



Persistent sleep problems among people in recovery from substance use disorders: a mixed methods study

Aleksander H. Erga, Sverre Nesvåg, Ingrid Elin Dahlberg & James R. McKay

To cite this article: Aleksander H. Erga, Sverre Nesvåg, Ingrid Elin Dahlberg & James R. McKay (2022): Persistent sleep problems among people in recovery from substance use disorders: a mixed methods study, *Addiction Research & Theory*, DOI: [10.1080/16066359.2022.2074406](https://doi.org/10.1080/16066359.2022.2074406)

To link to this article: <https://doi.org/10.1080/16066359.2022.2074406>



© 2022 The Author(s). Published by Informa UK Limited, trading as Taylor & Francis Group.



[View supplementary material](#)



Published online: 18 May 2022.



[Submit your article to this journal](#)



Article views: 456



[View related articles](#)




[View Crossmark data](#)

RESEARCH PAPER



Persistent sleep problems among people in recovery from substance use disorders: a mixed methods study

Aleksander H. Erga^{a,b} , Sverre Nesvåg^{a,c}, Ingrid Elin Dahlberg^a and James R. McKay^{a,d}

^aCentre for Alcohol and Drug Research, Stavanger University Hospital, Stavanger, Norway; ^bDepartment of Biological and Medical Psychology, Faculty of Psychology, University of Bergen, Bergen, Norway; ^cDepartment of Public Health, Faculty of Health, University of Stavanger, Stavanger, Norway; ^dDepartment of Psychiatry, Perelman School of Medicine, University of Pennsylvania, Philadelphia, PA, United States

ABSTRACT

Background: The aims of this study are to examine the one-year trajectory of sleep problems, identify clinical correlates, and describe subjective experiences related to persistent sleep problems during recovery from substance use disorders (SUD).

Methods: This study builds on a sequential mixed method design. The quantitative component features data from a prospective longitudinal study of 127 poly-SUD patients in the Stavanger area in Norway, while the qualitative component describes a thematic analysis of interviews with 16 persons from this study still experiencing sleep problems after at least one year of abstinence.

Results: The prevalence of sleep problems at baseline for the whole cohort was 79%. Among the 59 patients who were abstinent after one year, $N = 20$ (33.9%) had moderate and $N = 11$ (18.6%) had severe sleep problems. Persistent sleep problems were associated with psychological distress and were experienced as a major challenge in the struggle to stay drug free. Establishing daily routines related to work, school, and care for children were coping strategies for participants with persistent sleep problems.

Conclusions: Persistent sleep problems are often overlooked in a clinical setting. Based on our findings, these issues pose a major challenge in the struggle to stay drug free. For patients with psychological distress, and lack of responsibilities that established daily routines, sleep difficulties may result in increased risk of drug use episodes that result in relapse. These results argue that screening and evidence-based methods for insomnia and sleep health-programs should be commonplace adjunct intervention for patients with SUDs.

ARTICLE HISTORY

Received 1 September 2021
Revised 27 April 2022
Accepted 3 May 2022

KEYWORDS

Substance use disorders; sleep problems; psychological distress; recovery; mixed methods; insomnia



Introduction


Sleep problems are among the most often mentioned factors associated with substance use disorders (SUD), although it is unclear to what extent sleep problems either directly or indirectly affect the etiology of SUD (Conroy and Arnedt 2014; Vandrey et al. 2014). However, sleep problems have been found to be one of the most common negative consequences of both acute and more chronic heavy substance use (Mahfoud et al. 2009). While different kinds of substances (e.g. alcohol, different illicit and prescribed drugs) have quite diverse acute negative effects on sleep quality and quantity, chronic heavy substance use seems to have much the same negative effects on sleep, regardless of which substance is used (Hasler et al. 2012).

Much of the work that has been done on sleep disorders and substance use has focused on alcohol use disorders (Angarita et al. 2016). Individuals with chronic alcohol dependence were found to have greater odds of insomnia over a 13-year follow-up than those who were able to remit alcohol

dependence (Crum et al. 2004). In alcohol treatment samples, 50% or more of patients have significant insomnia in the six months prior to treatment (Brower 2001; Brower et al. 2011). In early abstinence from alcohol, sleep tends to be short, fragmented, and shallow, with some abnormalities persisting after two years of abstinence (Drummond et al. 1998).

Moreover, sleep disturbances have often predicted relapse to alcohol use. In a study by Brower et al. (2001), 60% of alcohol patients who had insomnia prior to treatment relapsed in the five months following treatment, versus 30% of those without insomnia. Patients with alcohol use disorder who were still experiencing insomnia after 5 months of abstinence were at a greater risk for relapse at 14 months (Drummond et al. 1998). In a study of veterans in treatment for alcohol use disorder (AUD), insomnia was associated with higher drinking quantity and alcohol-related consequences (Miller et al. 2017). Moreover, increased insomnia partially accounted for the relation of depression and post-traumatic stress disorder to later drinking problems in that

CONTACT Aleksander H. Erga  aleksander.hagen.erga@sus.no  Centre for Alcohol and Drug Research - KORFOR, Stavanger University Hospital, PO Box 8100, 4068 Stavanger, Norway

 Supplemental data for this article can be accessed online at <https://doi.org/10.1080/16066359.2022.2074406>

This article has been corrected with minor changes. These changes do not impact the academic content of the article.

© 2022 The Author(s). Published by Informa UK Limited, trading as Taylor & Francis Group.

This is an Open Access article distributed under the terms of the Creative Commons Attribution-NonCommercial-NoDerivatives License (<http://creativecommons.org/licenses/by-nc-nd/4.0/>), which permits non-commercial re-use, distribution, and reproduction in any medium, provided the original work is properly cited, and is not altered, transformed, or built upon in any way.

study. A recent study by Short et al. (2019) found that in military service members, insomnia predicted worsening of heavy drinking and alcohol-related problems over a six-month follow-up. However, one study found no relation between sleep disturbances at admission or discharge from a residual program and alcohol relapse at 12 months (Kolla et al. 2015).

A few studies have looked at changes in sleep disorders over time in individuals with AUD. Brower et al. (2011) followed a cohort of 267 people with alcohol dependence for 6 months. Forty-seven percent of the cohort was classified with insomnia at baseline. Insomnia correlated strongest with female gender, unemployment, and severity of co-occurring mental health and alcohol problems, but not with alcohol consumption levels. Insomnia symptoms improved significantly among abstinent and moderate drinkers, but did not improve among those who had relapsed to heavy drinking. Furthermore, one third of the abstinent and moderate drinkers were still classified with insomnia at six months follow-up. In this study, none of the co-occurring problems measured at baseline was found to explain the persistence of insomnia in either the abstinent, moderate or heavy drinking groups. A study by Zhabenko et al. (2013) showed that drinking predicted poor sleep among people with alcohol use disorder over an extended period of time (2.5 years in this study), and that the effects of drinking on poor sleep was mediated by the level of depression.

Sleep abnormalities are also frequently present in individuals with drug use disorders and predict poorer treatment outcome (Angarita et al. 2016; Huhn and Finan 2021). Sleep disorders in primary care patients predicted a higher rate of subsequent treatment for both drug and alcohol use disorders (Fortuna et al. 2018). In patients receiving addiction treatment, data collected with ecological momentary assessment over three weeks indicated that poor sleep was associated with increased drug craving (Freeman and Gottfredson 2018). A study by Magnee et al. (2015) found that sleep disturbances among people with SUD are associated with reduced health-related quality of life.

Cocaine users have chronically impaired sleep, which tends to improve with abstinence (Angarita et al. 2016). However, sleep problems in early cocaine abstinence impair cognitive abilities and increase risk of relapse (Angarita et al. 2014). In a secondary analysis of data from 96 US treatment programs, sleep disturbances were related to more substance use prior to treatment and higher rates of cocaine use after treatment (Dolsen and Harvey 2017). With regard to cannabis, poor sleep quality during periods of abstinence is associated with high relapse rates (Angarita et al. 2016). For example, poor sleep quality prior to self-guided cannabis quit attempts predicted a greater risk of cannabis relapse within two days (Babson et al. 2013). A recent review found that sleep disturbances in individuals with opioid use disorders are often correlated with negative treatment outcomes (Huhn and Finan 2021).

Sleep disorders may contribute to higher rates of relapse in those with alcohol and drug use disorders through a number of mechanisms. Insomnia and other sleep problems

are correlated with multiple measures of distress, including chronic stress levels, stress reactivity, high negative and low positive affect, chronic pain, and drug craving (Huhn and Finan 2021). Lack of sleep can also impair cognition and judgment (Angarita et al. 2014). A considerable amount of research has linked these factors to substance use and to increased risk of relapse after treatment (Brewer et al. 1998; Keyes et al. 2011; Sinha 2012).

There is also a relative lack of qualitative information on the experiences of individuals with substance use disorders who are also struggling with insomnia and other sleep problems. In one qualitative study that was done with 77 people with a heroin use disorder, Nettleton et al. (2011) found that coping with sleep problems represented a major challenge in the struggle to remain drug free and experience an improved quality of life. The establishment of more regular sleep practices was found to be an important marker of being in recovery.

To sum up, a growing literature confirms that sleep problems are closely related to substance use disorders. Sleep problems often persist for long periods after a person has become abstinent. Coping with sleep problems and establishing good sleep practices represent a major challenge for people in recovery from SUD and persistent sleep problems are an ongoing risk factor for relapse. Except for the study by Zhabenko et al. (2013), however, the observation times have been rather short in most studies, concentrating only on the first period with acute withdrawal problems or up to six months of follow-up. Moreover, there is more limited information on the impact of sleep disorders on recovery in those with drug use disorders or polysubstance use disorder.

This report addresses some of the limitation in knowledge about the impact of sleep disorders in patients with substance use disorders, through the utilization of both quantitative and qualitative methods, in a cohort of 127 patients with polydrug use disorder (pSUD) who received treatment in Norway and were followed for an extended time period. The quantitative component of the study addressed the following questions:

1. What were the prevalence and variation in sleep problems at baseline among a cohort of persons seeking treatment for polydrug use disorder?
2. Are persistent sleep problems associated with psychological, social, or drug use related factors?

The second, qualitative part of this study examine the following questions:

1. How did sleep problems affect the daily lives of a subsample of the participants who had been alcohol and drug free for at least one year after baseline but were still experiencing severe sleep problems at the time of the study?
2. How did these participants try to cope with their persistent sleep problems?
3. Did these individuals receive any treatment for their sleep problems and if so, was it helpful?

Materials and methods

This study has a sequential mixed methods design (Ivankova 2014; Doyle et al. 2016). The first part of the study is based on quantitative analysis of data from a prospective, longitudinal cohort study (the Stayer study) of 208 patients that started a new treatment sequence in the Stavanger University Hospital catchment area in Norway, in the period from March 2012 to December 2015 (Hagen et al. 2016). The second part of the study is based on qualitative data from in-depth interviews with a subsample of 16 patients from the Stayer cohort, who had severe sleeping problems at baseline and were still having them after at least one year of stable abstinence from alcohol and drugs.

Study design and participants

In order to access specialized treatment for substance use disorders within the Norwegian public health service, patients must fulfill the criteria for a diagnosis F1x.1—harmful use, or F1x.2—dependency syndrome, as defined by the ICD-10 (World Health Organization 1992). Inclusion criteria included: (a) signed written informed consent; (b) polysubstance use as defined by the above diagnostic criteria; (c) participant initiating a course of treatment within the substance abuse treatment services; and (d) age >16 years. We did not exclude patients with comorbid mental disorders. The Norwegian Stayer study was approved by the Regional Ethical Committee (REK 2011/1877).

Of the 208 participants in the Stayer cohort, 44 patients were omitted from this study due to mono substance use (e.g. alcohol or cannabis) or a non-drug related addiction (e.g. gambling disorder), leaving 164 patients fulfilling the criteria for the current study. During the one year of follow-up, 15 participants (9.1% of participants with pSUD) dropped out from the study. Ten participants were not included in the analyses because of missing data on key study instruments. At the one-year follow-up visit, 12 participants declined to complete the PSQI, or had missing on at least one mandatory item on the PSQI, leaving 127 participants eligible for this study.

Procedures

At baseline, participants completed a comprehensive neurocognitive, psychological, and psychosocial assessment, administered by trained researchers in the Stayer study group. This procedure was repeated one year after baseline, with shorter follow-ups at three and six months. In order to reduce the risk of attrition during follow-up, several strategies were implemented, including follow-up by an SMS-tracker (Rubinsky et al. 2013; Svendsen et al. 2017; Erga et al. 2021).

Assessment

Demographics, clinical history, lifestyle factors and information about social functioning were gathered using a semi-structured interview. In order to track substance use during the follow-up period, two strategies were employed. First,

alcohol and substance use was tracked using the consumption items from Alcohol Use Disorders Identification Test (AUDIT-C) (Saunders et al. 1993) and the Drug Use Disorders Identification Test (DUDIT-C) (Berman et al. 2007). These measures were administered 3, 6, and 12 months after baseline assessment. The instructions of both AUDIT and DUDIT were changed from 'past month' to 'since last assessment' to assess substance use over the full follow-up period.

For DUDIT-C, a cutoff score >1 was used as a definition of current substance use. In order to limit the risk of false positives on AUDIT-C, a cutoff score of ≥ 5 was used as a definition of problematic alcohol use. In addition, data from the SMS-tracker were used to provide information on drug use in participants who missed either the three- or six-month follow-up visits (details of the SMS-tracker and how it was implemented are available in the [Supplemental materials](#)). The course of drug use was categorized into three groups: (1) the *abstinent* group who reported persistent abstinence over the full 12-month period (i.e. no substance use episodes reported during the follow-up time); (2) the *early relapse with subsequent recovery* group who reported substance use episodes in the first 6 months of the follow-up period (i.e. score above cutoff on AUDIT-C, DUDIT-C or SMS-tracker at 3 or 6 months) but were abstinent at the 12-month assessment; and (3) a *mixed course relapse* group who had relapsed at the 12-month evaluation, with or without substance use at 3 and 6 months. In this group, relapse was defined as a positive screening with either AUDIT-C or DUDIT-C at the one-year follow-up visit (additional details on the grouping procedure are available in the [Supplemental materials](#)).

Sleep problems were assessed using a Norwegian translation of the PSQI (Buysse et al. 1989; Pallesen et al. 2005). This is a validated, self-administered 19-item questionnaire with seven subscale scores and a global PSQI score, with 5 points as a cut off for distinguishing between good and poor sleepers. In several studies, including those with people with substance use disorders (Sharkey et al. 2011; Brooks et al. 2012), it has been shown that self-reported measures provide valid assessments of sleep problems. The PSQI was used to measure sleep status at baseline and at one-year follow-up. The global PSQI score was used to categorize patients as normal sleepers (PSQI sum ≤ 5) or poor sleepers (PSQI sum > 5), as proposed by the original authors. Due to the high frequency of poor sleepers in this cohort, we also categorized participants with PSQI sum ≥ 10 , as severely poor sleepers. A cutoff of ≥ 10 was a pragmatic choice and represents the 50% percentile of the baseline data on PSQI in this cohort.

The level of psychological distress was measured using the 90-item self-report measure Symptoms Checklist 90—Revised (SCL-90-R) (Derogatis 1994). Although the SCL-90-R measures nine symptom dimensions, only the Global Severity Index (GSI) was used for this study.

Statistics

In part 1 of this study, we performed a quantitative analysis to describe the frequency and course of sleep difficulties,

and further explore the association between sleep difficulties and other measures. First, we estimated the frequency of sleep difficulties at baseline by categorizing participants into normal (PSQI sum ≤ 5) or poor sleepers (PSQI sum > 5). We further used T-tests and Chi-square analyses to analyze baseline differences between these two groups in mean age, gender, years of education, SCL-90-R GSI T-score, and indicators of social functioning.

In order to further differentiate between different sleep groups, we placed the participants into sleep categories (i.e. normal, moderate difficulty, severe sleep difficulty) using the before mentioned criteria. To examine the relation of sleep status to drug use, the sleep categories were stratified by course of drug use.

In an effort to further explore the association between sleep difficulties and psychological distress, we used a one-way ANOVA to investigate if the level of baseline psychological distress varied between normal (PSQI sum score ≤ 5), moderate difficulty (PSQI sum score 6–9), and severe difficulty (PSQI sum score ≥ 10) sleep groups. Tukey post-hoc analysis was used to identify differences in SCL-90-R GSI score between these groups. Lastly, a logistic regression model was used to identify predictors of persistent sleep problems at the one-year assessment. In this analysis, a dichotomous variable indicating persistent sleep problems (PSQI ≥ 5 at both assessments), or non-persistent sleep problems, was used as a dependent variable. Independent variables included age, gender, treatment type, addiction course, SCL-90-R GSI score at baseline, and work status. All statistical analyses were performed in SPSS v26 for PC. *p* Values $< .05$ (two-tailed) were considered statistically significant.

Qualitative method

The sample for the qualitative part of the mixed method study was recruited after the one-year follow-up of the last recruited participant in the Stayer study. At this time we identified 14 abstinent Stayer study participants who had severe sleeping problems at baseline and still had moderate or severe sleeping problems (nine participants with moderate and five participants with severe sleep problems) at their one-year follow-up. In addition, we identified two abstinent participants at one-year follow-up, who had no sleeping problems at baseline but had developed moderate/severe sleeping problems at the one-year follow-up. All these 16 participants were still abstinent when we identified them as eligible for the qualitative part of the study. This means that they had been abstinent between one and three years at the time of the interview. All of the 16 Stayer study participants, identified as eligible, agreed to participate in this part of the study.

The interviews were conducted a researcher with both lived experience as a drug user and schooling in qualitative research methods. The interviews were based on a semi-structured interview guide with a few main topics defined by the research questions for this part of the study. Furthermore, the interview guide contained a list of possible

follow-up questions for each main topic. The interviews were audio-taped and transcribed in full. Together, the member of the research group with user experience and the second author analyzed all the transcripts and wrote the qualitative part of the findings section. The transcripts were analyzed using the software program NVivo 12. We proceeded through six steps recommended by Braun and Clarke (2006). These steps are: (A) familiarization with the data, (B) coding, (C) searching for themes within each main topic, (D) reviewing the themes, (E) defining and naming the themes, and (F) writing up the report. In this process, the transcripts were read and re-read and adjustments to our interpretations made, to ensure that we stayed close to the participants experiences in the themes that we developed. The presentation of the findings is organized in relation to the main topics in this part of the study.

Results

Part I—quantitative analyses

A summary of the demographic variables is presented in Table 1. Three participants in this study was minors (aged 16 or 17 years old). At baseline, the participants had a mean PSQI global score of 9.5 (SD = 4.5), indicating a mean score well above the traditional cutoff on PSQI (SUM > 5). Indeed, 79.5% (N = 101) of participants scored > 5 on PSQI. When categorizing participants according to the severity of PSQI scores at baseline, 20.5% (N = 26) reported no sleep difficulties, 34.6% (N = 44) reported moderate sleep difficulties, and 44.9% (N = 57) reported severe sleep difficulties at baseline.

Patients with sleep difficulties at baseline (PSQI > 5) did not significantly differ from patients without sleep difficulties (PSQI ≤ 5) in age, gender, years of education, or social variables. However, there was a significant difference in SCL-90-R GSI T-score between patients with sleep difficulties ($M = 1.3$, SD = 0.6) and patients without sleep difficulties ($M = 0.6$, SD = 0.5), $t(125) = -4.6$, $p < .001$. ANOVA analysis with Tukey post-hoc analysis demonstrated a significant difference was between normal sleepers ($m = 0.6$, SD = 0.5), moderate ($m = 1.0$, SD = 0.5), and severe ($m = 1.4$, SD = 0.6) sleep difficulties on the SCL-90-R GSI ($F(2,127) = 17.1$, $p < .001$).

The course of substance use and sleep difficulties from baseline to one year are fully summarized in Table 2. A total of N = 30 participants were categorized in the ‘abstinence group.’ On the one-year assessment, this group had an average sum score on DUDIT = 0.6 (SD = 2.1), with scores ranging between 0 and 10. On AUDIT, the group had a mean score of AUDIT = 0.8 (SD = 1.7), with scores ranging between 0 and 6. Scores > 0 on DUDIT and AUDIT were accounted for by scores on the final items of the measures, which pertain to consequences of drug use and do not indicate consumption.

A total of N = 29 participants were categorized in the ‘early relapse with subsequent recovery’ group. At the one-year assessment, this group had an average sum score on DUDIT = 0.2 (SD = 0.8), with scores ranging between

Table 1. Demographical variables for the participants at baseline (N = 127).

	All (N = 127)	PSQI ≤5 (N = 26)	PSQI 6-9 (N = 44)	PSQI >9 (N = 57)
Demographic variables and treatment history				
Male, n (%)	83 (65.4)	16 (61.5)	31 (70.5)	36 (63.2)
Age	27.5 (7.5)	29.3 (7.1)	27.0 (7.8)	27.1 (7.5)
Years of education	12.4 (2.0)	12.7 (3.2)	12.2 (1.7)	12.5 (2.4)
Years of work experience	5.6 (5.7)	5.8 (6.7)	4.9 (5.1)	6.0 (5.7)
Previous treatment attempts, median (range)	1 (0 to 20)	1 (0 to 4)	1 (0 to 20)	1 (0 to 7)
Inpatient at baseline, n (%)	51 (40.2)	10 (38.5)	21 (47.7)	20 (35.1)
Native Norwegian, n (%) ^a	116 (91.3)	24 (92.3)	42 (95.5)	50 (86.8)
Permanent home, n (%) ^a	72 (56.7)	16 (61.5)	21 (47.7)	35 (61.4)
Stable income, n (%) ^a	84 (66.1)	17 (65.4)	26 (59.1)	41 (71.9)
Criminal lifestyle, n (%) ^a	36 (28.3)	5 (19.2)	14 (31.8)	17 (29.8)
In paid employment, n (%) ^a	19 (15.0)	1 (3.8)	3 (6.8)	15 (26.3)
Drug use characteristics				
Age of drug debut	13.2 (2.2)	12.7 (1.7)	12.8 (1.8)	12.9 (1.8)
Historical intravenous drug use, n (%) ^a	78 (61.4)	20 (76.9)	28 (63.6)	30 (52.6)
Intravenous drug use last three months, n (%) ^a	43 (33.9)	12 (46.2)	14 (31.8)	17 (29.8)
Coping of addiction ^b , median (range)	4 (1 to 5)	4 (3 to 5)	4 (2 to 5)	4 (1 to 5)
Drug preference				
Did not answer	23 (18.1)	3 (11.5)	9 (20.5)	11 (19.3)
Alcohol	7 (5.5)	1 (3.8)	4 (9.1)	2 (3.5)
Cannabis	23 (18.1)	1 (3.8)	9 (20.5)	13 (22.8)
Amphetamines	20 (15.7)	5 (19.2)	8 (18.2)	7 (12.3)
Opiates	11 (8.7)	3 (11.5)	2 (4.5)	6 (10.5)
Benzodiazepines	8 (6.3)	2 (7.7)	4 (9.1)	2 (3.5)
GHB / GBL	2 (1.6)	0	0	2 (3.5)
Multiple	33 (26.0)	11 (42.3)	8 (18.2)	14 (24.6)
Clinical variables				
SCL-90-R GSI	1.1 (0.6)	0.6 (0.5)	1.0 (0.5)	1.4 (0.6)
PSIQ, global score	9.5 (4.5)	3.7 (1.2)	7.5 (1.1)	13.6 (2.7)

SUD: The group with Substance Use Disorders; PSQI: Pittsburgh Sleep Quality Index; SCL-90-R: The Symptom Checklist-90-Revised. All data are mean (SD), unless otherwise indicated.

^aNumber of participants who respond positive to a yes/no question.

^bCoping of SUD was scored on a liker scale ranging from 1 (no coping) to 5 (high level of coping).

Table 2. Reported sleep difficulties at baseline and one-year follow-up, stratified according to abstinence status after one year (N = 127).

	1-year assessment								
	Abstinent (N = 30)			Early relapse with subsequent recovery (N = 29)			Mixed course relapse (N = 68)		
	PSQI score ≤5	PSQI score 6-9	PSQI score ≥10	PSQI score ≤5	PSQI score 6-9	PSQI score ≥10	PSQI score ≤5	PSQI score 6-9	PSQI score ≥10
Baseline									
PSQI score <5	7	3	0	7	0	1	5	0	3
PSQI score 5-9	4	3	1	2	5	1	7	11	10
PSQI score ≥10	6	3	3	2	6	5	2	12	18

0 and 4. On AUDIT, the group had a mean score of AUDIT = 0.4 (SD = 1.0), with scores ranging between 0 and 4.

A total of N = 68 participants were categorized in the 'mixed course relapse' group. At the one-year assessment, this group had an average sum score on DUDIT = 19.3 (SD = 14.2), with scores ranging between 0 and 44. On AUDIT, the group had a mean score of AUDIT = 13.1 (SD = 11.0), with scores ranging between 0 and 40. A total of 12 of these participants reported no drug use at the one-year assessment but reported alcohol use over the cutoff value (AUDIT-C ≥ 5). The mean AUDIT score for these participants were 13.5 (SD = 7.8), with scores ranging between 5 and 26.

Among the N = 30 participants who had stayed abstinent in the first year, N = 17 (56.7%) reported no sleep difficulties after one year. N = 13 (43.3%) patients were categorized in a less severe category when compared to baseline, N = 10 (33.3%) patients had similar or more severe sleep difficulties after one year of follow-up, and N = 7 (23.3%) reported no sleep difficulties at baseline and the one-year follow-up visit.

Among patients with early relapse with subsequent recovery (N = 29), N = 11 (37.9%) reported no sleep difficulties after one year. N = 10 (34.5%) patients was categorized in a less severe category when compared to baseline, N = 12 (41.4%) patients had similar or more severe sleep difficulties after one year of follow-up, and N = 7 (24.1%) reported no sleep difficulties at baseline and the one-year follow-up visit. Among patients with mixed course relapse (N = 68), N = 14 (20.5%) reported no sleep difficulties after one year. N = 21 (30.9%) patients was categorized in a less severe category when compared to baseline, N = 42 (61.8%) patients had similar or more severe sleep difficulties after one year of follow-up, and N = 5 (7.4%) reported no sleep difficulties at baseline and the one-year follow-up visit.

In the total sample, N = 78 (61.4%) reported persistent sleep difficulties after one year. A logistic regression model was fitted to determine the effects of age, gender, treatment type, addiction course, SCL-90-R GSI score at baseline, and work status on persistent sleep difficulties. The logistic

Table 3. Summary of logistic regression analysis with persistent sleep problems as the dependent variable.

Variable	OR	95 % CI	p value
(Constant)	0.3	–	.301
Age	1.0	0.9–1.0	.698
Gender	0.8	0.3–1.8	.547
Abstinence	[Reference]		
Early relapse with subsequent recovery	2.2	0.7–7.2	.181
Mixed state relapse	4.7	1.7–13.0	.003
SCL-90-R GSI	2.7	1.3–5.5	.008
Work status, baseline	0.8	0.2–3.8	.573
Work status, 1 year	1.3	0.5–3.8	.768

Bold indicates significant *p* values.

regression model was statistically significant, $\chi^2(7)=24.3$, $p=.001$. The model explained 23.8% of the variance in persistent sleep difficulties and correctly classified 72.2% of cases. Increasing scores on SCL-90-R GSI at baseline and the course of drug use predicted increased likelihood of persistent sleep problems. Course of abstinence was also entered as an independent variable. Here, we used abstinence as the reference category, with ‘early relapse with subsequent recovery,’ and ‘mixed course relapse’ as comparison groups. Here, the odds of persistent sleep problems were significantly higher for the ‘mixed course relapse’ group (OR = 4.7, 95% confidence interval 1.7–13.0; p value = .003. The results of the logistic regression are presented in Table 3.

Part II—qualitative analyses

At the time of the interviews, 2 of the 16 respondents in the qualitative sample had been drug free for a year, 5 had been drug free between one and two years, and 9 had been drug free between two and three years. They were in rather different life situations. Half of them lived alone while the others lived with partners, all of whom were also former substance users. Six of them had paid part-time or full-time jobs, two worked at home taking care of small children, while the other eight were without a job. In addition to the two respondents caring for small children, there were two others who had close relations to their own children, currently under care from the Children Welfare Service.

Five of those interviewed had experienced considerably better sleep at the time of the interview, relative to their sleep problems at baseline. The other 11 had experienced only a minor degree of improvement and still had what they reported as severe sleeping problems after more than one and up to three years of abstinence.

Problem characteristics

The sleep problems were characterized in much the same way by all the participants. They had great difficulties in falling asleep, often lying in bed for hours before they got three to six hours of sleep. Most of them also woke up many times during sleep after experiencing bad dreams and nightmares, often related to their earlier life as drug users. Some compensated for the few hours of sleep during the night, by sleeping during the day:

So then I am lying there thinking, and thinking that I can't sleep. Maybe I fall asleep at three and have to get up at six, when the

baby wakes up. So maybe I can get some sleep later in the day when the baby sleeps.

The participants reported that the problem of falling asleep was strongly associated with all the bad thoughts about their past lives and their current problems with psychological symptoms, problems in their relationships, problems with Children Welfare for those who had children, and a general fear of what the future may bring. They found it both difficult to understand and very frustrating that those kinds of thoughts were largely absent during the day but appeared as soon as they tried to sleep.

I struggle with thoughts. They bother me when I go to bed. Just like a lot of pictures. Things from the past. Things I can't tell to nobody.

For some of the participants, these kinds of sleep problems came in periods of a week or two between periods of a month or two of better sleep. They could not always relate this pattern to something specific happening in their lives, but they thought it had to do with some changes or events in their daily lives.

It goes in fits and starts. It depends on the challenges I am facing. After a meeting with the Child Welfare Service I am totally exhausted. I sleep in the day and I am pondering at night.

Impact of sleep problems on daily life

The persistent sleep problems affected the daily lives of the respondents in various ways and to differing degrees. All respondents talked about getting physically run down, being blunt and drowsy, having trouble with coordination, being more sensitive to light and noise, and having a sensation of ‘tunnel vision.’ All respondents had a feeling of a general bad mood. But while some felt mostly sad, others said that they got easily irritable and angry.

Some felt that it was the first part of the day that was most problematic, often in relation to child care, or attending school or work.

Sometimes I have actually fallen asleep in the middle of class.

Others felt worse in the evening:

I feel ok during the day, as long as I can take care of my child, be with friends or my parents, and they help taking care of my child. But after 5pm I get really tired and irritable and not easy to be with.

Some told stories about the problem developing into a vicious cycle.

Sometimes I have not been able to go to work. Instead, I have gone straight back to bed and slept for a long time. As soon as I wake up I feel really bad, realizing that the next day will be even worse.

Most of the respondents felt that bad moods and a tired body reduced their energy significantly. Some of those with a relative short drug free experience had been in situations where only small additional events had led to acute craving. Others, with a longer drug free history, did not feel that the sleep problem had led to acute craving, but more that the long-term loss of energy could be a part of a slow increase in relapse risk.

Yes, I can see how loss of energy can make me more vulnerable. But, I have come a long way and can more easily identify the things that increase my risk of relapse.

Trying to cope

All respondents had thoughts about what seemed to be more or less healthy ways to minimize sleep problems and cope with the consequences on their daily lives. In practice, however, the respondents can be divided into two distinct groups. There were those who managed to do at least some or most of the things that are recommended from a sleep hygiene perspective, such as being socially and physically active during the day and being careful with training, heavy meals, and a lot of blue screen light late in the evening. However, there were others who did not follow any of these recommendations, even if they were quite aware of them.

Surely I should have done all of those things, if I only could have found the energy for them. Even meditation and such things. I know that it doesn't help sitting looking at the computer and the television all night, but it makes the whole thing a bit more livable, at least.

Those who had some external factors that organized their day, such as child care obligations, school, work and/or organized leisure activities, such as training, and who had put in a lot of effort in suppressing the effects of bad sleep, said that this also helped them to live up to sleep hygiene recommendations.

I have pushed myself to go to bed and wake up at the same time each day, even during the weekends. In the periods where I relax on this, things quickly get worse.

The coping strategies that are recommended to reduce sleep problems require the kind of energy and awareness that respondents often simply do not have because of lack of sleep. Respondents felt that only a few nights of bad sleep could easily turn into a vicious cycle of lack of energy, reduced coping, and further bad sleep, while a more positive cycle of better sleep and more energy required performing the right coping strategies for sustained periods, which often seemed impossible.

Training after work is really important for me. Natural endorphin and strict routines also during the evening. But it can also be too much and I come home too late, really tensed up, very hungry and in need of hours of relaxing with TV series. Not the smartest thing to do if you want a good night sleep.

Sleep problem treatment experiences

The respondents had little experience with health services offering them any effective sleep problems treatment. In fact, most of them had not received any treatment for their sleep problems, in spite of the fact that they all had been offered treatment for their substance use disorders and other somatic and mental health problems. Knowledge about sleep hygiene strategies seemed to be based mostly on what they had heard in the media or from friends and relatives.

Some had been offered sleeping pills by their GP, but most of them were very skeptical about any kind of medication, finding it to be in conflict with their aim of living a drug free life.

I don't take any kind of medication, not even pills for headache. I would not have anything that reminds me of drugs.

Discussion

Sleep problems are common in people with alcohol and drug use disorders and they predict poor treatment outcome and relapse (Angarita et al. 2016). The negative impact of sleep problems on recovery is likely accounted for by increases in stress, stress reactivity, dysphoric mood, and pain, all of which are associated with relapse (Sinha 2012; Huhn and Finan 2021). The results of this study support and expand previous findings by using both quantitative and qualitative data to describe sleep difficulties. The prevalence of sleep problems among participants in this study are in the same range or even higher than found in previous studies (Mahfoud et al. 2009; Wallen et al. 2014), and persistent sleep problems were observed in 61% of the participants. Of note, 33% of participants still report significant sleep problems after continuous abstinence for one year.

At baseline, participants who later relapsed were more likely to report moderate sleep problems (40.3% vs. 26.7%) and less likely to report no sleep problems (13% vs. 32%) than those who remained abstinent. Moreover, they were more likely to report worsening sleep problems at one year (22.1% vs. 3.6%), compared to those who remained abstinent. Indeed these findings argue for a significant benefit to sleep from continued abstinence after one year. A promising note is that participants who have relapse episodes early on with subsequent recovery do not have increased odds of persistent sleep problems at 12 months when compared to the completely abstinent group. Still persistent sleep problems were common in both the abstinent and the early relapse with subsequent recovery groups, suggesting that abstinence is for many patients not sufficient to recover from SUD-related sleep problems.

The qualitative results shed a considerable light on what the experience of persistent sleep problems was like for the participants, and how it affected their daily lives. Those interviewed in the qualitative part of this study were 16 participants from the larger Stayer study who still had moderate to severe sleep problems at least one year after they stopped using alcohol and drugs. Five of them had experienced some improvement in sleep problems, but the other 11 had not. In line with previous research (Brower et al. 2011) and the quantitative part of this study, some of these individuals relate their sleep problems to former and/or current health and social problems while others also wondered if their sleep problems are due to the negative impact of drug use on their physiological diurnal rhythms (Hasler et al. 2012).

Sleep problems put a big strain on our participants' ability to stay drug free and have a good life. In the qualitative data, the participants tell stories about sleep problems affecting their mood, relations to others, and obligations with regard to childcare, school or work. They are, however, not certain about how, and to what degree, their sleep problems may lead to a higher risk of relapse. Some think that loss of energy, due to sleep problems, can result in a higher risk of relapse. Others think that the effect of persistent sleep problems on risk of relapse is mediated by their struggles with

current health and social problems. A third stance was that their ability to cope with sleep problems has become a prerequisite for their ability to cope with drug use cues and craving. These first-person experiences are in line with previous quantitative research, in which persistent sleep problems were found to be associated with relapse. Relationships between persistent sleep problems and the risk of relapse are complex, in particular, when considering co-occurring health, social problems, and coping strategies that may not always be effective (Zhabenko et al. 2013). The findings on how these participants try to cope with their sleep problems are thus highly relevant. While we do not have data to confirm causation, it is worth noting that individuals with the combination of persistent sleep problems and high levels of mental distress may be considered at high risk for relapse.

The qualitative results suggest that ability to cope with sleep problems is particularly related to the complete life situation (Magnee et al. 2015). We found that daily obligations, such as childcare, school and work, not only give meaning (and income) to the participants' life but also function as important external diurnal rhythm 'regulators.' For some, leisure activities can have the same function, but only for those who are able to combine such activities into a diurnal rhythm that also promotes good sleep hygiene. This is important information both for people with persistent sleep problems who are recovering from SUD and for those who provide support and treatment to them. The message should be that obligations such as childcare, school and work, and activities such as training, social leisure, gaming, and looking at movies and TV, should not only be seen as means for creating a meaningful life. These activities should also be organized in a way so that they promote the ability to regulate diurnal rhythm, especially when persistent sleep problems threaten to destroy quality of life and increase the risk of relapse.

Many sleep medications are problematic for people in recovery from SUD. Cognitive behavioral treatment (CBT) approaches have been found to be effective in developing better sleep hygiene practices and coping with the health and social problems related to persistent sleep problems (Chakravorty et al. 2019). It is possible that combining CBT for insomnia with strategies to develop obligations and activities that promote both meaning and diurnal regulation might be particularly effective in addressing sleep problems in those recovering from SUD.

There are several strength and limitation to this study. The main strength of this study is the use of mixed methods to address sleep in a cohort of patients with SUD. Second, the inclusion of an author who has lived experience with a substance use disorder (author IED) in the analysis of qualitative data is a strength of the study. Limitations include the lack of qualitative data from participants who relapsed, a lack of objective measures of drug use during the course of the study, and a lack of data to provide a valid estimation of duration of the relapse episodes.

Implications

Persistent sleep problems are prevalent among people in recovery from pSUD, and are associated with adverse

outcomes. In addition, persistent sleep problems have severe negative effects on mood, relations with others, and obligations regarding childcare, school or work; consequently they put a significant strain on our participants' struggles to stay drug free. While external diurnal rhythm 'regulators' (work, education, and family obligations) may have positive effects on coping with persistent sleep difficulties, patients could benefit from screening for sleep problems and adjunctive evidence-based approaches (e.g. cognitive behavioral therapy or sleep health-programs) to improve sleep difficulties during the recovery phase. In addition, more research is needed to gain deeper knowledge regarding the causes of insomnia and generate specialized treatment methods to address persistent sleep problems in patients with SUD.

Acknowledgments

We extend our sincere gratitude to the participants in our study and the staff of the participating clinical services, the KORFOR staff, and in particular, Thomas Solgård Svendsen, Anne-Lill Mjølhus Njaa, and Janne Aarstad, who collected all the initial and follow-up data.

Ethical statement

The Norwegian Stayer-study was approved by the Regional Ethical Committee (REK 2011/1877). All participants signed a written informed consent.

Disclosure statement

No potential conflict of interest was reported by the author(s).

Funding

The Western Norway Regional Health Authority, Strategic Initiative for Substance Use Research [912003] funded this research.

ORCID

Aleksander H. Erga  <http://orcid.org/0000-0001-5598-4746>

Data availability statement

The data that support the findings of this study are available from the corresponding author, AHE, upon reasonable request.

References

- Angarita GA, Canavan SV, Forselius E, Bessette A, Pittman B, Morgan PT. 2014. Abstinence-related changes in sleep during treatment for cocaine dependence. *Drug Alcohol Depend.* 134:343–347.
- Angarita GA, Emadi N, Hodges S, Morgan PT. 2016. Sleep abnormalities associated with alcohol, cannabis, cocaine, and opiate use: a comprehensive review. *Addict Sci Clin Pract.* 11(1):9.
- Babson KA, Boden MT, Harris AH, Stickle TR, Bonn-Miller MO. 2013. Poor sleep quality as a risk factor for lapse following a cannabis quit attempt [research support, U.S. Gov't, Non-P.H.S.]. *J Subst Abuse Treat.* 44(4):438–443.
- Berman AH, Palmstierna T, Kallmen H, Bergman H. 2007. The self-report Drug Use Disorders Identification Test: Extended (DUDIT-

- E): reliability, validity, and motivational index. *J Subst Abuse Treat.* 32(4):357–369.
- Braun V, Clarke V. 2006. Using thematic analysis in psychology. *Qualitative Research in Psychology.* 3(2):77–101.
- Brewer D, Catalano R, Haggerty K, Gainey R, Fleming C. 1998. A meta-analysis of predictors of continued drug use during and after treatment. *Addiction.* 93(1):73–92.
- Brooks AT, Krumlauf MC, Whiting BP, Clark RJ, Wallen GR. 2012. Are you sleeping? Pilot comparison of self-reported and objective measures of sleep quality and duration in an inpatient alcoholism treatment program. *Subst Abuse.* 6:135–139.
- Brower KJ. 2001. Alcohol's effects on sleep in alcoholics. *Alcohol Res Health.* 25(2):110–125.
- Brower KJ, Aldrich MS, Robinson EA, Zucker RA, Greden JF. 2001. Insomnia, self-medication, and relapse to alcoholism [research support, U.S. Gov't, P.H.S.]. *Am J Psychiatry.* 158(3):399–404.
- Brower KJ, Krentzman A, Robinson EA. 2011. Persistent insomnia, abstinence, and moderate drinking in alcohol-dependent individuals [research support, N.I.H., extramural]. *Am J Addict.* 20(5):435–440.
- Buyssse DJ, Reynolds CF, 3rd, Monk TH, Berman SR, Kupfer DJ. 1989. The Pittsburgh Sleep Quality Index: a new instrument for psychiatric practice and research. *Psychiatry Res.* 28(2):193–213.
- Chakravorty S, Morales KH, Arnedt JT, Perlis ML, Oslin DW, Findley JC, Kranzler HR. 2019. Cognitive behavioral therapy for insomnia in alcohol-dependent veterans: a randomized, controlled pilot study. *Alcohol Clin Exp Res.* 43(6):1244–1253.
- Conroy DA, Arnedt JT. 2014. Sleep and substance use disorders: an update. *Curr Psychiatry Rep.* 16(10):487.
- Crum RM, Ford DE, Storr CL, Chan YF. 2004. Association of sleep disturbance with chronicity and remission of alcohol dependence: data from a population-based prospective study [empirical study; followup study; longitudinal study; prospective study; quantitative study]. *Alcohol Clin Exp Res.* 28(10):1533–1540.
- Derogatis L. 1994. Symptom checklist-90-R: administration, scoring & procedure manual for the revised version of the SCL-90. Minneapolis (MN): National Computer Systems.
- Dolsen MR, Harvey AG. 2017. Life-time history of insomnia and hypersomnia symptoms as correlates of alcohol, cocaine and heroin use and relapse among adults seeking substance use treatment in the United States from 1991 to 1994 [multicenter study]. *Addiction.* 112(6):1104–1111.
- Doyle L, Brady AM, Byrne G. 2016. An overview of mixed methods research – revisited. *J Res Nurs.* 21(8):623–635.
- Drummond SP, Gillin JC, Smith TL, DeModena A. 1998. The sleep of abstinent pure primary alcoholic patients: natural course and relationship to relapse. *Alcohol Clin Exp Res.* 22(8):1796–1802.
- Erga AH, Hønsi A, Anda-Ågotnes LG, Nesvåg S, Hesse M, Hagen E. 2021. Trajectories of psychological distress during recovery from polysubstance use disorder. *Addict Res Theory.* 29(1):64–71.
- Fortuna LR, Cook B, Porche MV, Wang Y, Amaris AM, Alegria M. 2018. Sleep disturbance as a predictor of time to drug and alcohol use treatment in primary care [research support, N.I.H., extramural]. *Sleep Med.* 42:31–37.
- Freeman LK, Gottfredson NC. 2018. Using ecological momentary assessment to assess the temporal relationship between sleep quality and cravings in individuals recovering from substance use disorders. *Addict Behav.* 83:95–101.
- Hagen E, Erga AH, Hagen KP, Nesvåg SM, McKay JR, Lundervold AJ, Walderhaug E. 2016. Assessment of executive function in patients with substance use disorder: a comparison of inventory- and performance-based assessment. *J Subst Abuse Treat.* 66:1–8.
- Hasler BP, Smith LJ, Cousins JC, Bootzin RR. 2012. Circadian rhythms, sleep, and substance abuse. *Sleep Med Rev.* 16(1):67–81.
- Huhn AS, Finan PH. 2021. Sleep disturbance as a therapeutic target to improve opioid use disorder treatment. *Exp Clin Psychopharmacol.* DOI:10.1037/pha0000477
- Ivankova NV. 2014. Implementing quality criteria in designing and conducting a sequential QUAN -> QUAL mixed methods study of student engagement with learning applied research methods online. *J Mixed Methods Res.* 8(1):25–51.
- Keyes KM, Hatzenbuehler ML, Hasin DS. 2011. Stressful life experiences, alcohol consumption, and alcohol use disorders: the epidemiologic evidence for four main types of stressors. *Psychopharmacology.* 218(1):1–17.
- Kolla BP, Schneekloth T, Mansukhani MP, Biernacka JM, Hall-Flavin D, Karpayak V, Geske J, Frye MA. 2015. The association between sleep disturbances and alcohol relapse: a 12-month observational cohort study [observational study]. *Am J Addict.* 24(4):362–367.
- Magnee EH, de Weert-van Oene GH, Wijdeveld TA, Coenen AM, de Jong CA. 2015. Sleep disturbances are associated with reduced health-related quality of life in patients with substance use disorders. *Am J Addict.* 24(6):515–522.
- Mahfoud Y, Talih F, Streem D, Budur K. 2009. Sleep disorders in substance abusers: how common are they? *Psychiatry.* 6(9):38–42.
- Miller MB, DiBello AM, Carey KB, Borsari B, Pedersen ER. 2017. Insomnia severity as a mediator of the association between mental health symptoms and alcohol use in young adult veterans [randomized controlled trial]. *Drug Alcohol Depend.* 177:221–227.
- Nettleton S, Neale J, Pickering L. 2011. Techniques and transitions: a sociological analysis of sleeping practices amongst recovering heroin users [research support, non-U.S. gov't]. *Soc Sci Med.* 72(8):1367–1373.
- Pallesen S, Nordhus I, Omvik S, Sivertsen B, Matthiesen S, Bjorvatn B. 2005. Pittsburgh Sleep Quality Index. *Tidsskrift for Norsk Psykologforening.* 42(8):714–718.
- Rubinsky AD, Dawson DA, Williams EC, Kivlahan DR, Bradley KA. 2013. AUDIT-C scores as a scaled marker of mean daily drinking, alcohol use disorder severity, and probability of alcohol dependence in a U.S. general population sample of drinkers. *Alcohol Clin Exp Res.* 37(8):1380–1390.
- Saunders JB, Aasland OG, Babor TF, de la Fuente JR, Grant M. 1993. Development of the Alcohol Use Disorders Identification Test (AUDIT): WHO collaborative project on early detection of persons with harmful alcohol consumption-II. *Addiction.* 88(6):791–804.
- Sharkey KM, Kurth ME, Anderson BJ, Corso RP, Millman RP, Stein MD. 2011. Assessing sleep in opioid dependence: a comparison of subjective ratings, sleep diaries, and home polysomnography in methadone maintenance patients. *Drug Alcohol Depend.* 113(2-3):245–248.
- Short NA, Allan NP, Oglesby ME, Moradi S, Schmidt NB, Stecker T. 2019. Prospective associations between insomnia symptoms and alcohol use problems among former and current military service personnel. *Drug Alcohol Depend.* 199:35–41.
- Sinha R. 2012. How does stress lead to risk of alcohol relapse? *Alcohol Res Curr Rev.* 34:432–440.
- Svendsen TS, Erga AH, Hagen E, McKay JR, Nja ALM, Arstad J, Nesvåg S. 2017. How to maintain high retention rates in long-term research on addiction: a case report. *J Social Work Pract Addict.* 17(4):374–387.
- Vandrey R, Babson KA, Herrmann ES, Bonn-Miller MO. 2014. Interactions between disordered sleep, post-traumatic stress disorder, and substance use disorders. *Int Rev Psychiatry.* 26(2):237–247.
- Wallen GR, Brooks AT, Whiting B, Clark R, Krumlauf MC, Yang L, Schwandt ML, George DT, Ramchandani VA. 2014. The prevalence of sleep disturbance in alcoholics admitted for treatment: a target for chronic disease management. *Fam Community Health.* 37(4):288–297.
- World Health Organization. 1992. The ICD-10 classification of mental and behavioural disorders: clinical descriptions and diagnostic guidelines. Geneva: World Health Organization.
- Zhabenko O, Krentzman AR, Robinson EA, Brower KJ. 2013. A longitudinal study of drinking and depression as predictors of insomnia in alcohol-dependent individuals. *Subst Use Misuse.* 48(7):495–505.