TYPOLOGY OF SLEEP MEDICATION USERS AND ASSOCIATED MENTAL HEALTH AND SUBSTANCE USE FROM A MONTREAL EPIDEMIOLOGICAL STUDY

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ABSTRACT

Background
Sleep medication is often reported as one of the most highly used psychotropic drugs in terms of past-year prevalence. Since their use often varies according to the characteristics of individuals, it is important to better understand these particular utilization patterns.

Objectives
The study aims to develop a typology of sleep medication users' characteristics, including their associated mental health and substance use.

Methods
Residents from the epidemiological area of south-west Montreal, Quebec aged 15 years and older responded to a questionnaire in 2009 and 2011. Among the 1822 people who participated at both T1 and T2, 306 (17%) reported use of medication to help them sleep. These participants were selected for cluster analysis based on five variables related to mental health. The identified clusters were then tested for association with sociodemographic, psychosocial, and service use characteristics.

Results
A three-cluster solution emerged: 1) older individuals without mental health problems, drug use or psychotropic medication use; 2) individuals with elevated psychological distress, drug use and low social support, and 3) individuals with mood and anxiety disorders, using services for mental health and taking two or more psychotropic medications.

Conclusions
The results establish the significance of problems related to mental health in differentiating sleep medication users. Consideration of these differences may improve the ability of health professionals to provide services that are better suited for patients, including interventions that increase the ability to cope with stress (cluster 2) and more integrated services for those with concurrent disorders (cluster 3).

Key Words: *Sleep medication; mental health; typology; longitudinal model*

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Sleep complaints are common among the adult population. Decreased quality of sleep is associated with physical and psychiatric conditions and can cause significant impairment in daily functioning. Insomnia is reported as the most frequent sleep disorder[1], affecting one in five adults.[2] Sleep medications are often reported as some of the most highly used psychotropic drugs, with over sixty million prescriptions dispensed each year in the United States alone.[3,4] Population-based studies have estimated past-year use of sleep medication for 7.4% of the adult and 11-14% of the elderly population.[5] In Quebec, the past-year prevalence of sleep medication use is higher (9.1%) than that of anxiolytics (6.9%) or antidepressants (5.2%).[6] Medications currently

designated for insomnia or acute sleep disruption include prescription benzodiazepine and non-benzodiazepine drugs as well as over-the-counter sleep-aids containing antihistamines. Side effects associated with sleep medication use have been well-documented and include cognitive problems, daytime drowsiness, increased risk of accidents, and increased breathing problems during sleep.[7] Recent data has demonstrated an association between sedative-hypnotic use and increased hazards of death, with the risk increasing for larger dosages.[8] While most sleep medications are intended for short-term use, a proportion of users take the medication for longer than the recommended duration, which may increase the potential for dependence and problematic withdrawal symptoms.[9]

Despite evidence suggesting that the most common sedative-hypnotics present a low risk of abuse[10,11], certain populations are more susceptible to becoming dependent. Misuse of sleeping pills is higher for those who already exhibit substance abuse.[12,13] In addition, self-reported dependence and difficulty quitting use of sleep medications is more common in females, and increases with age.[9,14] Women and older individuals not only exhibit higher use of sleep medication in general, but are also more at risk for associated adverse effects. In a recent report of emergency room visits related to zolpidem use, a commonly prescribed non-benzodiazepine hypnotic, two-thirds of visits were from women and three-quarters were by adults over the age of forty-five.[15] Furthermore, use of sleep medication among the elderly may cause falls, fractures, and cognitive problems.[5,16,17]

Sleep disturbances are also associated with symptoms of depression and anxiety, although the direction of causation is poorly understood. Decreased sleep quality is both a consequence of and a risk factor for development of psychiatric illnesses.[18] Medication guides for widely-prescribed z-hypnotics, such as zopiclone and zolpidem, include warnings that the drugs may not be recommended for patients with a history of depression.[19] Some sleep medications could cause a worsening of depressive symptoms in patients with pre-existing depression.[20] The

association between use of sleep medication and sociodemographic and individual risk factors including sex, age, income, symptoms of depression and anxiety, and drug use has been well explored.[9,17,21,22] Sleep medication users, however, constitute a heterogeneous population whose health service and medication needs are related to an interaction between the causes and consequences of the sleep disorder, comorbid illnesses, and available coping resources. It is unclear in the literature how these factors interact and overlap for users. Additionally, the literature is limited with regard to differentiating sleep medication users based on mental health characteristics; especially how these characteristics affect medication use over time. Cluster analysis has been employed by a number of studies classifying patients with mental disorders[23,24] and use of mental health services.[25,26] One of the few typologies on the use of hypnotics identifies nonproblematic users, at-risk users, users with a probable mental disorder, and compulsive users.[27] A more comprehensive and empirically-derived profile of long-term sleep medication users may provide a useful basis for predicting course of therapy and identifying potential inappropriate use.

METHODS

Data Collection
This study focuses on an epidemiological catchment area in south-west Montreal, Quebec with a population of about 270 000. The first two cycles of this longitudinal study were conducted in 2009 and 2011 based on procedures and criteria of the National Population Health Survey.[28] At the start of the study, 3408 addresses were randomly selected and one individual per household was chosen. The sampling was stratified by geographic location, density, and socioeconomic status. The final sample consisted of 2433 participants with a response rate of 48.7%. In 2011, 1822 of the 2433 participants completed the second interview cycle for a retention rate of 75%. The questionnaire was administered by trained interviewers in the participants' homes and in their chosen language (English or French).

Participants were required to sign both a consent form and a permission form allowing the research team to contact them if the questionnaire detected a mental illness for which the individual was not receiving services. For those aged 15 to 17, parents provided consent before the questionnaire was administered. The project was approved by the Research Ethics Committee of the Douglas Mental Health University Institute.

Variables and Measures

Sleep medication use was measured at time 1 (T1) and time 2 (T2) using the following question drawn from the Canadian Community Health Survey (cycle 1.2, 2009).[29] "In the past 12 months, did you take any medication to help you sleep (such as Imovane, Nytol, or Starnoc)?" The longitudinal design enabled the identification of three groups: participants who used sleep medication only at T1 (remittent), only at T2 (incident), and both at T1 and T2 (persistent). The main variable, therefore, is *longitudinal patterns of use*, which refers to participants classified as remittent, incident or persistent users.

To generate profiles of sleep medication users, five variables recorded at T1 were theoretically relevant to the literature for mental health problems or substance use that interferes with sleep and longitudinal patterns of sleep medication use. Diagnosis of *mood disorder* (major depression or mania) and *anxiety disorder* (panic disorder, social phobia, or agoraphobia) within the 12 months preceding the first survey was evaluated using the Composite International Diagnostic Interview: CIDI[30]. Self-reported use of one illicit drug (marijuana, cocaine, crack, speed, ecstasy, or steroids) and one psychotropic medication other than those for sleep (antidepressants, anxiolytics, antipsychotics, mood stabilizers, or stimulants) during the 12 months preceding the first survey was recorded. *Psychological distress* was dichotomized using the K-10 scale.[31] The scale requires respondents to estimate the frequency of psychological symptoms over the course of the month preceding the survey and an aggregate score was calculated (min=0; max=34). Elevated psychological distress was defined as a score greater than or equal to 9.

The following contextual variables, postulated to affect profiles of sleep medication users were recorded at T1, and the items employed came from the Canadian Community Health Survey cycle 1.2 questionnaire (CCHS cycle 1.2, 2009): 1) physical health: Five-point Likert scales were used to assess self-reported physical health (excellent, very good, good, fair, poor); 2) quality of life: measured with a scale using a self-report to measure domains related to material and physical well-being, relationships, social, community and civic activities, personal development and fulfillment, and recreation[32] with aggregate scores (min=26; max=140) being dichotomized based on the median (elevated ≥ 111); 3) social support: a scale measuring self-reported attachment, social integration, reassurance, tangible help, orientation and opportunity for nurturance was used to measure this variable[33], and aggregate scores (min=42; max=96) were dichotomized based on the median (elevated ≥ 82); 4) use of an avoidant strategy to cope with stress (through use of cigarettes, alcohol, drugs, or medications); 5) service use characteristics: those considered were consultation of at least one health professional for mental health reasons within the 12 months preceding the first cycle (psychologist, psychiatrist, drug and alcohol counsellor, family doctor, or other professional) and use of sleep medication under supervision of a health professional, and 6) sociodemographic variables: sex, age, marital status, and household income were the variables considered.

Statistical Analysis

Before being subjected to statistical analysis using SPSS (version 20), the data was weighted according to the proportions of age and sex distribution of the population. Cluster analysis was performed on the 306 respondents having reported use of sleep medications at either T1 or T2, according to the steps described by Rapkin and Luke (1993).[34] The relevant variables included in the analysis were selected at T1 and limited to five in number for statistical reasons: mood disorder, anxiety disorder, drug use, use of psychotropic medication other than sleeping pills,

and elevated psychological distress. Because few participants have a diagnosis of alcohol or drug dependence (n = 17), this clinical variable was not retained.

The correlation matrix indicated that none of the internal variables were highly correlated with each other; the highest coefficient barely exceeded 0.50. Because the risk of multicollinearity was very low, a typology of sleep medication users was carried out by the Two-Step classification method.[35] To determine inter-subject distance and participant classification, the Log-likelihood method was used. The final number of clusters was set at three, according to the Bayesian Information Criterion (BIC) algorithm.

Complementary chi-square and Cramer's V analyses were conducted to test the association between contextual (i.e. external) variables and differentiation of the clusters. The contextual variables used to determine the predictive validity of the clusters included longitudinal patterns of sleep medication use (incident, remittent, and persistent), sociodemographic characteristics (sex, age, marital status, and income), psychosocial factors (satisfaction with life, perception of physical health, social support, and coping strategy for stress), and service use characteristics (consultation of a health professional, use of sleep medications with supervision).

RESULTS

Participant Characteristics
From the 1822 participants, 1799 responded at both T1 and T2, and the prevalence of sleep medication consumption was 10.7% at T1 (193) and 12.1% at T2 (218). The number of participants reporting use of sleep medication at either T1 or T2 was 306 (17%). Among them, 114 started using sleep medications in the 12 months preceding T2 (37.3%), 100 showed persistent use (32.7%), and 91 ceased use of sleep medications after T1 (29.7%).

Participants using sleep medications presented unique characteristics at T1 (Table 1).

The average age was 47.5 years ± 12.5, 61.5% were female, 26.9% were divorced,

separated, or widowed; 39.1% had an income below $25,000. The majority of sleep medication users reported good physical health (72.9%); however, a large proportion reported having low social support (53.6%) and low quality of life (59.9%). Among sleep medication users, 21.8% showed presence of a mood disorder within the past year (major depression or mania), 9.7% had an anxiety disorder (panic disorder, social phobia, or agoraphobia), and 51.8% showed elevated psychological distress. Forty-two percent reported using at least one other psychotropic medication over the last year and 20.3% consumed at least one illicit drug. Just over half (52.8%) reported the use of cigarettes, alcohol, drugs, or medication to deal with stress. Although few participants reported having consulted a health professional for mental health reasons (16.5%), the majority were using sleep medications under supervision (78.2%).

Cluster Identification and Labelling
The Two-Step cluster analysis generates three separate classes that best fit the latent structure of the data as shown in Table 2. It was possible to classify 275 of the 306 participants having taken sleep medication at T1 or T2. The five variables included in the analysis each have statistically significant effects on the differentiation of the clusters (p<0.001, V>0.30).

Cluster 1, comprising 34.6% of the sample, consists of participants without the five characteristics included in the analysis, labelled "*users without mental health issues*". In contrast, Cluster 3 was characterized by the presence of mood and/or anxiety disorders, elevated psychological distress, and the use of at least one psychotropic medication in addition to sleep medication at the initial state. Cluster 3 represents "*users with mental disorders and multiple medication use*" and represents 25.8% of the sample.

Between the profiles of the two clusters is Cluster 2, comprising 39.6% of the sample.

Cluster 2 groups individuals without mental disorders; but, with elevated levels of psychological distress and use of at least one illicit drug in the year preceding the first interview.

Cluster 2 was given the label "*users with psychological distress and drug use.*" It is important to note, however, that Clusters 2 and 3 seem to not differ significantly on measures of psychological distress and consumption of other psychotropic medications.

TABLE 1 Descriptive statistics of participants using sleep medication in the 12 months pre-interview at either T1 or T2 according to longitudinal pattern of use (n=306)

Characteristics	Longitudinal sleep medication use			
	Incident[†] T2- group	Remittent T1- group	Persistent T1-2- group	Total (T1 or T2)
n	114 (37.4)	91 (29.8)	100 (32.7)	306 (100)
Sex				
Male	50 (43.9)	35 (38.6)	32 (32.1)	118 (38.5)
Female	64 (56.1)	56 (61.4)	68 (67.9)	188 (61.5)
Age				
15-49	58 (50.9)	41 (45.1)	55 (55.0)	154 (50.5)
50 +	56 (49.1)	50 (54.9)	45 (45.0)	151 (49.5)
Average (standard deviation)	46.5 (12.9)	48.1(12.4)	48.1 (11.7)	47.5 (12.4)
Marital status				
Living with a partner	51 (45.0)	28 (31.3)	33 (33.0)	113 (37.0)
Single	42 (36.5)	30 (33.1)	38 (38.2)	110 (36.1)
Divorced|separated|widowed	21 (18.5)	32 (35.6)	29 (28.8)	82 (26.9)
Income				
0-24999	35 (37.2)	23 (30.7)	43 (48.3)	101 (39.1)
25000-69999	25 (26.6)	30 (40.0)	28 (31.5)	83 (32.2)
70000 and over	34 (36.2)	22 (29.3)	18 (20.2)	74 (28.7)
Reported physical health				
Excellent, very good, or good	89(77.6)	73 (80.2)	61 (60.6)	223 (72.9)
Quality of life				
High	60 (52.3)	33 (36.7)	29 (28.9)	121 (40.1)
Social support				
High	52 (50.0)	38 (43.2)	44 (45.4)	134 (46.4)
Consultation of health professional				
Yes	12 (11.1)	12 (14.1)	19 (21.5)	44 (16.5)
Supervision				
Yes	0 (0)	69 (75.8)	80 (80.0)	149 (78.2)
Avoidant coping strategy				
Yes	52 (50.0)	41 (51.1)	54 (57.6)	147 (52.8)
Psychological distress				
Elevated	46 (40.4)	50 (55.2)	62 (62.3)	158 (51.8)
Drug use				
Other	93 (80.9)	75 (82.4)	76 (76.0)	244 (79.7)
Yes	22 (19.1)	16 (17.6)	24 (24.0)	62 (20.3)
Other psychotropic medication				
Yes	31 (27.2)	44 (48.4)	53 (53.0)	128 (42.0)
Mood disorder				
Yes	14 (12.1)	18 (22.6)	31 (32.9)	63 (21.8)
Anxiety disorder				
Yes	9 (7.9)	7 (8.5)	12 (12.7)	28 (9.7)

Notes: The entries are frequencies (percentages). The percentages are calculated within subgroups in the columns. [†]Incident pattern of use refers to those participants who were not taking sleep medications at the start of the study but reported using them in the 12 months before T2. Remittent pattern of use refers to participants who used sleep medication only at T1, and persistent pattern of use refers to participants who used sleep medication at both T1 and T2.

TABLE 2 Cluster analysis of sleep medication users according to mental health disorder, psychological distress, and substance use (n=306)

Internal variables	Typology			χ^2	Cramer's V
	Cluster 1 95 (34.6)	Cluster 2 109 (39.6)	Cluster 3 71 (25.8)		
Mood disorder				225.2***	0.91
No	95 (100)	109 (100)	10 (14.1)		
Yes	0 (0)	0 (0)	61 (85.9)		
Elevated psychological distress				168.2***	0.78
No	95 (100)	38 (34.9)	2 (2.8)		
Yes	0 (0)	71 (65.1)	69 (97.2)		
Other psychotropic medications				105.6***	0.62
No	95 (100)	57 (52.3)	17 (23.9)		
Yes	0 (0)	52 (47.7)	54 (76.1)		
Anxiety disorder				89.6***	0.57
No	95 (100)	109 (100)	43 (60.6)		
Yes	0 (0)	0 (0)	28 (39.4)		
Drug use				37.3***	0.37
No	95 (100)	73 (67.0)	52 (73.2)		
Yes	0 (0.0)	36 (33.0)	19 (26.8)		
Labels	Users without mental health issues	Users with psychological distress and drug use	Users with mental disorders and multiple medication use		

Notes: The entries are frequencies (percentages). The percentages are calculated within the clusters in the columns and the missing cases (31) are excluded. ***p<0.001

Cluster Validation with Contextual Variables

The three profiles also differ with respect to the contextual variables that were not included in the cluster analysis (Table 3). The distribution of long-term patterns of consumption (incident, persistent, and remittent) vary significantly between the clusters (p<0.001, V≥0.20). Cluster 1 presents the highest proportion of participants who initiated use of sleep medications two years after the baseline ("new users" or "incident"; 54.2%). Individuals who reported use of sleep medications at both baseline and two years later (persistent) are more represented in Cluster 3 (49.3%).

With the exception of sex, all sociodemographic, psychosocial and service use variables considered at T1 were significantly associated with the cluster differentiation (p<0.05, V≥0.16). Having consulted a health professional for mental health concerns over the year preceding the start of the study is the variable most associated with profiles. Users without mental health issues (Cluster 1) are found to be mainly aged 50 years and older, living with a partner, having a household income of $70,000 or higher, and report having a positive perception of their physical health, elevated social support and high quality of life. In contrast, individuals aged less than 50 years, single, and earning less than $25,000 annually are more numerous in Cluster 3 (users with mental disorders and multiple medication use). These individuals are those who have consulted a health professional about mental health, reported low social support and quality of life, and have taken sleep medications under supervision of a health professional. Those with psychological distress and drug use (Cluster 2) are mainly individuals aged less than 50 years who reported low social support and low quality of life, use of sleep medication without supervision, and use of an avoidant strategy to cope with stress through the use of alcohol, cigarettes, drugs, or medications. The salient characteristics of the clusters are summarized in Table 4.

TABLE 3 Distribution of complementary psychosocial, sociodemographic, and service use characteristics within clusters (n=306)

Contextual variables	Typology			χ^2	Cramer's V
	Cluster 1 95 (34.6)	Cluster 2 109 (39.6)	Cluster 3 71 (25.8)		
Sleep medication use T1-T2				22.5***	0.20
Incident	52 (54.2)	39 (35.8)	16 (22.5)		
Remittent	20 (20.8)	38 (34.9)	20 (28.2)		
Persistent	24 (25.0)	32 (29.4)	35 (49.3)		
Supervision				7.78*	0.21
No	13 (29.5)	22 (31.0)	6 (10.9)		
Yes	31 (70.5)	49 (69.0)	49 (89.1)		
Age				6.7*	0.16
15-49	41 (43.2)	58 (53.2)	45 (63.4)		
50 +	54 (56.8)	51 (46.8)	26 (36.6)		
Sex				1.5	-
Male	44 (45.8)	44 (40.4)	26 (36.6)		
Female	52 (54.2)	65 (59.6)	45 (63.4)		
Marital status				24.8***	0.21
Living with a partner	55 (57.9)	35 (32.4)	16 (22.9)		
Single	25 (26.3)	40 (37.0)	33 (47.1)		
Divorced|separated|widowed	15 (15.8)	33 (30.6)	21 (30.0)		
Household income				22.2***	0.22
0-24999	15 (19.7)	39 (41.1)	32 (53.3)		
25000-69999	28 (36.8)	25 (26.3)	20 (33.3)		
70000 +	33 (43.4)	31 (32.6)	8 (13.3)		
Reported physical health				36.1***	0.36
Fair or poor	10 (10.5)	27 (24.8)	37 (52.1)		
Excellent, very good, good	85 (89.5)	82 (75.2)	34 (47.9)		
Quality of life				65.5***	0.49
Low	28 (29.5)	66 (62.3)	65 (91.5)		
High	67 (70.5)	40 (37.7)	6 (8.5)		
Social support				22.7***	0.30
Low	31 (34.4)	56 (54.4)	48 (72.7)		
High	59 (65.6)	47 (45.6)	18 (27.3)		
Consulted health professional for mental health reasons				73.7***	0.65
Not applicable	62 (81.6)	31 (51.7)	5 (13.5)		
No	14 (18.4)	16 (26.7)	7 (18.9)		
Yes	0 (0.0)	13 (21.7)	25 (67.6)		
Avoidant coping strategy				23.5***	0.31
No	57 (69.5)	43 (42.6)	22 (31.9)		
Yes	25 (30.5)	58 (57.4)	47 (68.1)		
Labels	Users without mental health issues	Users with psychological distress and drug use	Users with mental disorders and multiple medication use		

Notes: The entries are frequencies (percentages). The percentages are calculated within the clusters in the column and the missing cases (31) are excluded. *p<0.05; **p<0.01;***p<0.001

TABLE 4 Summary of salient characteristics of three types of sleep medication users (n=306)

Characteristics	Typology		
	Cluster 1	Cluster 2	Cluster 3
Label	*Users without mental health issues*	*Users with psychological distress and drug use*	*Users with mental disorders and multiple medication use*
Internal variables	-Absence of mood disorder -Absence of anxiety disorder -Absence of elevated distress -Not using other psychotropic drugs -Not using illicit drugs	- Absence of mood disorder - Absence of anxiety disorder -Elevated distress - -Illicit drug use	-Mood disorders -Anxiety disorders -Elevated distress -Using other psychotropic drugs -
Complementary variables	-Initiated use in the 12 months preceding T2 -With supervision -50 years and older -Living with a partner -Higher income -Report being in good physical health -Elevated social support -Have not reported a mental health problem -Absence of avoidant strategy for coping with stress	-Stopped use in the 12 months preceding T2 -Without supervision -Under 50 years of age -Divorced|separated| widowed -Lower income - Report being in good physical health -Low social support -Have not consulted a health professional about mental health -Avoidant strategy for coping with stress	-Continued use across T1 and T2 -With supervision - Under 50 years of age -Single -Lower income -Report having poor physical health - Low social support -Have consulted a health professional about mental health - Avoidant strategy for coping with stress

DISCUSSION

The current study used longitudinal data from a population-based sample of 1822 participants. The sample included 306 sleep medication users at either T1 or T2 who were studied to characterize patterns of use in the epidemiological catchment area of south-west Montreal. The annual prevalence of sleep medication use was 10.7% at T1 and 12% at T2. The rate of sleep medication use in this region was found to be slightly higher than that reported in the greater Quebec population (9.1%).[6] In addition, data collected at T2 showed that two years after the start of the study, 6.4% of respondents had initiated use of sleep medications, 5.1% had previously been using sleep medications but stopped, and 5.6% continued to use sleep medications. It is difficult to find comparative studies in the literature. However, a recent study estimated a prevalence of persistent use of 4.2% in Norway; nevertheless, persistent use was defined as having used prescribed sleep medication at least 3 days or more per week for more than 6 months at some time in the individual's life.[9] In any case, the relatively elevated rate of sleep medication use, and particularly, persistent use, may be related to the higher prevalence of mental disorders and low income in the south-west of Montreal.[36]

Development of a typology of sleep medication users may help to understand patterns of use in the general population. Based on data from a longitudinal sample of 306 sleep medication users, three empirically-grounded clusters emerged. Individuals were classified into three distinct profiles based on diagnosis of mental illness, level of psychological distress, and use of prescription and illicit drugs, labelled *users without mental health issues*, *users with psychological distress and drug use*, and *users with mental disorders and multiple medication use* (Table 2). These profiles were similar to three of the four subtypes of hypnotics consumers identified by Wainstein and his collaborators (2011)[27] using several indicators of psychotropic drugs related to consumption behaviors.

Users without mental health issues constituted 34.6% of sleep medication users. At the start of the study, users in this subgroup showed a distinct absence of past-year mood or anxiety disorder, elevated psychological distress, and use of other psychotropic medications or drugs. These users neither presented a diagnosis of mental illness nor reported problems related to mental health in the previous 12 months that caused them to consult a health professional. Results indicated that inclusion in the *non problematic users* group was associated with initiating use of sleep medications in the 12 months preceding the second interview. The high number of participants in Cluster 1 with an "incident" pattern of use may be explained by the increase in occurrence of insomnia with age. Individuals aged 50 and over were overrepresented as *non problematic consumers*. This cluster also included high numbers of participants with elevated social support and quality of life, high income, and reporting good physical health. One interpretation of the use of sleep medications in this subpopulation, having an absence of elevated psychological distress and mental illness, is that it may be related to the natural decline of sleep quality with age. Aging is associated with changes in the sleep-wake cycle, waking up earlier, feeling more awake at night, and spending less total time asleep[37]. Older individuals are also more susceptible to some primary sleep disorders including sleep-disordered breathing and restless legs syndrome.[38]

Conversely, *users with mental disorders and multiple medication use* (25.8%) displayed mood and anxiety disorders, and reported elevated psychological distress and used psychotropic medications for reasons other than sleep at the start of the study. The association between presence of mental disorders and use of multiple psychotropic medications has been demonstrated in cross-sectional studies[39]. Mental illness has also been associated with sleep problems, and has been shown to be both a risk factor and a consequence[18,40]. This group, having a high risk of mental health disorders, used psychotropic drugs other than sleep agents, including antidepressants, anxiolytics, mood stabilizers, and antipsychotics.

The profile of *users with mental disorders and multiple medication use* was also associated with a persistent pattern of sleep medication consumption. These results are in accordance with a study demonstrating that individuals with mental illness using multiple pharmacological agents were more likely to display long-term consumption of benzodiazepines.[41] This suggests that symptoms of anxiety, distress and depression and use of multiple medications may play a role in the continued use of sleep medications. This persistent pattern of use was also accompanied by an increased use of mental health services. The majority of *users with mental disorders and multiple medication use* reported having consulted a health professional for problems related to mental health, and most were using sleep medications under the supervision of a professional. The fact that this subpopulation made use of health services may be explained not only by the presence of mental health issues and monitored medication use, but also by a negative perception of their physical health and quality of life. The association between sleep difficulties, physical health, symptoms of anxiety and depression, and health-related quality of life has been well explored in the literature.[42]

The current study identified a third, intermediate profile constituting the highest proportion of users (39.6%): *users with psychological distress and drug use*. The

distinguishing characteristics of these users are drug use and elevated psychological distress at the start of the study. Sleep medication has been shown to be associated with psychological distress[43,44] and substance use and abuse.[2,12,45]

Like drug and alcohol use, some types of sleep medication use could represent self-medication for psychological distress. Use of non-prescription sedatives was shown to be associated with low income and alcohol dependence by Goodwin and Hasin (2002).[14] In such cases, medication can be a resource used to cope with sleep and distress symptoms. Accordingly, the current results demonstrated that *users with psychological distress and drug use* had lower scores on the social support scale and reported using alcohol, drugs, medications, or cigarettes to cope with stress. Social support is a coping resource that is associated with reduced distress and increased reliance on approach-based coping strategies.[46] Poor social support is also associated with low income[47,48] and can be brought on with increased use of alcohol, drugs, and medication. In particular, alcohol is commonly used to deal with sleep disturbance[45], especially for males.[1]

The majority of respondents included in Cluster 2, *users with psychological distress and drug use*, no longer reported using medication to help them sleep two years after the start of the study. Despite their elevated psychological distress and drug use at baseline, members of Cluster 2 were more likely to cease consumption of sleep medications over time.

The cluster analysis results indicated significant heterogeneity in a population-based sample of sleep medication users. The results also suggested that three profiles of sleep medication users could be generated based on presence of mental disorder, psychological distress, and substance use. Furthermore, the typology of sleep medication users was validated externally through association with both longitudinal patterns of consumption and psychosocial factors.

Methodological Considerations
The results support the use of classification analysis to provide relevant information on naturally- occurring subgroups. In practice, a typology of medication users may aid in identifying individuals who will most benefit from appropriate interventions and further research.

The present study has methodological limitations that must be taken into account when interpreting the results and planning future research. The questions used to determine medication use required respondents to self-report use of medication for a specific purpose over the past 12 months, classifying the drug as sleep medication, mood stabilizer, anxiolytic, antidepressant, antipsychotic, or stimulant. The question is formulated such that drug classification is based on its use; not its pharmacology. Some medications, such as quetiapine, can be used as an anxiolytic, sleep medication, or antidepressant depending on the dose prescribed.[49] Although it is difficult to evaluate the precision of classification in the current study, the Quebec Health Survey of 1987 estimated that only 16% of medications were falsely reported as tranquilizers, sedatives, or sleep medications.[50] Furthermore, the questionnaire provided examples of common medications within each category to increase accuracy of classification.

Another methodological limitation is the response rate at T1 (48.7%). A low response rate may result in an underrepresentation of more vulnerable individuals who are generally more difficult to recruit in a population-based study. In this case, the prevalence of mental disorders in the population may have been underestimated. However, the response rate is higher than the median rate reported in a meta-analysis of epidemiological studies in 2006.[51] The rate of participation for the second set of interviews among participants who completed the first interview (75%) corresponds to the median reported in a meta-analysis of longitudinal epidemiological studies.[52] Furthermore, the characteristics of respondents who responded at T2 (n=1822) and those who dropped out (n=611) did not differ significantly on the variables under study (results not presented).

Despite the above mentioned limitations, the present research represents one of very few studies to use cluster analysis to characterize sleep

medication users based on problems related to mental health, long-term patterns of consumption, and psychosocial and sociodemographic characteristics. Many drug utilization studies are unable to identify factors that may differ between consumers and non-consumers such as lifestyle, substance use, and service use, which may confound results.[53] Because decreased quality of sleep and sleep medication use are so closely tied to mental health and quality of life, analyzing patterns of use in the context of a larger population-based study of community health provides a better understanding.

CONCLUSION

The present study identified and characterized types of sleep medication users across two years in an epidemiological catchment area in south-west Montreal, Quebec. The results support the role of mental health problems in differentiating sleep medication users. The developed typology may help to predict long-term use, detect clinically-relevant factors that affect sleep and distress in patients, and identify potentially-inappropriate patterns of use. Sleep medication *users with psychological distress and drug use* may benefit from interventions that increase resources to cope with stress and decrease social isolation. The continued use of sleep medications by *users with mental disorders and multiple medication use* suggests a need to develop interventions that actively target comorbid sleep and psychiatric problems to decrease the cost and adverse effects associated with multiple medication use. In addition, the results suggest the importance of considering presence or history of mental illness when treating patients for disordered sleep.

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