 7 domains with 1 item each assessing severity of sleep-onset, sleep maintenance, early morning awakening problems, sleep dissatisfaction, interference of sleep difficulties with daytime functioning, noticeability of sleep problems by others and distress caused by the sleep difficulties. Each item is measured on a five-point Likert scale (0 = no problem; 4 = very severe problem) and total scores range from 0 to 28. The total score is interpreted as follows: absence of insomnia (0–7); sub-threshold insomnia (8–14); moderate insomnia (15–21); and severe insomnia (22–28). For this study we used a cut-off of scores of 15 and above to be indicative of clinical insomnia, as used by Yong et al. [31] previously in Singapore. The ISI has been used in studies among those with psychosis [32].

2.1.3. The alcohol use disorders identification test (AUDIT)

AUDIT is a brief, 10 item inventory developed by the World Health Organization as a screening questionnaire for hazardous and harmful drinking [33]. This 10-item self-report questionnaire covers the domains of alcohol consumption (items 1–3), drinking behaviours (items 4–6) and alcohol-related problems (items 7–10). Each question is scored from 0 to 4 with a maximum score of 40, with scores of 8 or higher suggesting hazardous alcohol use, and a need for further monitoring or assessment [34]. Its psychometric properties were established

in a study among psychiatric patients in Singapore [35].

2.1.4. WHO Quality of Life-BREF (WHOQOL-BREF)

This 26-item questionnaire measures QOL based on four domains: physical health (7 items), psychological (6 items), social relationships (3 items), and environmental (8 items) [36]. Two items that ask about an individual's 'overall perception of QOL' and 'overall perception of their health' are examined separately. The other 24 items contribute to the domain scores. Each item of the WHOQOL-BREF is scored on a five-point ordinal scale. Mean domain scores are then multiplied by 4 in order to transform the domain score into a scaled score, with a higher score indicating a higher QOL. Previous studies have examined the QOL of patients with FEP in Singapore using the WHOQOL –BREF [37].

2.2. Clinical assessments and dose of anti-psychotic medications

All patients in EPIP are assessed clinically at baseline and followed up prospectively to track clinical outcomes. These include the Structured Clinical Interviews for DSM-IV (SCID-clinical version) [38] at the first contact (baseline) to establish the diagnosis; duration of untreated psychosis (DUP) which is operationalized as the time, in months, between onset of psychotic symptoms (delusions, hallucinations, disorganized behaviour) and the time when a definitive diagnosis and treatment is also established. Severity of symptoms and functioning are assessed using the Positive and Negative Syndrome Scale (PANSS) for schizophrenia [39] and Global Assessment of Functioning Scale (GAF) [40] respectively. These ratings are performed by psychiatrists who are trained in the use of the rating instruments [41]. Data pertaining to clinical assessments and anti-psychotic medications were collected from patient records. The daily dose of antipsychotic medications was converted into chlorpromazine (CPZ) equivalents [42–44].

2.3. Statistical analysis

All statistical analyses were conducted using STATA version 13.1. Descriptive statistics such as mean and standard deviation were calculated for continuous variables, whereas frequencies and percentages were calculated for categorical variables. Multiple logistic regression analysis using enter method were performed to determine the socio-demographic and clinical correlates of insomnia. We included age, sex, ethnicity, marital status, employment, religion, years of education, smoking status, SCID diagnosis, age, CPZ equivalents, baseline ratings for the PANSS positive and negative symptoms scales, as well as the general psychopathology scale (GPS), GAF scores and DUP as independent variables in the regression model. Socio-demographic correlates have not been extensively explored in studies relating to sleep in FEP, thus we included those variables in the analysis that have been identified in population studies as associated with insomnia [7,45] while the choice of clinical variables was *a priori* based on previous literature examining insomnia among those with FEP [19–21].To investigate the relationship between quality of life, functioning and insomnia, multiple linear regression analyses were used. In linear regression models, we treated insomnia as a primary independent variable and QOL as well as functioning as dependent variables after controlling for the socio-demographic and clinical variables. In these regression analyses, multicollinearity between independent variables was determined by obtaining the variance inflation factor (VIF) values. If the VIF value was > 10, multi-collinearity was considered. Using the VIF value of > 10 as cut-off, we found that none of the significant independent variables displayed multi-collinearity. The overall model fit was also examined using Hosmer-Lemeshow goodness-of-fit tests, Akaike Information Criterion (AIC) and area under the receiver operating characteristic (ROC) curve. Statistical significance was set at the conventional level of $p < 0.05$, using two-sided tests.

Table 1
Sociodemographic characteristics of the sample of first-episode psychosis patients.

		n	%
Gender	Female	137	49.1
	Male	142	50.9
Ethnicity	Chinese	199	71.3
	Malay	41	14.7
	Indian	25	9.0
	Other	14	5.0
Marital status	Never married	239	85.7
	Currently married	33	11.8
	Separated	2	0.7
	Divorced	5	1.8
Employment	Employed/NS	117	42.9
	Student/homemaker	78	28.6
	Unemployed	78	28.6
Religion	Christian	70	25.1
	Buddhist/taoist	80	28.7
	Hindu	14	5.0
	Islam	56	20.1
	Others	59	21.1
Smoking status	Current smoker	73	26.2
	Never smoked	158	56.6
	Ex-smoker	48	17.2
AUDIT score ≥ 8	No hazardous use	243	87.1
	Hazardous use	36	12.9
SCID diagnosis	Schizophrenia and related psychosis	212	90.2
	Mood disorder with psychotic symptoms	23	9.8

	Mean	SD
Age (years)	25.8	6.2
Years of education	13.2	3.1
Estimated CPZ equivalents (mg/day)	278.0	217.1
Baseline PANSS positive	21.8	6.0
Baseline PANSS negative	15.8	8.7
Baseline PANSS GPS	38.3	11.4
Baseline GAF total	44.3	12.1
DUP since onset of symptoms (in months)	13.6	21.7

AUDIT - Alcohol Use Disorders Identification Test; CPZ - Chlorpromazine; GAF – Global assessment of functioning; NS - National Service, PANSS - Positive and Negative Syndrome Scale; SCID - Structured Clinical Interview for Diagnostic and Statistical Manual of Mental Diseases.

3. Results

The study included a sample of 280 respondents. 601 patients were included in EPIP during the two year period of the study recruitment, of these, 49 were ineligible for participation in the study due to various reasons (patient met diagnosis for 'ultra- high risk of psychosis', language ineligibility etc.) and 272 patients refused to participate in the study, giving a response rate of 50.8%. As compared to those who agreed to participate, the respondents who declined to participate were more likely to be older. The patients had a mean age (SD) of 25.8 (6.2) years and the age of the patients ranged from 15 to 40 years. There was almost an equal proportion of men and women, and the majority of the patients were of Chinese ethnicity (71.3%), never married (85.7%) and had schizophrenia and related psychosis (90.2%) (Table 1).

The Cronbach's alpha of ISI in this sample was 0.90. The prevalence of clinical insomnia (moderate and severe) was 22.6% according to the ISI cut-off score of 15 and above, while that of subthreshold insomnia (scores of 8–14) was 39.1%. 38.4% of those with FEP in the study did not have any insomnia (Table 2). Total ISI scores ranged from 0 to 28 with a mean (SD) of 9.8 (6.6). Table 3 shows the sociodemographic and clinical factors associated with insomnia. Older age and higher dosage of antipsychotic medications as measured by CPZ equivalents were significantly associated with a lower risk of insomnia while hazardous alcohol use (AUDIT score of 8 and above), current participation in smoking, and a longer duration of untreated psychosis were

Table 2
Sociodemographic and clinical characteristics of the study sample by insomnia.

		Insomnia			
		No (n = 216)		Yes (n = 63)	
		n	%	n	%
Gender	Male	102	71.8	40	28.2
	Female	114	83.2	23	16.8
Ethnicity	Chinese	158	79.4	41	20.6
	Malay	27	65.9	14	34.1
	Indian	18	72.0	7	28.0
	Others	13	92.9	1	7.1
AUDIT ≥ 8	Non-hazardous use	195	80.3	48	19.7
	Hazardous use	21	58.3	15	41.7
Smoking status	Never smoked	135	85.4	23	14.6
	Currently smoking	48	65.7	25	34.3
	Ex-smokers	33	68.8	15	31.2
Employment	Employed/NS	92	78.6	25	21.4
	Student/homemaker	64	82.1	14	17.9
	Unemployed	56	71.8	22	28.2
Religion	Christian	58	82.9	12	17.1
	Buddhist/taoist	67	83.8	13	16.2
	Hindu	12	85.7	2	14.3
	Islam	39	69.6	17	30.4
	Others	40	67.80	19	32.20
Marital	Single/never married	187	78.2	52	21.8
	Ever married	29	72.5	11	27.5
SCID diagnosis	Schizophrenia and related psychosis	168	79.3	44	20.7
	Mood disorder with psychotic symptoms	20	86.9	3	13.1

	Insomnia			
	No		Yes	
	Mean	SD	Mean	SD
Age (years)	26.0	6.4	25.0	5.9
Years of schooling	13.4	3.0	12.7	3.4
CPZ eqv (mg/day)	294.8	225.9	226.8	175.3
Baseline PANSS positive score	22.4	6.2	19.5	4.9
Baseline PANSS negative score	16.4	8.9	13.9	7.8
Baseline PANSS GPS score	38.7	11.6	36.7	10.7
Baseline GAF Total	71.6	11.4	71.4	9.8
Duration of untreated psychosis (months)	12.1	19.4	19.4	28.4

AUDIT - alcohol use disorders identification test; CPZ - chlorpromazine; PANSS - positive and negative syndrome scale; SCID - structured clinical interview for diagnostic and statistical manual of mental diseases.

Table 3
Sociodemographic and clinical correlates of insomnia.

		Odds ratio	95% Wald confidence limits		*p* value
Age (years)	(Mean, SD)	0.91	0.84	0.99	0.024
Gender	Female	1			
	Male	1.37	0.61	3.10	0.447
Ethnicity	Chinese	1			
	Malay	1.63	0.10	27.28	0.734
	Indian	1.58	0.18	13.69	0.677
	Others	0.21	0.01	5.75	0.356
AUDIT ≥ 8	Non- hazardous use	1			
	Hazardous use	5.03	1.76	14.41	0.003
Smoking status	Never smoked	1			
	Currently smoking	3.50	1.27	9.64	0.015
	Ex-smokers	2.78	0.91	8.51	0.073
Years of schooling		1.02	0.89	1.17	0.742
Employment	Employed/NS	1			
	Student/homemaker	0.99	0.34	2.91	0.983
	Unemployed	1.13	0.44	2.87	0.801
Religion	Christian	1			
	Buddhist/taoist	0.79	0.25	2.52	0.686
	Hindu	0.40	0.02	9.20	0.569
	Islam	1.63	0.10	25.47	0.728
	Others	1.84	0.57	6.00	0.310
Marital	Single/never married	1			
	Ever married	2.68	0.76	9.45	0.125
SCID diagnosis	Schizophrenia and related psychosis	1			
	Mood disorder with psychotic symptoms	0.42	0.09	1.92	0.262

	Odds ratio	95% Wald confidence limits		*p* value
CPZ eqv (mg/day)	0.998	0.995	0.9998	0.035
Baseline PANSS positive score	0.93	0.86	1.01	0.080
Baseline PANSS negative score	0.98	0.92	1.05	0.591
Baseline PANSS GPS score	1.01	0.96	1.07	0.644
Duration of untreated psychosis (months)	1.02	1.01	1.04	0.010
Overall model fit				
Hosmer-Lemeshow goodness-of-fit tests				
Pearson $\chi 2$	242(27)			
p value	0.052			
AIC	223.58			
Area under ROC curve	0.833			

AIC - Akaike Information Criterion; AUDIT - alcohol use disorders identification test; CPZ - chlorpromazine; PANSS - positive and negative syndrome scale; ROC - Receiver Operating Characteristic; SCID - structured clinical interview for diagnostic and statistical manual of mental diseases.

significantly associated with a higher risk of insomnia.

Table 4 shows the relationship between insomnia, QOL, and functioning. After adjusting for all correlates in multiple linear regression models, analyses revealed that insomnia was associated with lower QOL across all four domains i.e., physical health, psychological, social relationships, and environment.

4. Discussion

The prevalence of insomnia in this sample of patients with FEP was 22.6% which is lower than that reported in studies among patients with schizophrenia elsewhere. Xiang et al. [20] and Hou et al. [46] reported a prevalence of 36% (of at least one type of insomnia over the previous 12 months), and 28.9% respectively among Chinese patients with schizophrenia. Ritsner et al. [18] classified 45.4% of the patients in their study with schizophrenia as poor sleepers. However, due to differences in the definitions of insomnia, the time-frames used to establish it as well the assessment instruments used in these studies, direct comparisons are difficult to make. Few studies have explored insomnia in Singapore; a study by Yeo et al. [47] reported a prevalence of 15.3% among Chinese and Malays in the community in Singapore while Yong et al. [31] reported a prevalence of 21.4% among patients with Parkinson disease using an ISI cut off score of 15.

Multivariate analysis identified hazardous alcohol use, current smoking and a longer duration of untreated psychosis to be significantly associated with a higher risk of insomnia while older age and higher antipsychotic doses were associated with a lower risk of insomnia. Few studies have examined the risk of hazardous alcohol use and smoking on insomnia among patients with schizophrenia. Population studies suggest that insomnia may lead to excessive alcohol use. Persons with chronic insomnia reported use of alcohol at bedtime for sleep about twice as often (12.9%) as an age-sex matched control group (5.6%) [48], while an epidemiologic community survey that assessed psychiatric disorders and insomnia with a 1-year follow-up found that uncomplicated insomnia was associated with an increase in risk of first onset of alcohol abuse over the following year [49]. Vinson et al. [50] examined the association of hazardous alcohol use and sleep in primary

Table 4
Relationship between quality of life, functioning and insomnia.

	Insomnia							*p* value
	No		Yes		Multiple linear regression			
	Mean	SD	Mean	SD	Adjusted B	95% CI		
WHOQOL domains								
Physical health	14.76	2.13	10.82	2.42	− 3.20	− 3.95	− 2.44	< 0.001
Psychological	12.86	2.79	9.60	2.90	− 2.46	− 3.45	− 1.48	< 0.001
Social relationships	13.51	2.53	10.33	3.33	− 3.06	− 4.01	− 2.12	< 0.001
Environment	13.69	2.64	11.38	2.52	− 1.64	− 2.50	− 0.78	< 0.001
Functioning								
GAF total	43.74	12.23	46.5	11.23	− 1.23	− 4.52	2.05	0.460

GAF - Global Assessment of Functioning; WHOQOL - World Health Organisation Quality of Life.
Adjusted B was estimated after controlling for sex, ethnicity, marital status, employment, religion, smoking status, diagnosis, age, years of education, Chlorpromazine equivalents, baseline Positive and Negative Syndrome Scale - positive, negative and general psychopathology scores and duration of untreated psychosis.

care patients and concluded that hazardous drinking was associated with few sleep problems, however, using alcohol for sleep was strongly associated with hazardous drinking. On the other hand, Haario et al. [51] in their prospective cohort study found that heavy drinking and binge drinking at baseline were associated with subsequent insomnia symptoms at follow-up after adjusting for all confounding variables. Studies on general population have found that cigarette smoking adversely affects sleep and is associated with insomnia [52–54]. Current smokers were more likely to have shorter sleep time, longer sleep latency, higher rapid eye movement sleep density, more episodes of sleep apnea, and more leg movements during sleep [55,56]. The stimulant effects of nicotine, withdrawal, or a higher prevalence of sleep disordered breathing may lead to insomnia in smokers [57].

Prolonged duration of untreated psychosis has been linked with several adverse outcomes in terms of both symptoms and functioning [58]. It is thus plausible that a longer duration of untreated psychosis also affects sleep architecture adversely. It is also possible that a longer duration of untreated psychosis prolongs untreated comorbid insomnia leading to more chronic and treatment-resistant insomnia in these patients.

The finding that older age is associated with a lower risk of insomnia is somewhat puzzling as both population-based studies and previous studies among patients with schizophrenia have found that older age is associated with a higher risk of insomnia [20,59]. However, this was a young cohort (age range – 15–40 years) and given that those in the youngest age group were more likely to be students or those doing their National Service in the army (a statutory requirement for all male Singaporean citizens and second-generation permanent residents wherein they undergo a period of compulsory service in the uniformed services), it is possible that they needed more sleep and given their functional role, felt the effects of sleep deprivation more acutely [60]. Studies also suggest that excessive use of electronic devices by teenagers and young adults is associated with delayed sleep/wake schedules, and that it has a negative effect on duration of sleep [61,62] and those belonging to the younger cohort in the current study may have an excessive use of electronic devices, especially handheld mobile devices.

The role of antipsychotics in sleep has been investigated in previous studies and it is suggested that their blockade of dopaminergic D2 receptors as well as adrenergic alpha1, histaminergic H1, and cholinergic (muscarinic-1) receptors play a significant role in improving sleep in schizophrenia patients [21,63]. Both high potency typical antipsychotics and atypical antipsychotics have been shown to increase total sleep time and increase sleep efficiency in schizophrenia [63]. This would explain our finding of higher antipsychotic doses being associated with a lower risk of insomnia.

The study found that all four QOL domains as assessed by WHOQOL-BREF were associated with insomnia, even after adjusting for confounders. The finding has been reported in previous studies among patients with schizophrenia wherein insomnia has been found to have an independent effect on QOL [18,20,23,46]. It is possible that insomnia, leading to lack of energy, daytime dysfunction and associated stress, impairs all aspects of QOL [18].

There are some limitations to the study. The study was cross-sectional in nature and hence causality cannot be determined. Insomnia and other outcomes were captured using only self-reported and self-administered measures. Self-administered measures place a significant cognitive burden on the respondent. However, we had to weigh this against social desirability bias and their willingness to disclose sensitive information; concerns that are addressed by using self-administered tools. [64,65]. Since two of the questionnaires collected information on smoking and alcohol use, we felt it is best to use a self-administered mode. Studies also suggest that adolescents report significantly higher levels of alcohol use, illicit drug use, and psychological distress in the computer mode than on paper self-administered questionnaires [66], thus we decided to use iPad as a mode of self-administration for this relatively young sample. Respondents were also informed that if they had any queries, they could approach the trained researchers who were stationed in the same area (clinic and assessment rooms). It is also important to acknowledge that studies have reported no significant differences in the quality of life outcomes based on the format of administration [67,68], and the validated self-administered version of ISI [69] was used in this study. We did not have a control group and thus are unable to determine whether the prevalence is reflective or higher than the wider population. Depression and anxiety were not measured and while the PANSS scale captures general psychopathology as one of the domains, the use of specific scales could have provided more information. Only about 50% of the patients who were accepted into the programme participated in the research. As the study was based on self-report, patients needed to be clinically stable, hence clinicians only referred patients whom they felt could participate in the study. Patients were young and were struggling to come to terms with the diagnosis, its implications and the effects of the illness and hence may have been less willing to participate in research. This low participation rate does hinder the generalisation of the results. However, a power analysis based on single proportion formulae performed to determine the sample size for estimating the prevalence of insomnia confirmed that the sample size was adequate for the study. On the basis of the prevalence estimate of 22.6%, we found that only 269 subjects are needed to produce a confidence interval estimate with 0.05 margin of error. Hence our current sample size is sufficient to estimate the prevalence of insomnia. However, in terms of identifying significant correlates of insomnia, various authors have suggested that a minimum of 5 to 10 events are required for each of the potential predictor variable to be investigated [70–72]. In our sample we have 63 events which suggest

that we should have no > 6 predictors in the model. Therefore, we re-examined the data using manual backward variable selection method by excluding non-significant variables using a p value of ≥ 0.05 criteria as standard cut off. The results indicated that the significant correlates of insomnia remained the same and fulfilled the rule of 10 events per predictor. While only two of the patients were prescribed sleeping pills regularly, some were also prescribed sleeping tablets p.r.n. Thus, we were unable to include data on sleep medications in the analysis in a meaningful way. It is also possible that patients may have received treatment for sleep related problems from family physicians which was not reflected in their medication records captured from IMH. Lastly, we included only English speaking participants in the study, and although English literacy is high in Singapore, especially in the younger age groups, < 5% participants were turned down due to language ineligibility. The strengths of the study include the large sample size of multi-ethnic FEP patients, and inclusion of variables such as hazardous alcohol use, and smoking which have not been examined in relation to insomnia among FEP patients in previous studies. In conclusion, our study found that about one in five FEP patients suffered from insomnia which is a significant finding. Given the adverse consequences of insomnia as well as the identification of preventable associated factors such as hazardous alcohol use and smoking, these must be screened for and patients must be referred concurrently for treatment of insomnia, smoking cessation as well as brief intervention for hazardous alcohol when needed.

Awareness of the extent of the problem, its effects on QOL as well as the need for sleep hygiene must be created among FEP patients. Intervention studies that involve pharmacological and non-pharmacological interventions must be considered. FEP provides an opportunity for early detection and management of insomnia which can prevent the development of chronic insomnia as well as its long term effects on illness severity and quality of life of patients.

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