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Sleep disturbances in young and middle-aged adults - Empirical patterns and related factors from an epidemiological survey

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Abstract

Background: Previous research suggests that sleep disorders are highly associated with other mental health problems. However, sleep problems even below the diagnostic threshold of sleep disorders are very common in the general population, which highly affects wellbeing and functioning. In order to broaden the focus beyond those severe cases we explored empirical patterns across the whole spectrum of sleep problems as well as associated clinical and other factors.
Method: A representative community sample of $N = 1274$ residents from the canton of Zurich was interviewed for sleep problems and diagnostic criteria for mental disorders as well as was given a number of mental health-related psychometrical checklists. Based on a broader spectrum of sleep problems we conducted a latent class analysis (LCA) to derive distinct classes of such disturbances. Classes were compared regarding their associations to mental health-relevant and other risk factors.
Results: The LCA revealed four classes – no sleep disturbances (72.6%), difficulties initiating and maintaining sleep (15.8%), delayed sleep (5.3%), and severe sleep problems (6.4%). Severe sleep problems were related to female gender and generalized anxiety disorder, while depression was linked to all sleep problem classes. Persons with difficulties initiating and maintaining sleep and severe sleep problems reported higher levels of psychopathology, burnout and neuroticism, while all sleep problem types were tied to stress-related variables, but not alcohol use disorder.
Discussion: Sleep problems are highly prevalent among the young and middle-aged adults in our representative sample of young and middle-aged adults and as such represent a serious public mental health problem. Our findings indicate sleep problems to have a multi-dimensional structure with some differential associations. While all subtypes were associated with poorer mental health and particularly more depression, severe sleep problems appeared to be the sleep subtype seen in agoraphobia and GAD, while delayed sleep had no specific associations. The variety of associations assessed leads one to assume that likewise a variety of sleep interventions is required.

1. Introduction

A large number of epidemiological studies demonstrate that sleep disturbances are quite prevalent in the general population, but rates vary considerably between 10% and almost 50% [29]. The reason for this variation probably lies in the heterogeneity of methodological approaches for sleep disturbances, e.g. assessing the whole spectrum of sleep disturbances or only clinically relevant disturbances.

Although the majority of these epidemiological studies have been conducted in Western countries, sleep disturbances seem to be a universal problem, with equally high rates reported in certain developing countries (e.g [13,17,45]). Although there is little evidence for a general decline in sleep duration over the last decades [11] the smaller body of evidence points to a trend towards poorer sleep quality.

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In total sleep problems represent a serious public mental health problems with respective economic costs. Sleep problems are associated with a wide range of health and social outcomes including negative effects on the work productivity. In economic terms, it is estimated that for example Germany's annual costs due to insufficient sleep amount to roughly 30 to 60 billion US $ or 1.02 to 1.56% of the GDP [18].

Not surprisingly sleep disturbances are highly associated with mental disorders either as they precede sleep problems or accompany mental disorders [12,30]. However, it has been discussed that sleep quality has been deteriorated in relation to a person's professional workload [35,36]. The work overload in industrialized countries has been lately discussed intensively under the heading of "burnout".

So far most epidemiological studies focus on only clinically relevant sleep disorders and mental disorders according to various classification systems which restricts our view to exclusively severe cases e.g. insomnia. This is a serious shortcoming of existing research since it does not mirror the whole continuum of sleep problems and associated mental health problems as well as it might limit the generalizability of the finding to the general population.

In a recently conducted large epidemiological survey we had the opportunity to address some of these questions assessing a wider spectrum of sleep disturbances as well as related psychopathology with various questionnaires, which would also allow us to analyze the whole spectrum of mental health problems associated with sleep problems, i.e. also below the diagnostic threshold of mental disorders according to the Diagnostic and Statistical Manual of Mental Disorders (DSM; [2]). Further we aimed to estimate the impact of neuroticism and other indicators of stress sensitivity such as perceived stress and negative affect on sleep problems using psychometric measures. Finally, we wanted to investigate the impact of distress from the work environment on sleep problems [6].

Before this background we hypothesized that we would find a (i) high rate of sleep disturbances in the general population comparable to previous studies, (ii) different homogeneous subgroups with specific patterns of sleep disturbances are prevalent in the general population (iii) which are related to mental problems above and below the threshold of classified mental disorders according to DSM, (iv) and further are also related to stress-related measures and (v) to burnout.

2. Material and methods

2.1. Study design and sampling

This epidemiological study was conducted as part of the Zurich Programme for Sustainable Development of Mental Health Services, a research programme with nine sub-projects (www.zinep.ch).

As a first step in the epidemiology survey, we used a computer-assisted telephone interview (CATI) to screen 9829 Swiss participants, aged 20 to 41 years, who were representative of the general population of the canton of Zurich. The Symptom Checklist-27 (SCL-27) [19] served as our screening instrument (described in the Section "2.2. Measures"). Participants were randomly chosen through the residents' registration offices for the canton. Residents without Swiss nationality were excluded. The overall response rate was 53.6%. Reasons for non-response were no telephone connection, reaching only a telephone answering machine, incorrect telephone number, communication impossible, unavailability during the study period, or refusal by the target person or a third party. In cases where potential subjects were available by telephone the response rate was 73.9%.

In a second step, we randomly selected 1500 subjects from the initial screening sample for comprehensive face-to-face interviews that were conducted by trained and experienced clinical psychologists. All subjects who completed the semi-structured interviews were subsequently asked to complete various questionnaires with a response rate of 84.9% (N = 1274). For the current analyses, we used those cases who completed their interview and the questionnaires. All assessments were conducted between August 2010 and September 2012.

Our stratified-sampling procedure included 60% high-scorers (i.e., scoring below the 75th percentile of the global severity index (GSI) for the SCL-27) and 40% low-scorers (i.e. below the 75th percentile of the GSI). This design was chosen to enrich the sample pool with subjects at higher risk for mental disorders. Such a two-phase procedure – initial screening and comprehensive interviews with a stratified subsample – is fairly common in epidemiological research [15]. The study design has been explained in further detail by Ajdacic-Gross et al. [1].

The ethics committee of the canton of Zurich (KEK) approved the ZInEP Epidemiology Survey as fulfilling all requirements for legal and private data protection. It was designed to be in strict accordance with the declaration of Helsinki of the World Medical Association as revised in 2008. All participants gave written informed consent.

The ZInEP epidemiological survey was funded by a private foundation certified by the cantonal health authorities. The foundation had no further role in the experimental design; the collection, analysis, and interpretation of data; the writing of this report; or the decision to submit this paper for publication.

2.2. Measures

The data of the ZInEP study was assessed using a semi-structured interview as well as additional self-report questionnaires [1]. As background variables sex, age, education (basic versus higher), and marital status (single, married, separated/divorced/widowed) at time of data assessment were included in the analyses as demographic variables.

Sleep problems were assessed by a well-investigated questionnaire that has been used for over three decades in the Zurich study, a large prospective epidemiological study [12].

Accordingly, the participants were asked whether or not they had experienced each of 13 symptoms of disturbed sleep during the last 12 months (Table 1). Due to too low prevalence as well as substantial correlations items 7 and 8, as well as items 11 and 12 were combined into one indicator for the current study (for more details please refer to Table 1). The sleep problems questionnaire had been proved to have good psychometric properties in terms of validity and retest stability [12].

Lifetime psychiatric diagnoses from the spectrum of affective, anxiety and alcohol-related disorders according to DSM-IV criteria were assessed using specific observer-rated checklists.

In addition to the clinical interview, a number of self-report checklists were applied:

The Symptom-Checklist-27 (SCL-27; [19]) is a modification of the widely-used Symptom-Checklist-90 and was used in the current study to assess psychological distress below the diagnostic cut-off in a rather continuous fashion. The SCL-27 was originally designed to screen for psychiatric symptoms in patients with somatic complaints [20]. The six subscales cover a range of symptoms including depressive, dysthymic, vegetative, agoraphobic and sociophobic symptoms. In addition, a global severity score (GSI) was assessed to assess overall psychopathology.

We further used the Maslach-Burnout-Inventory [25] to assess syndromes of emotional exhaustion, depersonalization, and reduced personal accomplishment as stress response to their work load and strain. Other stress-related measures were assessed to cover overall stress perception that is not exclusively related to work environment. Accordingly, we assessed perceived stress with the 10-items Perceived Stress Scale (PSS; [14]), the 12-item Screening Scale for Chronic Stress (SSCS; [37]) to cover chronic stress in various domains of daily life, such as work overload, worries, lack of social recognition, or work discontent, as well as the 10-item negative affect subscale of the Positive and Negative Affect Scale (PANAS-N; [43]) to measure negative affect. Finally, neuroticism was assessed as it has been detected as highly relevant for the experience or development of mental health problems, including sleep problems [7,44].

2.3. Statistical considerations

We used a latent class analysis (LCA) to identify distinct patterns of sleep disturbances in a community sample. This allows identifying homogeneous groups of individuals based on similarities of sleep disturbance patterns. Fit statistics were provided that allow testing for multiple class solutions. Accordingly, starting with a single (full sample) class solution, we tested solutions with increasing numbers of classes. We evaluated the relative fit of different models using the Bootstrapped Likelihood Ratio Test (BLRT; [26]), the Bayesian information criterion (BIC), the sample-size-adjusted BIC (BIC-A), the Akaike information criterion (AIC; [26]), and the entropy measure [33]. Significant BLRT values suggest that a model is preferable over another model with the next lowest number of classes. A non-significant BLRT value indicates that the solution includes too many classes [28]. Lower values of BIC, AIC and BIC-A for a given model indicate an improved model fit relative to another model with more or less classes. Furthermore, entropy was considered as a measure of classification accuracy (with higher values indicating better classification).

Descriptive statistics for socio-demography, comorbid conditions and mental health-related psychometric assessments were provided for the total sample as well for the classes of sleep disturbances. Chi-square tests for categorical variables and One-way-analyses of variance (ANOVA) for continuous variables were used to test for overall differences across classes. Pairwise post-hoc comparisons between single classes were conducted using Bonferroni post-hoc tests for continuous variables and multinomial logistic regressions with changing reference categories for categorical variables. To control the probability of committing type-I-error in families of comparisons Alpha levels were Bonferroni-corrected at $p < 0.05$ for the number of comparisons for diagnoses (48 simple effect tests) as well as psychometric measures (84 simple effect tests) [10].

LCAs were conducted using MPlus v6 [27]. All other analyses were conducted using Stata/SE 12 [40].

Table 1
Frequencies and proportions of sleep problems for the original items and for the final indicators as used in the study.

Item number	Original item	N	%	Items as used in the analysis	N	%
1	Trouble to get up in the morning	140	11.94	Trouble to get up in the morning	140	11.94
2	Feeling whacked or not well rested in the morning	166	14.16	Felling whacked or nor well rested in the morning	166	14.16
3	Difficulties to fall asleep	198	16.92	Difficulties to fall asleep	198	16.92
4	Awakening during night	240	20.5	Awakening during night	240	20.5
5	Early awakening	85	7.25	Early awakening	85	7.25
6	Feeling drowsy and fatigue during daytime	78	6.65	Feeling drowsy and fatigue during daytime	78	6.65
7	Sleep deficits because going to bed too late	83	7.08	Delayed sleep onset	96	8.18
8	Not being tired very late at night	52	4.43			
9	Partially too much sleep	35	2.98	Partially too much sleep	35	2.98
10	Being tired very early in the evening	51	4.35	Being tired very early in the evening	51	4.35
11	Anxiety states during the night	21	1.79	Night time fear and anxiety	46	3.92
12	Awakening with fear from nightmares	36	3.07			
13	Falling asleep unintentionally (TV, movie or during meetings)	26	2.22	Falling asleep unintentionally (TV, movie or during meetings)	26	2.22

Table 2
LPA fit statistics for the tested class solutions.

	1 Class	*2 Classes*	*3 Classes*	*4 Classes*	*5 Classes*
AIC	7307.525	5500.692	5338.779	5315.335	5305.554
BIC	7363.266	5617.240	5516.135	5553.499	5604.526
Sample Adjusted BIC	7328.326	5544.184	5404.963	5404.210	5417.121
Entropy	*na*	0.921	0.855	0.886	0.897
Parametric BLRT	*na*	2 *v* 1	3 *v* 2	4 *v* 3	5 *v* 4
		H0 Loglikelihood value = −3642.763	H0 Loglikelihood value = −2727.346	H0 Loglikelihood value = −2634.389	H0 Loglikelihood value = −2610.667
		$p < 0.001$(LMR < 0.001)	$p < 0.001$ (LMR < 0.001)	$p < 0.001$(LRT=0.0414)	$p = 0.020$ (LRT = 0.4018)
N for each class	C1 = 1173	C1 = 932	C1 = 883	C1 = 851	C1 = 850
		C2 = 241	C2 = 187	C2 = 185	C2 = 154
			C3 = 103	C3 = 62	C3 = 62
				C4 = 75	C4 = 69
					C5 = 38

Note: AIC = Akaike Information Criterion, BIC = Bayesian Information Criterion, BLRT = Bootstrapped Likelihood Ratio Test; C1 = class 1; C2 = class 2; C3 = class 3; C4 = class 4.

3. Results

For determining the number of latent classes fit indices for competing class solutions were considered (Table 2). Accordingly, the BIC was at minimum with three classes and the sample-size-adjusted BIC indicated best fit with the four-class model, while the BLRT, AIC and entropy indicated improvement up to the five-class solution. The inspection of the five-class solution, however, indicated one class with <5% (3.2%) of the participants, which was decided as too small for further analyses. Therefore, we decided to keep the four-class solution for further analyses of sleep disturbances (see Fig. 1).

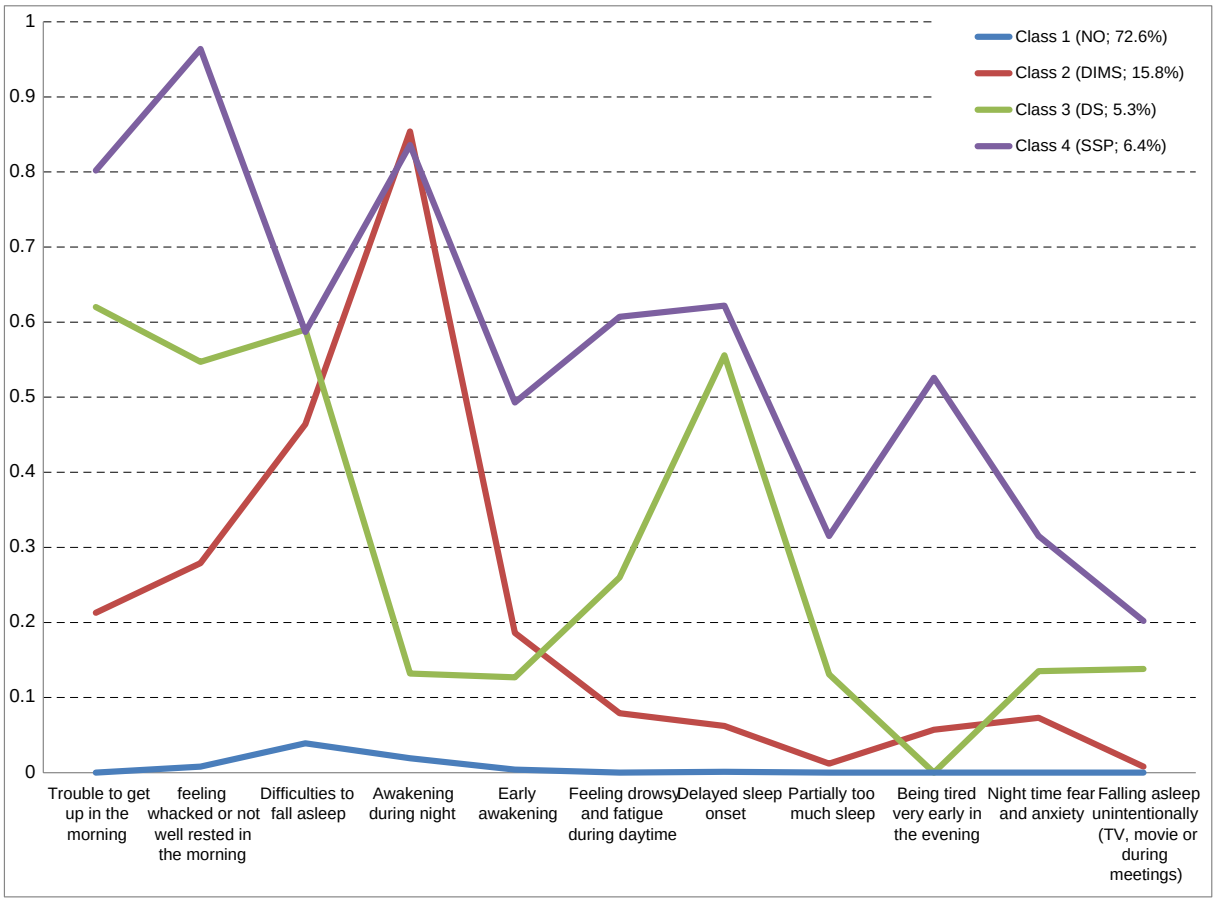

Fig. 1. Four-class solution for sleep disturbances. Note: NO = No sleep problems; DIMS = Difficulties initiating and maintaining sleep; DS = Delayed sleep; SSP = Severe sleep problems.

Table 3
Distributions of sociodemographic characteristics among the four derived classes of sleep disturbances.

	Classes of sleep disturbances					*p*-value
	Total sample	NO	DIMS	DS	SSP	
	M ± SD/N (column-%)	M ± SD/N (column-%)	M ± SD/N (column-%)	M ± SD/N (column-%)	M ± SD/N (column-%)	
Gender female	637 (54.3)	454 (53.4)	96 (51.9)	33 (53.2)	54 (72.0)	**.017**[a]
Age	31.6 ± 6.8	31.5 ± 6.8	32.4 ± 6.7	30.2 ± 7.0	31.3 ± 6.4	0.127
High educational degree	734 (62.7)	539 (63.5)	121 (65.4)	34 (55.7)	40 (53.3)	0.181
Single	802 (69.4)	589 (70.2)	123 (68.0)	44 (72.1)	46 (61.3)	0.111
Married	317 (27.4)	226 (26.9)	54 (29.8)	12 (19.7)	25 (33.3)	
Separated/divorced/widowed	37 (3.2)	24 (2.9)	4 (2.2)	5 (8.2)	4 (5.3)	

Note: NO = No sleep disturbances; DIMS = Difficulties initiating and maintaining sleep; DS = Delayed sleep; SSP = Severe sleep problems; M = mean; SD = standard deviation.
[a] SSP > DS,DIMS,NO.

According to this solution, class 1 ($N = 851$; 72.6%) represented the majority of participants who were not affected by sleep disturbances (see Fig. 1). Class 2 ($N = 185$; 15.8%), class 3 ($N = 62$; 5.3%), and class 4 ($N = 75$; 6.4%) contained those who experienced various sleep disturbances during the last 12 months. Class 2 comprised those with predominant symptoms of initiating sleep and frequent awakening during the night but few, if any, consequences, and class 3 those who reported difficulties initiating sleep with subsequent impairment, i.e. difficulties getting up in the morning, which may represent a phase delay. Finally, Class 4 contains those with a broad range of symptoms, almost all of which were more severe than the other classes and associated with classified mental disorders.

Accordingly, we labeled these groups as *no sleep disturbances* (NO; Class 1), *difficulties initiating and maintaining sleep* (DIMS; Class 2), *delayed sleep* (DS; Class 3), and *severe sleep problems* (SSP; Class 4).

Gender female was specifically linked to SSP while no other sociodemographic differences were found across classes (Table 3).

Furthermore, classes of sleep disturbances were associated with a range of comorbid conditions (see Table 4). However, after Bonferroni corrections only comorbid depression and anxiety disorders remained to differ significantly across groups. Accordingly, those who experienced sleep disturbances (i.e. DIMS/DS/SSP) were more likely to have comorbid depression; and higher prevalence of generalized anxiety disorder (GAD) was observed in SSP compared to NO. Surprisingly we found no overall link between sleep disturbances and Alcohol use disorder (AUD) or agoraphobia, even not before Bonferroni corrections.

All other mental health-related variables were linked to different classes of sleep disturbances except for the burnout subscale of personal efficacy (see Table 5). Self-reported psychopathology was all linked to sleep disturbances of classes DIMS and SSP. Especially symptoms of dysthymia were more frequently reported by the class of SSP compared to other classes. Overall higher burnout as well as subscale scores of emotional exhaustion were linked to DIMS and SSP while cynism was linked to SSP only.

Sleep disturbances (DIMS and SI) were linked to higher Big-5 neuroticism while all classes of sleep disturbances experienced higher negative affect as well as perceived and chronic stress compared to those without sleep disturbances (NO).

Table 4
Distributions of comorbid disorders among the four derived classes of sleep disturbances.

	Classes of sleep disturbances					*p*-value	Group comparisons[a]
	Total sample	NO	DIMS	DS	SSP		
	N (column-%)	N (column-%)	N (column-%)	N (column-%)	N (column-%)		
Depression	200 (17.1)	105 (12.3)	47 (25.4)	25 (40.3)	23 (30.7)	<.001	DIMS/DS/SSP > NO
Panic disorder	44 (3.8)	24 (2.8)	11 (6.0)	5 (8.1)	4 (5.3)	0.042	–
Agoraphobia	39 (3.3)	23 (2.7)	8 (4.3)	2 (3.2)	6 (8.0)	0.082	–
Social phobia	108 (9.2)	64 (7.5)	27 (14.6)	5 (8.1)	12 (16.0)	0.004	–
Simple phobia	178 (15.2)	110 (12.9)	40 (21.6)	11 (17.7)	17 (22.7)	0.005	–
GAD	93 (7.9)	50 (5.9)	19 (10.3)	8 (12.9)	16 (21.3)	<0.001	SSP > NO
OCD	85 (7.3)	52 (6.1)	23 (12.4)	6 (9.7)	4 (5.3)	0.019	–
Alcohol use disorder	107 (9.1)	73 (8.6)	20 (10.8)	9 (14.5)	5 (6.7)	0.300	–

Note: NO = No sleep disturbances; DIMS = Difficulties initiating and maintaining sleep; DS = Delayed sleep; SSP = Severe sleep problems.
[a] Bonferroni-corrected for multiple testing.

Table 5
Distributions of psychopathology, burn-out, stress-related measures and neuroticism among the four derived classes of sleep disturbances.

	Classes of sleep disturbances						
	Total sample	NO	DIMS	DS	SSP	*p*-value	Group comparisons[a]
	M ± SD	M ± SD	M ± SD	M ± SD	M ± SD		
SCL-27 GSI	1.79 ± 0.52	1.72 ± 0.49	1.94 ± 0.54	1.83 ± 0.44	2.09 ± 0.62	<0.001	DIMS/SSP > NO
SCL-27 depression	1.85 ± 0.71	1.77 ± 0.67	2.05 ± 0.78	2.02 ± 0.68	2.04 ± 0.83	<0.001	DIMS > NO
SCL-27 dysthymia	2.10 ± 0.80	2.01 ± 0.76	2.27 ± 0.77	2.08 ± 0.75	2.71 ± 0.94	<0.001	SSP > NO/DIMS/DS DIMS > NO
SCL-27 vegetative	1.62 ± 0.59	1.55 ± 0.55	1.77 ± 0.62	1.73 ± 0.58	1.94 ± 0.70	<0.001	DIMS/SSP > NO
SCL-27 agoraphobia	1.40 ± 0.57	1.36 ± 0.54	1.49 ± 0.61	1.39 ± 0.53	1.62 ± 0.82	<0.001	SSP > NO
SCL-27 social phobia	1.92 ± 0.78	1.86 ± 0.75	2.09 ± 0.87	1.93 ± 0.74	2.14 ± 0.77	<0.001	DIMS > NO
Burnout - total	2.68 ± 0.95	2.58 ± 0.92	2.87 ± 0.96	2.83 ± 0.92	3.19 ± 1.07	<0.001	DIMS/SSP > NO
Burnout - Emotional exhaustion	3.27 ± 1.40	3.10 ± 1.33	3.59 ± 1.49	3.56 ± 1.30	4.14 ± 1.46	<0.001	DIMS/SSP > NO
Burnout - cynism	2.49 ± 1.29	2.39 ± 1.25	2.71 ± 1.31	2.58 ± 1.30	2.96 ± 1.45	<0.001	SSP > NO
Burnout – personal efficacy	2.30 ± 0.99	2.28 ± 0.99	2.31 ± 0.98	2.34 ± 0.93	2.47 ± 1.14	0.439	–
Perceived stress	14.35 ± 6.65	13.40 ± 6.32	16.53 ± 7.08	18.20 ± 6.85	16.64 ± 6.31	<0.001	DIMS/DS/SSP > NO
Negative affect	21.37 ± 6.60	20.47 ± 6.23	23.01 ± 6.64	24.77 ± 6.90	24.81 ± 7.52	<0.001	DIMS/DS/SSP > NO
Chronic stress	1.39 ± 0.76	1.29 ± 0.74	1.59 ± 0.80	1.76 ± 0.78	1.78 ± 0.70	<0.001	DIMS/DS/SSP > NO
Neuroticism	11.7 ± 3.8	11.3 ± 3.7	12.8 ± 3.6	12.5 ± 4.0	13.2 ± 3.7	<0.001	DIMS/SSP > NO

Note: NO = No sleep disturbances; DIMS = Difficulties initiating and maintaining sleep; DS = Delayed sleep; SSP = Severe sleep problems; M = mean; SD = standard deviation; GSI = Global Severity Index.
[a] Bonferroni-corrected for multiple testing.

4. Discussion

We conducted a cross-sectional survey in an epidemiological sample in the canton of Zurich Switzerland. Our large sample was assessed with a variety of different instruments thus allowing to provide a multi-faceted view on sleep problems in the general population. Our study findings provide strong evidence that a large proportion of young and middle-aged adults of the general population i.e. more than one quarter, suffers from various kinds of sleep disturbances.

A closer look at those affected individuals revealed that only 23% indicated severe sleep problems while the majority reported less severe sleep problems. A similar level of "insomnia" has been reported in previous epidemiological studies as well [3,9,12,16]. The novelty of our study was not only to identify different patterns of sleep disturbances in the general population but to show that they were differentially related to a number of clinical or mental health-related factors including environmental stress.

Since our assessments were limited to individuals up to the age of 43 years, the rate of almost 28% of people reporting sleep problems is comparably high. The exclusion of older people allowed us to exclude possible age-related health issues that might affect sleep quality [22]. Therefore, it was not surprising that age was unrelated to sleep disturbances in our sample.

Furthermore, our results confirmed previous findings that female sex was significantly linked to sleep problems, particularly to severe sleep problems [8,22]. Although the impact of menopausal effects, such as the decrease of estrogen and progesterone, on sleep problems can be largely excluded due to our rather young sample, there is evidence that sleep problems already in young and middle adulthood are more frequent in women than in men as mental disorders are likewise more frequent in women [5]. Especially increasing health problems and mood symptoms were found to increase the sleep directly or via the side-effects of associated medications especially in women [32].

Quite surprisingly we found no associations between alcohol use disorders and sleep problems although the literature suggests a strong association that is, however, bi-directional [39]. While many people use alcohol to promote sleep [24] there is also evidence that increased alcohol use has a negative impact on the sleep architecture that we would expect some sleep problems during the night sleep [31], which could be demonstrated if we would have applied objective measures of sleep disturbances as assessed in a sleep laboratory.

Other mental health problems, however, were indeed related to sleep disturbances but, however, only a small number of associations remained significant after correcting for multiple testing. Accordingly, major depression was highly related to overall sleep disturbances while GAD, in particular, to severe sleep problems. As this is a cross-sectional assessment, we cannot say whether these conditions were comorbid with sleep disturbances or rather precipitating or perpetuating conditions. According to the literature a bidirectional longitudinal association suggests both predictions from and to sleep problems [23,38].

In addition, we were also able to extent this view towards a more dimensional perspective by using symptom checklists. Accordingly, our data provide evidence that sleep problems were also concomitant with a broad range of mental health problems below the diagnostic threshold. Sleep problems obviously are often experienced as highly distressing and are therefore related to mental health

problems across the entire continuum [4]. Primarily independent from mental health problems, sleep problems seem to occur more likely in people exposed to environmental stress in particular work related stress. Two out of three burnout dimensions as described by Maslach et al. [25], i.e. exhaustion and cynism were related to sleep problems, in particular class 2 and 4, i.e. sleep problems in initiating and maintaining sleep as well as severe sleep problems, but not delayed sleep. The latter is unusual as there is a strong lay view that late nights are a contributing factor to "burnout". Burnout as conceptualized by the MBI is a dimensional concept and as such includes more or less severe cases of burnout and related sleep problems.

Moreover, we have used measures to assess the subjective experience of daily life stress and stress-related negative affect. Our findings revealed that individuals with sleep disturbances reported higher levels of perceived overall stress, negative affect as well chronic daily life stressors. Although not directly tested in the current study subjectively perceived stress was found in previous study to trigger mental health outcomes [34], which might reflect similar mechanisms in its association with sleep problems. Thus, if any stress, for example work stress leads to sleep problems. It might be similarly possible that this association depends on how stress is subjectively perceived. This assumption finds support by earlier research suggesting that a tendency to experience daily life as highly stressful is strongly related to sleep disturbances [41]. Moreover, a recent study found that such increased stress-reactivity might be predisposed by negative affect in persons with higher neuroticism, which, in turn, are more likely to develop sleep problems [21]. Indeed, the link between higher neuroticism and sleep disturbances was confirmed in the current study. Although the pathway is not entirely clear, these findings suggest that various sleep disturbances might be a consequence of a complex interplay between environmental stress, psychological distress and their subjective perceptions. This is in line with previous findings suggesting that a certain vulnerability exists that promotes sleep disturbances and problems [42].

To our knowledge this is the first time, latent class analysis has been used to study the association between sleep disturbances and related factors. The key strength of this study was the use of a large epidemiological sample and the use of a broad range of sleep problems that might be experienced by even healthy individuals. Our results can therefore be generalized to young middle-aged adults within the general population. By including 17 different indicators of sleep disturbances, we were able to obtain a detailed description of how primarily healthy people actually experience sleep problems and thereby not limited by using clinical criteria of sleep disorders.

Despite these strengths the current study has a number of limitations that have to be acknowledged. First of all, as already mentioned above, our cross-sectional design does not allow us to draw causal conclusions. Whether these associations are the cause or consequence of those sleep problems cannot be finally examined and might be subject to further investigation in studies with prospective designs. Furthermore, since all information on sleep disturbances in the past relies on self-reports, therefore the data might be subject to recall bias. However, at least we can exclude that the recall was biased due to cognitive problems in older age since our sample was restricted to young adults. Moreover, it is hardly possible to obtain data from more reliable sources when assessing such a large sample. And finally, the selection of sleep-related factors used in this study is not exhaustive therefore it cannot be excluded that there exist other unobserved variables that affect symptoms of disturbed sleep.

5. Conclusion

In sum, our findings broadly contribute to the literature of sleep disturbances in terms of its multidimensional structure as well as its correlates, such as comorbid conditions. We have shown that sleep problems are commonly present in association with a broad range of other conditions rather than occurring independently or isolated syndrome, which might have important implications for treatment. Whether different treatment methods for different subtypes of sleep problems are indicated requires further investigation. However, the identification of specific factors linked to these subtypes as well as their different symptom expressions may help to understand etiological mechanisms and has important implications for identification, prevention and reduction of sleep disturbances.

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