

Original Article

Complex medical conditions and health risk behaviors among homeless males with schizophrenia

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Abstract

A comprehensive assessment of complex medical conditions and health risk behaviors among homeless individuals with schizophrenia facilitates the identification of health needs and areas for improvement in health services, thereby promoting more holistic care for this highly vulnerable population. The aim of this study was to assess complex medical conditions and health risk behaviors among Thai homeless males with schizophrenia. Additionally, factors related to the presence of multimorbidity in these vulnerable individuals were explored. Using a cross-sectional design, the study identified the prevalence of systemic diseases, physical disabilities, co-occurring mental disorders, and health risk behaviors among Thai homeless males with schizophrenia at the largest public homeless shelter in Pathum Thani, Thailand. Factors related to the presence of multimorbidity among these individuals were analyzed using univariable and multivariable generalized linear models for binomial response data with an identity link function to estimate prevalence difference (PD). Among 231 homeless males with schizophrenia, the prevalence of multimorbidity was 35.9%. Disease-specific prevalence was dominated by epilepsy (21.6%) and anemia (10.8%). About 38.4% of participants were underweight. The most common health risk behaviors included smoking (71.5%) and alcohol consumption (23.7%). Physical disabilities and co-occurring mental disorders were identified in 11.7% of participants, while 5.7% reported a history of suicide attempts. Underweight individuals had a significantly higher prevalence of multimorbidity compared to those with normal weight (adjusted PD (95%CI): 0.150 (0.017–0.823)). The study highlights that the substantial burden of complex medical conditions and health risk behaviors in this population underscores the need for a healthcare system that is not only reactive but also proactive. Such a system should prioritize health promotion and disease prevention to effectively safeguard the well-being of these vulnerable individuals.

Keywords: Epidemiology, homeless persons, morbidity, schizophrenia, social work

Introduction

Schizophrenia is a chronic brain disorder resulting in mental illness, characterized by an individual's disordered thinking and abnormal interpretation of reality [1,2]. The onset of schizophrenia commonly occurs in early adulthood, with its health consequences usually persisting throughout life [3]. Complete remission could only be achieved in 8.2% of the first-episode patients, while the rest experienced intermittent relapses or continuous illness [4].



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Schizophrenia results in either positive or negative symptoms [5]. The positive symptoms can be in a psychotic dimension—e.g., hallucination, or a disorganization dimension—e.g., disorganized behavior [5]. Negative symptoms that may stop functioning comprise affective flattening, alogia, asociality, anhedonia, and avolition [6]. Positive symptoms can lead to severe consequences, including suicide [7] and accidental deaths [8], while negative symptoms result in difficulty or even disability in maintaining activities of daily living—e.g., family integration problems and impaired occupational and social functioning [9]. The use of antipsychotic medications can also result in negative side effects such as lack of motivation that affects the functioning of daily life [10], abnormal glucose and lipid metabolism [11,12], and tardive dyskinesia that makes patients socially anxious and vulnerable to negative societal reactions [13].

The interplay of schizophrenia's adverse health consequences and social factors, such as economic hardship [14], lack of family support [15], and social exclusion [16], can lead to a heightened susceptibility to becoming homeless. Higher schizophrenia incidence associated with urbanization has been observed in Europe [17,18], America [19], and Asia [20]. Urbanization negatively impacts the population's mental health through several factors, such as increased stressors, diminished family and social support, overcrowding, and inadequate mental healthcare services [21,22]. Deinstitutionalization with neither organized living arrangements nor continuing mental healthcare has also contributed to homelessness among individuals with mental disorders [23]. Bi-directionality of schizophrenia and homelessness brings forth a vicious cycle that puts the patients in extreme vulnerability to the absence of general and mental healthcare, as well as other dangers from being neglected [24-26].

In Thailand, schizophrenia prevalence was estimated at 0.8% of the entire population (approximately 400,000 cases) in 2013 [27]. This prevalence was considerably higher than the global prevalence of 0.3% [28]. Regarding public schizophrenia care in Thailand, all district hospitals are responsible for providing primary care before referral for more specialized treatment by psychiatrists at tertiary care hospitals or mental institutions [29]. The community mental health system, formed by village health volunteers, officers at the Subdistrict Health Promotion Hospital, and a multidisciplinary healthcare team from the district hospitals, also supports schizophrenia patients in terms of long-term follow-up, rehabilitation, and mental health promotion in the community [29,30]. In contrast to many countries, such as the US and Singapore, which have a more mixed system with both the public and private sectors offering mental healthcare services [31,32], Thailand's mental health services mainly rely on public services [33]. Although minimizing the impairment caused by schizophrenia is a top priority for mental health providers, only 61.0% and 64.9% of patients with mental illness in Thailand had access to mental health services in 2015 and 2016 [27]. Many Thai schizophrenia patients are unaware of their mental disorder, which is further linked to a lack of healthcare-seeking behavior and poor adherence to therapy [34-36]. Lack of schizophrenia literacy and caregiving skills among family members has also been an issue, resulting in discouragement in taking care of the patients [27,35]. Loss of income due to patients' restricted occupational functioning can affect the family's ability to provide support for the patients [35,37]. Stigmatization of schizophrenia patients and their family members has long been pervasive [38,39]. Schizophrenia patients are perceived as unusual, aggressive, and even harmful in Asian cultures, including Thailand [40]. This negative impression leads to low social acceptance, discrimination, and ignorance among community members, exacerbating the problem of insufficient community support and increasing the likelihood of patients becoming homeless [40]. Once become homeless, Thai schizophrenia patients are typically unable to receive not only necessary mental health treatment but also other medical care. The lack of access to care can also aggravate the unacknowledged problem of multimorbidity—living with two or more chronic illnesses (e.g., having both schizophrenia and epilepsy).

To support Thai homeless individuals with physical, mental, or social disadvantages, 11 public homeless shelters (currently recognized as 'Aid Centers') have been established in all regions of the country [41]. The eligibility of individuals to be admitted in the shelter is defined by the laws comprising the Protection of Helpless Persons Act, B.E. 2557 (2014), the Beggar Control Act, B.E. 2559 (2016), and the Mental Health Act, B.E. 2551 (2008) [42-44]. According to these laws, homeless individuals were classified into three subtypes: vagabonds, impecunious

individuals, and beggars. A vagabond is a person who moves around without a permanent residence. An impecunious individual is a person who experiences socioeconomic hardship to the extent that the person cannot take care of himself or by family. A beggar is defined as a person asking strangers for money in a public place. In this report, the term panhandler was later used instead of beggar to be respectful.

The goal of these aid centers is to protect the holistic health of the homeless and re-establish the functioning that allows them to return to society. Nonetheless, only reactive health services for treating diseases with noticeable symptoms are available, while comprehensive care for other medical conditions, along with disease prevention and health promotion, remains suboptimal. Information regarding the prevalence of diseases and risk behaviors necessary for developing a comprehensive healthcare system in this setting is still lacking. Moreover, there is a dearth of research devoted to identifying the complex health conditions in need of care. A study in Thailand revealed that sex significantly differentiated the prevalence of schizophrenia and related health risk behaviors [45]. In 2019, the prevalence of schizophrenia was twice as high among male patients, with 140 cases per 100,000 population compared to the 70 cases per 100,000 population observed among female counterparts. It was thus suggested that schizophrenia problems and related risk behaviors in Thai men and women be prioritized separately [45].

The aim of this study was to identify the prevalence of systemic diseases, physical disabilities, and health risk behaviors among Thai homeless men with schizophrenia at the largest aid center in Thailand. In addition, factors related to the presence of multimorbidity were also analyzed to generate a hypothesis regarding potential factors that could affect multimorbidity in these vulnerable individuals [46]. The study would provide useful information, including characteristics of Thai homeless males with schizophrenia by overall and subtypes of homelessness, their prevalence of systemic diseases across different age groups, and the co-occurring disabilities that are necessary for comprehensive healthcare system development. Furthermore, the study would also provide clues about factors that may be related to the presence of multimorbidity and ease further epidemiological investigation of multimorbidity-associated factors in this unique population.

Methods

Study design and setting

This cross-sectional study was conducted at Thanyaburi Men's Aid Center in Thanyaburi District, Pathum Thani Province, Thailand. The prevalence of systemic diseases, physical disability, and health risk behaviors among all homeless male individuals with schizophrenia was primarily measured as of March 2018. Thanyaburi Aid Center for male homeless has been the largest among all 11 public homeless shelters in Thailand. The shelter provides necessities for living, primary healthcare services, and rehabilitation to homeless males aged ≥ 18 years old. The public shelter has the legal authority to take care of vagabonds, impecunious individuals, and panhandlers, either with or without mental illness, who consent to be admitted. The homeless with mental disorders at this shelter were initially sent to a designated psychiatric hospital (Srithanya Hospital) for diagnosis and proper treatment. Once the overall symptoms are controlled, the homeless must provide consent to be further admitted to the aid center, or otherwise return to their families. At this aid center, the caretaker-to-homeless ratio was 1:10. On-site primary healthcare services, including first aid, physical examination, basic medical care, and evaluation before referral, were provided by one nurse. For serious illness or the need for definitive diagnosis and treatment of systemic disease, the cases were referred for treatment at the local district hospital (Thanyaburi Hospital). An annual health check-up was carried out by nurses and public health officers from the Primary and Holistic Care Department of Thanyaburi Hospital. On-site mental health services were provided once a month by one psychiatrist from Srithanya Hospital—the largest psychiatric hospital in Thailand.

Study participants

Eligible individuals for this study were Thai homeless males aged ≥ 18 years old who were diagnosed with schizophrenia as shown in the existing records of diagnosis and treatment of

mental disorders available at Thanyaburi Men's Aid Center for Men as of March 2018—the month when data were collected for this study. The diagnosis of schizophrenia was based on the diagnostic and statistical manual of mental disorders, either the fourth edition (DSM-4) or the fifth edition (DSM-5), depending on the year each individual was diagnosed. The diagnoses of schizophrenia, along with other mental disorders, were made to provide monthly on-site mental health services at the aid center.

A minimum study size required to estimate the burden of multimorbidity among Thai homeless males with schizophrenia was calculated according to the study size estimation method for proportion described by Schaeffer and colleagues [47]. The estimated population of 3,993 homeless individuals in the Bangkok Metropolitan Area was reported in 2018 by Issarachon Foundation [48]. The proportion of homeless males with schizophrenia in this target population was unknown. The hypothesized prevalence of multimorbidity among homeless males with schizophrenia in the current setting was 10% of the total population. A precision of 5% was specified. A minimum study size of 134 was required. In this study, the entire population of homeless individuals with schizophrenia residing at this aid center as of March 2018 was included for analysis, totaling 231 individuals for final analysis, which is more than the minimal sample size required. This approach ensures a more comprehensive and representative dataset while mitigating potential biases that may arise from sampling.

Data collection

Comprehensive health services data used for analysis comprised demographic characteristics, systemic diseases, health risk behaviors, physical disabilities, and co-occurring mental disorders as of March 2018, the most recent data permitted for research. All study variables were collected from four data sources, including the shelter's general registry, physician's record, psychiatric record, and annual health check-up record. The demographic characteristics, including age (year), marital status, duration of stay in the homeless shelter (year), and type of helplessness (vagabond, impecunious, panhandler) were retrieved from the general registry at the shelter. Systemic diseases include hypertension, diabetes mellitus, cardiovascular disease, thyroid disease, anemia, asthma, and epilepsy. Physical disabilities were blindness, deafness, and limb loss. Data regarding systemic diseases and physical disabilities were obtained from physicians' records of diagnoses and treatments for the homeless available at the on-site healthcare unit. Co-occurring mental disorders comprising mental retardation, depression, anxiety, and substance-related disorder, along with the diagnosis of alcoholism and history of suicide attempts, were diagnosed and recorded by psychiatrists providing monthly on-site mental health services. These psychiatric records were also available at the on-site healthcare unit. Weight (kilogram) and height (centimeter) for body mass index (BMI) calculation were obtained from annual health check-up records in 2018. BMI values were further categorized into four groups, including normal BMI (18.5–24.9 kg/m²), underweight (<18.5 kg/m²), pre-obesity (25.0–29.9 kg/m²), and obesity (≥30 kg/m²) [49]. Risk behaviors, comprising smoking (non-, former-, and current smoker), and alcohol consumption (non-, former-, and current drinker), were documented in the homeless persons' health records and validated by the caretakers during health check-ups in 2018.

Statistical analysis

Personal characteristics and risk behaviors were summarized using descriptive statistics. The Shapiro-Wilk test for normality was employed to evaluate the distribution of the data. To examine the difference in characteristics across groups of the homeless with schizophrenia (e.g., by three subtypes of homelessness according to the law), a one-way analysis of variance (ANOVA) was employed. If the assumptions for one-way ANOVA were violated, the Kruskal-Wallis equality-of-populations rank test was applied instead. When only two subtypes were presented, an independent sample t-test, either with or without equal variances, was used. A two-sample Wilcoxon rank-sum test was applied when assumptions of the independent sample t-test were violated. Imputation of missing data in each study variable was planned to be implemented only if the proportion of missing data exceeded 10% of the total study population to prevent biased estimates of the relationship [50–51].

Univariable and multivariable binomial generalized linear regression models with identity link functions were performed to estimate the crude and adjusted prevalence differences,

indicating factors related to the outcome. The binary outcome for the regression analyses was the presence of multimorbidity. For the presence of a multimorbidity variable, the index category was defined as having at least one of the following co-occurring systemic diseases in addition to schizophrenia, including hypertension, cardiovascular disease, diabetes mellitus, thyroid disease, anemia, asthma, and epilepsy. The referent category was an absence of these co-occurring diseases. Independent variables explored for their relationship with the presence of multimorbidity included age, BMI, smoking, alcohol consumption, physical disabilities, and co-occurring mental disorders.

Results

Characteristics of homeless individuals with schizophrenia

All 231 homeless males with schizophrenia who were living at this aid center were included in the analysis as a total study population without any exclusions. Missing values were found in some study variables. Nonetheless, among the variables with missing values, the highest number of missing values was only 7 out of 231 values (3.03%) in the BMI variable. Thus, none of the variables required data imputation.

Of all 231 individuals, 78.4% were vagabonds, while no panhandler was found. The overall mean age was 47.4 years. The mean age of impecunious individuals was significantly lower than that of the vagabonds by 4 years ($p=0.029$). However, the proportions across three age groups of <40, 40–59, and ≥ 60 years old were not significantly different between vagabonds and impecunious groups. Almost all individuals were single, while three people were married but abandoned, and five were divorced or widowed. About 40.7% of the individuals had stayed at the shelter for more than five years and the longest stay was up to 26 years.

The distribution of the duration of stay at the aid center among vagabonds, characterized by a median of four years and a large interquartile range of 9.8 years, significantly differed from a median of 3.3 years and an interquartile range of four years among the impecunious individuals ($p=0.025$). Among the individuals aged under 60, the average duration of stay was 5.6 years, with a maximum of 23.5 years. The prevalence of underweight (BMI<18.5) was 38.4%, while obesity was rare (1.4%). The mean BMI of the vagabonds was significantly lower than that of the impecunious individuals ($p<0.001$). Regarding health risk behaviors, most of the individuals were current smokers (71.5%) and 23.7% were current alcohol drinkers. Alcoholism was diagnosed in 1.3% of the individuals and a history of suicide attempts was determined in 13 individuals (5.7%) (Table 1).

Table 1. Characteristics of male homeless individuals with schizophrenia by types of homelessness

Characteristics	Vagabond	Impecunious	Total	p-value
	n (%) [†]	n (%) [†]	n (%) [‡]	
Homeless people [‡]	181 (78.4)	50 (21.6)	231	
Age (years)				
Mean (SD)	48.2 (11.4)	44.2 (11.3)	47.4 (11.5)	0.029 ^a
Min-max	21–98	20–76	20–98	
<40	40 (22.1)	14 (28.0)	54 (23.4)	0.646 ^b
40–59	117 (64.6)	31 (62.0)	148 (64.1)	
≥ 60	24 (13.3)	5 (10.0)	29 (12.5)	
Marital status				
Single	172 (97.2)	47 (94.0)	219 (96.5)	0.397 ^b
Married	2 (1.1)	1 (2.0)	3 (1.3)	
Divorced/widowed	3 (1.7)	2 (4.0)	5 (2.2)	
Duration of stay in the shelter (years)				
Median (IQR)	4.0 (9.8)	3.3 (4.0)	3.4 (7.7)	0.025 ^c
Min-max	0.2–26.2	0.1–14.5	0.1–26.2	
0–1	15 (8.5)	11 (22.0)	26 (11.5)	0.009 ^b
1.1–5	82 (46.6)	26 (52.0)	108 (47.8)	
>5	79 (44.9)	13 (26.0)	92 (40.7)	
Body mass index (kg/m ²)				
Mean (SD)	19.7 (3.0)	22.3 (5.8)	20.3 (3.9)	<0.001 ^d
Min-max	13.6–27.7	14.2–50.9	13.6–50.9	
Normal weight (18.5–24.9)	90 (51.1)	29 (60.4)	119 (53.1)	<0.001 ^b
Underweight (<18.5)	76 (43.2)	10 (20.8)	86 (38.4)	
Pre-obesity (25.0–29.9)	10 (5.7)	6 (12.5)	16 (7.1)	

Characteristics	Vagabond	Impecunious	Total	p-value
	n (%) [†]	n (%) [†]	n (%) [‡]	
Obesity (≥30.0)	0 (0)	3 (6.3)	3 (1.4)	
Smoking				
Nonsmoker	40 (22.3)	15 (30.6)	55 (24.1)	0.338 ^b
Former smoker	7 (3.9)	3 (6.1)	10 (4.4)	
Current smoker	132 (73.8)	31 (63.3)	163 (71.5)	
Alcohol consumption				
Non-drinker	114 (64.0)	27 (54.0)	141 (61.8)	0.100 ^b
Former drinker	21 (11.8)	12 (24.0)	33 (14.5)	
Current drinker	43 (24.2)	11 (22.0)	54 (23.7)	
Alcoholism				
No	175 (98.9)	49 (98.0)	224 (98.7)	0.528 ^b
Yes	2 (1.1)	1 (2.0)	3 (1.3)	
Suicide attempt				
No	166 (93.8)	48 (96.0)	214 (94.3)	0.738 ^b
Yes	11 (6.2)	2 (4.0)	13 (5.7)	

SD: standard deviation; IQR: interquartile range

[†] Percentage by row, [‡] Percentage by column

^a Analyzed using an independent sample t-test with equal variance

^b Analyzed using exact probability test

^c Analyzed using a two-sample Wilcoxon rank-sum test

^d Analyzed using independent sample t-test with unequal variance

Prevalence of systemic diseases

Approximately one-third (35.9%) of the 231 homeless people with schizophrenia had at least one systemic disease in addition to schizophrenia. The three most prevalent comorbidities among the total individuals were epilepsy (21.6%), anemia (10.8%), and hypertension (9.5%). Analysis of age-specific prevalence revealed that epilepsy was the most common comorbidity among the individuals in the age groups of <40 and 40–59 years, with a prevalence of 27.8% and 20.9%, respectively. In contrast, anemia was the most prevalent comorbidity among those aged ≥60 years (17.2%). However, the exact probability test revealed no significant differences in the age-specific prevalence of any co-occurring diseases across the three age groups (**Table 2**).

Table 2. Systemic diseases of male homeless individuals with schizophrenia by age groups

Systemic diseases	Age groups (years)			Total n (%) [‡]	p-value*
	<40	40–59	≥60		
	n (%) [†]	n (%) [†]	n (%) [†]		
Homeless with schizophrenia [‡]	54 (23.4)	148 (64.1)	29 (12.5)	231	
Hypertension					
No	51 (94.4)	133 (89.9)	25 (86.2)	209 (90.5)	0.397
Yes	3 (5.6)	15 (10.1)	4 (13.8)	22 (9.5)	
Cardiovascular disease					
No	53 (98.1)	148 (100)	29 (100)	230 (99.6)	0.359
Yes	1 (1.9)	0 (0)	0 (0)	1 (0.4)	
Diabetes mellitus					
No	53 (98.1)	144 (97.3)	29 (100)	226 (97.8)	>0.999
Yes	1 (1.9)	4 (2.7)	0 (0)	5 (2.2)	
Thyroid disease					
No	54 (100)	147 (99.3)	29 (100)	230 (99.6)	>0.999
Yes	0 (0)	1 (0.7)	0 (0)	1 (0.4)	
Anemia					
No	48 (88.9)	134 (90.5)	24 (82.8)	206 (89.2)	0.441
Yes	6 (11.1)	14 (9.5)	5 (17.2)	25 (10.8)	
Asthma					
No	54 (100)	147 (99.3)	29 (100)	230 (99.6)	>0.999
Yes	0 (0)	1 (0.7)	0 (0)	1 (0.4)	
Epilepsy					
No	39 (72.2)	117 (79.1)	25 (86.2)	181 (78.4)	0.337
Yes	15 (27.8)	31 (20.9)	4 (13.8)	50 (21.6)	
Having at least one of the diseases					
No	34 (63.0)	97 (65.5)	17 (58.6)	148 (64.1)	0.756
Yes	20 (37.0)	51 (34.5)	12 (41.4)	83 (35.9)	

[†] Percentage by row

[‡] Percentage by column

*p-value for exact probability test

Prevalence of physical disabilities and co-occurring mental disorders

Physical disabilities and/or co-occurring mental disorders were determined in 27 individuals (11.7%). Limb loss and movement difficulty were the most common physical disability, with a prevalence of around 3.9% of the total individuals. Co-occurring mental disorder with the highest prevalence was mental retardation (3.5%). An extremely complex disability was found in one individual who was blind and had lost the right arm in addition to having schizophrenia (**Table 3**).

Table 3. Types of disabilities among male homeless individuals with schizophrenia

Types of disabilities	Disabilities, n (%) [†]
Total cases with disabilities	27 (11.7)
Physical disabilities	13 (5.6)
Limb loss and movement difficulty	9 (3.9)
Deaf	2 (0.9)
Blind	1 (0.4)
Blind & limb loss and movement difficulty	1 (0.4)
Co-occurring mental disorders	14 (6.1)
Mental retardation	8 (3.5)
Depression	4 (1.7)
Depression and anxiety	1 (0.4)
Substance-related disorder	1 (0.4)

[†] Percentage calculated from the total number of homeless people with schizophrenia (n=231)

Factors related to multimorbidity

The results of regression analysis to explore factors related to the presence of multimorbidity are presented in **Table 4**. The univariable analysis estimated the magnitude and direction of the unadjusted relationship between each explanatory variable and the presence of multimorbidity. From the univariable analysis, positive values of prevalence difference (PD) indicating greater prevalence of multimorbidity were identified in the groups of individuals who were underweight, overweight, ever or current drinkers, having physical disabilities, and having co-occurring mental disorders. However, none of these positive PD values were statistically significant.

The prevalence of multimorbidity in the underweight group was 12.8% greater than the prevalence in the normal weight group (PD (95%CI): 0.128 (-0.006–0.261)). Individuals who were overweight or obese had a slightly greater prevalence of multimorbidity than those in the normal weight group by 1.3% (PD (95%CI): 0.013 (-0.211–0.238)). Prevalence of multimorbidity was found to be higher among those who were ever or current alcohol drinkers than the non-drinkers by 6.9% (PD (95%CI): 0.069 (-0.060–0.198)). Individuals with physical disabilities had a 10.8% greater prevalence of multimorbidity than those without the conditions (PD (95%CI): 0.108 (-0.170–0.387)). The prevalence of multimorbidity among individuals with co-occurring mental disorders was 15% greater than the prevalence in their counterparts (PD (95%CI): 0.150 (-0.120–0.419)).

The multivariable model revealed that the only significant factor related to the increased prevalence of multimorbidity was underweight after adjusting for other covariates. Underweight individuals had a 15% significantly greater prevalence of multimorbidity compared to individuals with normal weight (PD (95%CI): 0.150 (0.017–0.823)). Although factors including age ≥ 40 years, overweight or obese, being ever or current alcohol drinker, having physical disabilities, and having co-occurring mental disorders also showed positive values of adjusted PD; none of these factors obtained statistically significant results (**Table 4**).

Table 4. Factors related to the presence of multimorbidity among male homeless individuals with schizophrenia (n=231)

Factors	Presence of multimorbidity n (%) [†]	Univariable analysis			Multivariable analysis		
		Prevalence difference	95% confidence interval	p-value	Prevalence difference	95% confidence interval	p-value
Multimorbidity outcome	83 (35.9)						
Age (years)							
<40	20 (37.0)		Reference			Reference	
≥40	63 (35.6)	-0.014	-0.161–0.132	0.847	0.019	-0.128–0.166	0.803
Body mass index (km/m ²)							
Normal weight	36 (30.3)		Reference			Reference	
Underweight	37 (43.0)	0.128	-0.006–0.261	0.060	0.150	0.017–0.823	0.027
Overweight or obesity	6 (31.6)	0.013	-0.211–0.238	0.908	0.034	-0.190–0.256	0.760
Smoking							
Nonsmoker	22 (40.0)		Reference			Reference	
Ever or current smoker	60 (34.7)	-0.053	-0.201–0.094	0.480	-0.091	-0.242–0.060	0.239
Alcohol consumption							
Nondrinker	47 (33.3)		Reference			Reference	
Ever or current drinker	35 (40.2)	0.069	-0.060–0.198	0.295	0.108	-0.026–0.241	0.113
Physical disabilities							
No	77 (35.3)		Reference			Reference	
Yes	6 (46.2)	0.108	-0.170–0.387	0.446	0.046	-0.237–0.328	0.752
Co-occurring mental disorders							
No	76 (35.0)		Reference			Reference	
Yes	7 (50.0)	0.150	-0.120–0.419	0.276	0.181	-0.091–0.454	0.191

[†] Percentage by row; prevalence difference estimated by binomial generalized linear models with identity link function

Discussion

The finding that the majority of the individuals (87.5%) were of working age (<60) with a maximum duration of stay of up to 23.5 years was concerning since they might have sustained lives in society if they had timely access to mental health services to maintain daily and occupational functionality [52]. Nonetheless, enabling access to mental health services has long been challenging, not only in this context but also globally [53]. In Thailand, several barriers to schizophrenia care include the patient's and caregiver's lack of disease perception and understanding, which affects help-seeking behavior and adherence to therapy, the expectation of stigmatization and discrimination against individuals with schizophrenia, and the lack of community support [34-36,54]. In addition to social stigma, negative attitudes towards schizophrenia and other mental disorders in healthcare settings were also noted [55]. The stigmatization in healthcare affects accessibility to necessary care, compromised patient-provider relationships, suboptimal quality of care, and discontinuation of treatment [56,57]. To alleviate these barriers in access to schizophrenia care and other necessary care to maintain personal functionality, which would consequently reduce the likelihood of the patients becoming neglected and homeless, the intervention enhancing community support along with improved training for health professionals in caring for individuals with mental illness are recommended [56,57].

The fact that 40.7% of all individuals have stayed in the shelter for more than 5 years and the maximum length of stay of more than 26 years indicates long-term shelter dependence among these individuals. Since these individuals with schizophrenia could have periodic relapses or persistent illness over a long period [4], this psychological condition could further impact their capacity to return to the community and even cause lifetime homelessness [58]. Long-term homelessness, defined as ≥ 1 year, has been shown to create a greater burden on the public system [59,60]. The effect of schizophrenia on shelter dependence would create system congestion at the shelter in the long run, as new incident cases of homelessness could not be admitted due to the inability to discharge the current individuals in need of care. This issue highlights the importance of increasing family and social support for schizophrenia patients before they become neglected, as well as for those who have become homeless, to help them return to and sustain their lives in society. Early diagnosis and treatment during the prodromal phase of schizophrenia to prevent the likelihood of relapse would enhance psychosocial outcomes in schizophrenia patients [61]. The strategy that provides psychosocial support to both schizophrenia patients and their families alongside medical treatment was determined to be more effective than medication-only conventional treatment in terms of relapse rate reduction and sustainability of care when family interventions were sustained [62]. Schizophrenia patients would also benefit from social skills training that provides them the opportunities and motivation to practice everyday life skills, allowing them to develop interpersonal management and independent living abilities for better functioning in their communities [63].

The prevalence of underweight among these participants (38.4%) was substantially greater than the 9% reported among the Thai male general population [64]. This high prevalence of being underweight might be related to insufficient food intake because of the negative symptoms of schizophrenia [65]. In addition, the clinician might primarily focus on the mental problem and possibly overlook the underweight problem [66]. Being underweight is an indicator of malnutrition, which could potentially increase susceptibility to infections, such as pneumonia in individuals with schizophrenia [67]. This study additionally showed that being underweight was significantly related to multimorbidity among homeless individuals with schizophrenia (**Table 4**). While the presence of multimorbidity was useful in expressing the overall burden of multiple systemic diseases, the term, on the other hand, traded off its ability to define a specific condition. To provide more information regarding being underweight and specific diseases, the proportion of each systemic disease in the subgroup of underweight individuals was also analyzed. Among 86 underweight individuals, 37 (43.0%) had at least one systemic disease. These diseases included epilepsy (22.1%), anemia (18.6%), and hypertension (10.5%). None of these underweight individuals had cardiovascular disease, diabetes, thyroid disease, or asthma. These additional findings indicated the burden of specific diseases that should be considered in comprehensive care for these underweight individuals.

Unlike the chronic non-communicable diseases with the highest rates of morbidity in Thai general populations, which comprised diabetes mellitus, cardiovascular disease, hypertension, and obesity; the most common comorbidities in Thai homeless males with schizophrenia in this setting were epilepsy and anemia [68]. The high prevalence of epilepsy in this study was consistent with prior studies that showed epilepsy as a common comorbidity with schizophrenia [69,70]. The prevalence of schizophrenia among epilepsy patients was found to range from 0.8% to 70% [69,70]. Shared susceptibility to epilepsy and schizophrenia has been explained by a finding of leucine-rich glioma-inactivated (LGI) family genes that are causally associated with partial epilepsy, and their auditory features might also contribute to auditory hallucinations and thought disorders that are symptoms of schizophrenia [71]. Psychotic symptoms, including hallucinations and paranoid delusions, were also shared by both schizophrenia and epilepsy [72].

Apart from epilepsy, iron deficiency anemia was previously shown to be independently associated with negative symptoms of schizophrenia [73]. This association might explain the finding of a 10.8% prevalence of anemia among the study individuals. The empirical findings of complex medical conditions involving being underweight, epilepsy, and anemia indicate the need for improved nutrition and comprehensive healthcare beyond the treatment of schizophrenia in this setting. Better nutrition might be attained through the inclusion of dietitians from the local public hospitals in the collaborative healthcare team. Information from general health check-ups held annually at this aid center should be analyzed and leveraged to continuously monitor the burden of comorbidity and healthcare needs. The existing reactive healthcare approach, which has been centered on referrals once serious illness occurs, should be supplemented by proactive healthcare, such as monitoring and modifying dietary intake [74].

Major health risk behaviors among the study individuals were smoking, alcohol consumption, and suicide attempts. Although smoking and drinking were prohibited in the homeless shelter, these behaviors could still occur when these individuals went out for community-based occupational skills training. The notably high prevalence of smoking in the current study was consistent with previous studies that reported smoking was more common in individuals with schizophrenia than among individuals with other mental illnesses or the general population [75,76]. A hypothesis so-called 'self-medicative' suggests that nicotine triggers the release of dopamine and serotonin, which consequently drives the individual's desire to smoke [77]. Another theory proposes a shared genetic propensity between smoking and schizophrenia [78]. The contribution of smoking to the development of schizophrenia has also been investigated [79]. Despite these existing hypotheses, the underlying reason for the high smoking prevalence in schizophrenia patients has remained unclear [77].

Apart from smoking, almost one-fourth of these individuals were current alcohol drinkers, and three individuals (1.3%) were found to have alcoholism. Even without alcohol dependence syndrome, schizophrenia patients could be prone to the negative effects of alcohol on their social adjustment [80]. Alcoholism could also contribute to violent behavior, criminal activity, and suicide attempts in individuals with schizophrenia [81,82]. The finding of a 5.7% prevalence of prior suicide attempts in this current context was further concerning since a previous study unveiled that nearly 40% of schizophrenia patients who had attempted suicide once later repeated suicide attempts, and 41% of schizophrenia patients made at least one suicide attempt in general [83]. Management of these health risk behaviors should be an integral part of the healthcare system in this homeless shelter. Smoking cessation using pharmacotherapy [84] and medication-assisted treatment for alcoholism [85] might be the services additionally provided at the shelter by the local hospitals. Psychosocial intervention to prevent suicide attempts [86] could also be useful in this setting.

This study contributed to the literature by filling a crucial knowledge gap regarding the health status of homeless males with schizophrenia in Thailand. This extremely vulnerable population was often overlooked in health research and policy. To provide a holistic view of health challenges faced by these individuals and inform policy, this study reported meaningful information on a wide range of health conditions and risk behaviors. It also investigated factors related to the multimorbidity outcome. Nonetheless, as a cross-sectional study that could not assess the temporal relationship, this finding was limited to generating a hypothesis. A comparison of factors, such as ever smoking versus never smoking, within the group of homeless

individuals with schizophrenia did not determine which health conditions were specifically related to schizophrenia versus homelessness in general. Further studies comparing homeless individuals with and without schizophrenia were thus recommended to specify health issues associated with schizophrenia among homeless individuals. Although this study was conducted in the largest homeless shelter in Thailand, the results can only apply to homeless males with schizophrenia in this urban setting and may not be generalized to other regions or settings in Thailand. Therefore, assessing health issues among homeless males in other shelters with different social and healthcare contexts is recommended to improve care for these vulnerable populations in other settings.

Conclusion

About one-third of the homeless Thai men with schizophrenia in this study had complex medical issues, which included being underweight, epilepsy, and anemia. The high prevalence of smoking was a great concern. The evidence of these complex medical conditions and health risk behaviors necessitates the need for not only a reactive healthcare system but also a proactive one that promotes health and prevents diseases to authentically protect the health of these vulnerable individuals. The proactive healthcare interventions relevant to this setting include dietetic and nutritional management, smoking cessation, alcohol control, and psychological support.

Ethics approval

This study was approved in 2018 by the Ethics Committee of Human Research in Medical and Public Health of Pathum Thani Province, Pathum Thani Provincial Public Health Office (PPHO-REC 2561/015).

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Competing interests

All the authors declare that there are no conflicts of interest.

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Underlying data

Derived data supporting the findings of this study cannot be shared due to the restricted permission for data use solely for this research by the Aid Center.

Declaration of artificial intelligence use

We hereby confirm that no artificial intelligence (AI) tools or methodologies were utilized at any stage of this study, including during data collection, analysis, visualization, or manuscript preparation. All work presented in this study was conducted manually by the authors without the assistance of AI-based tools or systems.

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