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Ten Holt, J.; Van Emmerik, A.A.P.; Blanken, P.; Borgdorff, J.E.; Ten Holt, P.P.C.; Kok, R.M.; ... ; Berg, J.F. van den

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Direct and Indirect Exposure to Trauma, Posttraumatic Stress Disorder Symptoms, and Poor Subjective Sleep Quality in Patients with Substance Use Disorder

Julia ten Holt[1], Arnold A.P. van Emmerik[2], Peter Blanken[3], Jesse E. Borgdorff[4], Pieter P.C. ten Holt[1], Rob M. Kok[5], Joanne Mouthaan[6], Bouwe Pieterse[4], Julia F. Van den Berg[5,6]

[1]Brijder Addiction Treatment Clinic, Parnassia Group, Alkmaar, Netherlands; [2]Department of Clinical Psychology, University of Amsterdam, Amsterdam, Netherlands; [3]Parnassia Addiction Research Centre (PARC), Parnassia Group, The Hague, Netherlands; [4]Brijder Addiction Treatment Clinic, Parnassia Group, The Hague, Netherlands; [5]Parnassia Group Academy, Parnassia Group, The Hague, Netherlands; [6]Department of Clinical Psychology, Leiden University, Leiden, Netherlands

ABSTRACT

Background: Despite the frequent co-occurrence of posttraumatic stress disorder and substance use disorder, screening for trauma exposure and posttraumatic stress disorder symptoms is not a routine practice in substance use disorder clinics. The aims of this study were to examine the prevalence of exposure to traumatic events, posttraumatic stress disorder symptoms, and subjective sleep quality in substance use disorder inpatients after detoxification. In addition, we analyzed associations of sociodemographics, direct and indirect exposure to traumatic events, and sleep quality with posttraumatic stress disorder symptom severity.

Methods: Adults diagnosed with substance use disorder (n = 188; 25% women, mean age 46.6 ± 12.3 years) from 2 inpatient addiction clinics were assessed at approximately 4 days post-admission for age, gender, educational level, self-reported substance use, trauma exposure, general and posttraumatic stress disorder-specific subjective sleep quality, and posttraumatic stress disorder symptom severity. Correlates of posttraumatic stress disorder symptom severity were identified with linear regression analyses.

Results: The prevalence of direct trauma exposure was high (89%), 51% of participants screened positive for posttraumatic stress disorder and 87% reported clinically significant poor sleep quality. Younger age, female gender, direct and indirect exposure to more traumatic events, and poor subjective sleep quality were associated with more severe posttraumatic stress disorder symptoms.

Conclusion: Nearly all substance use disorder patients admitted for detoxification in our study had been directly or indirectly exposed to 1 or more traumatic events, and many reported posttraumatic stress disorder symptoms and poor sleep quality. Younger and female substance use disorder patients were at higher risk of posttraumatic stress disorder symptoms. Our results emphasize the need for systematic screening for direct and indirect trauma exposure, posttraumatic stress disorder symptoms, and poor sleep quality in patients admitted for clinical substance use disorder treatment.

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INTRODUCTION

Over the past 3 decades, the relationships between trauma exposure, posttraumatic stress disorder (PTSD) symptoms, and substance use disorders (SUD) have been widely investigated.[1-4] Posttraumatic stress disorder is more prevalent in patients with SUD than in the general population: 36.6% in a Dutch sample of treatment-seeking SUD patients[5] compared to 7.4% in the general Dutch population.[6] A recent review of 6 international studies of PTSD prevalence in SUD patients showed a mean prevalence of 36% as well.[7] Several studies have shown that patients with comorbid PTSD/SUD had a worse treatment prognosis than patients with SUD alone;[8-10] however, a systematic review did not find conclusive evidence.[11]

Exposure to trauma, PTSD, and SUD is related in several ways. First, exposure to trauma can lead to PTSD, which is characterized by intrusions, avoidance, negative cognitions and emotions, and hyperarousal.[12] Substances such as alcohol and sedating drugs are often used to cope with these symptoms, but eventually, this self-medication may lead to the onset or persistence of SUD.[13] Second, SUD

Corresponding author: Julia F. Van den Berg, e-mail: j.vandenberg@parnassia.nl

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may lead to increased exposure to violence, accidents, and other substance use-related traumatic events, which in turn increases the risk for PTSD.[14-16] A third possibility is that PTSD and SUD can be the result of a shared genetic vulnerability.[17]

Historically, screening for trauma or PTSD has not been a routine part of addiction care,[18] and still today, many PTSD diagnoses go undetected in treatment-seeking SUD patients.[5,7] This can be explained by several factors, for instance, clinicians being reluctant to explore SUD patients' trauma history, and especially in large multidisciplinary teams, it is often unclear who is responsible for exploring patients' trauma history.[19] Screening for a history of both direct and indirect trauma exposure could have additional merit, as a recent review has shown that indirect exposure to trauma can lead to PTSD symptoms as well, albeit to a lesser extent than direct exposure to trauma.[20] Even in absence of a full-blown PTSD diagnosis, PTSD symptoms may complicate the course, treatment, and prognosis of SUD. Both direct and indirect trauma exposure have also been shown to be associated with SUD.[21]

Poor sleep quality is a common symptom of both PTSD and SUD. Sleep disturbance and PTSD have a complex, bidirectional relationship. Sleep alterations have been suggested as core symptoms, as well as risk and prognostic factors of trauma-related disorders.[22] In SUD, substance use and withdrawal commonly lead to sleep disturbances and, conversely, poor sleep quality may lead to substance use and relapse.[23] However, we are not aware of studies investigating both sleep disturbance, trauma-related sleep disturbance, and PTSD symptoms in patients with SUD.

Firstly, the current study aimed to replicate earlier findings[3,5] regarding the prevalence of direct and indirect trauma exposure, PTSD symptoms, and the prevalence of clinical diagnoses of PTSD in SUD inpatients after detoxification. Secondly, the study aimed to examine the prevalence of general and PTSD-specific poor subjective sleep quality in SUD inpatients after detoxification. We are not aware of earlier studies on PTSD-specific poor subjective sleep quality in this population. Thirdly, we aimed to investigate whether demographic characteristics, primary problem substance, general and PTSD-specific sleep quality, and direct and indirect trauma history were correlates of severity of PTSD symptoms, as this has yet not been established in a SUD population.

MAIN POINTS

- Almost all (96%) substance use disorder inpatients had been directly or indirectly exposed to traumatic events.
- Many substance use disorder inpatients had directly experienced physical assault (59%) or sexual assault (21%).
- Indirect exposure to traumatic events was an independent predictor of posttraumatic stress disorder (PTSD) severity, even when adjusted for direct exposure to traumatic events.
- Most (87%) substance use disorder inpatients had clinically relevant sleep problems.
- Assessment of substance use disorders in inpatients should include attention to direct and indirect trauma exposure, PTSD, and sleep quality.

MATERIAL AND METHODS

Participants and Procedure

Participants were recruited in December 2016 and January 2017 at 2 inpatient clinics specialized in addiction treatment in the Netherlands. The main purpose of admission to the inpatient clinic was detoxification; after detoxification, the patients were generally referred to outpatient treatment. The personalized withdrawal regime depended on the substance(s) the patient had been taking prior to admission to the clinic. For alcohol withdrawal, for instance, the treatment protocol involved the individual titration of long-acting benzodiazepine (e.g., diazepam) dosage against withdrawal severity, which was assessed with the Clinical Institute Withdrawal Assessment for Alcohol–Revised[24] at least every 2 hours in the first 3 days.[25] For cocaine and cannabis withdrawal, no medication was used, unless there were persisting symptoms.

Inclusion criteria were (1) age 18 years or older and (2) a diagnosis of SUD according to the fifth edition of the Diagnostic and Statistical Manual of Psychiatric Disorders (DSM-5).[12] Exclusion criteria were (1) insufficient understanding of the Dutch language to complete the questionnaires, (2) poor physical condition that did not allow an interview, and (3) aggression or insufficient psychological stability to undergo the interview according to the nursing staff.

All consecutive patients who were newly admitted in the study period and who met our inclusion criteria were asked to participate on the third day after their admission or later to avoid interference of acute withdrawal symptoms with the assessment of PTSD symptoms and sleep quality. If the patient still showed withdrawal symptoms on the day of the planned interview, the interview was postponed till a later moment when the symptoms had subsided.

Participants were informed about the study's aims and procedures and signed an informed consent form before participating. Subsequently, participants filled out questionnaires on substance use, exposure to trauma, PTSD symptoms, and sleep quality. According to the patients' preferences, the questionnaires could also be administered as an interview. When participants had been exposed to a traumatic event and scored above the clinical cut-off on the PTSD symptoms questionnaire (see below), they were eligible for a structured diagnostic interview to further assess the presence of PTSD. When a diagnosis of PTSD was confirmed, the participant was referred to a psychologist to discuss treatment options.

The Medical Ethical Committee of the Leiden University Medical Center granted the study an exemption from requiring (Approval Number: P16.152, Date: 8 July 2016).

Measurements

In addition to demographic characteristics (age, gender, and educational level), data were collected using the following standardized instruments.

Substance use was assessed with a questionnaire based on the first section of the self-report version of the Measurements in the Addictions for Triage and Evaluation 2.1.[26] Participants were asked to indicate which psychoactive substance was their primary problem substance and how often they had previously been admitted for treatment of SUD. Primary problem substances were then categorized into "alcohol," "cannabis," or "cocaine," as these were the largest groups, and a category "other."

The Dutch translation of the Life Events Checklist for DSM-5 (LEC-5)[27] was used to evaluate exposure to trauma. The LEC-5 is a 17-item self-report questionnaire that measures exposure to stressful events (e.g., "natural disasters" or "sexual assault"). Participants were asked to indicate if and how they had experienced each event ("happened to me," "witnessed it," "learned about it through an affected friend or family member," "exposed through work," or "unsure/not applicable"). The total number of different traumatic events was separately computed for direct exposure ("happened to me") and for indirect exposure (all other ways of exposure). When participants endorsed "other" events, these were not re-categorized into another category but counted as separate events. The Dutch translation of the LEC-5 is currently being validated. Research indicates that the LEC, the LEC-5's predecessor to which the LEC-5 is very similar, was strongly associated with PTSD symptoms as established with 2 different questionnaires and showed good test–retest reliability and convergent validity with an established measure of trauma exposure.[28]

The presence and severity of PTSD symptoms were assessed using the Dutch translation of the PTSD Checklist for DSM-5 (PCL-5).[27] The PCL-5 consists of 20 items corresponding to the PTSD symptom clusters "intrusions," "avoidance," "cognition and mood," and "arousal and reactivity" in the DSM-5.[12] Participants indicated how much they were burdened by each symptom over the past month using a 5-point scale ranging from 0 ("not at all") to 4 ("extremely"). The total score thus ranges from 0 to 80, with a higher score indicating more and/or more severe PTSD symptoms. Previous research advised a cut-off score within the range of 28-37 to distinguish participants with PTSD from participants without PTSD.[29] Because our purpose was screening, we used a sensitive cut-off score of $\geq$30. The psychometric properties of the Dutch translation of the PCL-5 are still under investigation. However, research on the English PCL-5 indicates that the test has excellent reliability and validity.[29]

Posttraumatic stress disorder was assessed with the Clinician-Administered PTSD Scale for DSM-5 (CAPS-5).[30,31] The CAPS-5 is a structured clinical interview that systematically assesses the frequency and intensity of each PTSD symptom. These frequency and intensity scores are then merged into a symptom severity score (0-4). This symptom severity score has to be at least 2 for a symptom to be considered as present.

Subjective sleep quality was assessed with the Dutch translation of the Pittsburgh Sleep Quality Index (PSQI).[32] The PSQI consists of 19 self-rated questions that assess a wide variety of factors relating to sleep quality, including estimates of sleep duration and latency and estimates of the frequency and severity of sleep-related problems. Frequency questions are scored on a 4-point scale of 0 ("not during the past month") to 3 ("3 or more times a week"). The total PSQI score has a range of 0-21, and a score of $\geq$5 is used to determine the presence of clinically significant poor subjective sleep quality.[32]

The PSQI offers an addendum for PTSD patients (PSQI-A)[33] which measures PTSD-related poor sleep quality and can be used as a tool for screening PTSD in clinical and research settings. The addendum consists of 7 questions with possible scores from 0 to 3 and a total score with a range of 0-21. The addendum has been shown to have sufficient internal consistency (α=0.85) and good convergent validity with the CAPS. A PSQI-A total score of $\geq$4 resulted in a sensitivity of 0.94 and a specificity of 0.82 for women with PTSD compared to women without PTSD. In addition, 93% of women with a score of $\geq$4 also met diagnostic criteria for PTSD. The prevalence of PTSD in this sample was 72.7%.[33]

Statistical Analysis

All data were analyzed using International Business Machines Statistical Package for the Social Sciences Statistics for Windows, version 25.0 (IBM SPSS Corp., Armonk, NY, USA). First, descriptive statistics were calculated for the demographic and clinical characteristics of the total sample, including the prevalence of direct and indirect exposure to trauma, PTSD symptom severity, clinical diagnoses of PTSD, and general and PTSD-specific subjective sleep quality. For non-normally distributed variables, medians and interquartile ranges (IQRs) were reported, and for normally distributed variables, means and standard deviations were reported. Descriptives of categorical variables were reported as n (%). Second, to identify significant correlates of PTSD symptom severity in SUD patients, a multiple regression analysis was performed with PTSD symptom severity (PCL-5 total scores) as the dependent variable. The following independent variables were entered into the model in blocks: demographic

factors (age, gender, and education), primary problem substance (alcohol, cannabis, cocaine, or other), number of directly experienced traumatic events, number of indirectly experienced traumatic events, subjective sleep quality (PSQI total score), and subjective PTSD-related sleep quality (PSQI-A total score). A *P*-value of $< .05$ was considered significant.

RESULTS

Figure 1 shows the recruitment and retention of participants in the study.

During the recruitment period, 316 patients were newly admitted to the study sites and 188 met all eligibility criteria and signed informed consent. Table 1 shows the demographic and clinical characteristics of the total sample, and Table 2 shows the prevalence of direct and indirect exposure to traumatic experiences.

Pertaining to our first study aim, Table 1 presents an overview of the prevalence of direct and indirect trauma exposure, PTSD symptoms, and the clinical diagnoses of PTSD. Nearly all participants (n = 181, 96.3%) reported direct or indirect exposure to at least 1 traumatic event at some point in their lives. Direct exposure to at least 1 traumatic event ("happened to me") was endorsed by 167 participants (88.8%), 100 participants (53.2%) had witnessed at least 1 traumatic event happening to someone else, and 98 participants (52.1%) had heard about at least 1 traumatic event happening to a good friend or relative. Exposure to traumatic events through work was less common (12.2%). These last 3 categories were added and reported together as "indirect exposure." Approximately half of the participants (51.3%) had a score of ≥30 on the PCL-5. Of the 96 patients exceeding the PCL-5 cut-off score, 34 patients were subsequently interviewed with the CAPS-5. Of these participants, 20 (58.8%) were diagnosed with PTSD. Fourteen of these 20 patients (70.0%) had not been previously diagnosed with PTSD according to their patient files.

Related to our second study aim, Table 1 also shows that a vast majority of participants, 163 (86.7%), scored above the cut-off (PSQI score ≥ 5) for clinically significant poor sleep quality, and 108 (57.4%) scored above the cut-off (PSQI-A score ≥ 4) for clinically significant PTSD-related sleep problems.

Table 2 shows that physical assault was the most frequently directly experienced trauma (n = 110, 58.5%), and sudden accidental death was the most commonly indirectly experienced trauma (n = 63, 33.7%).

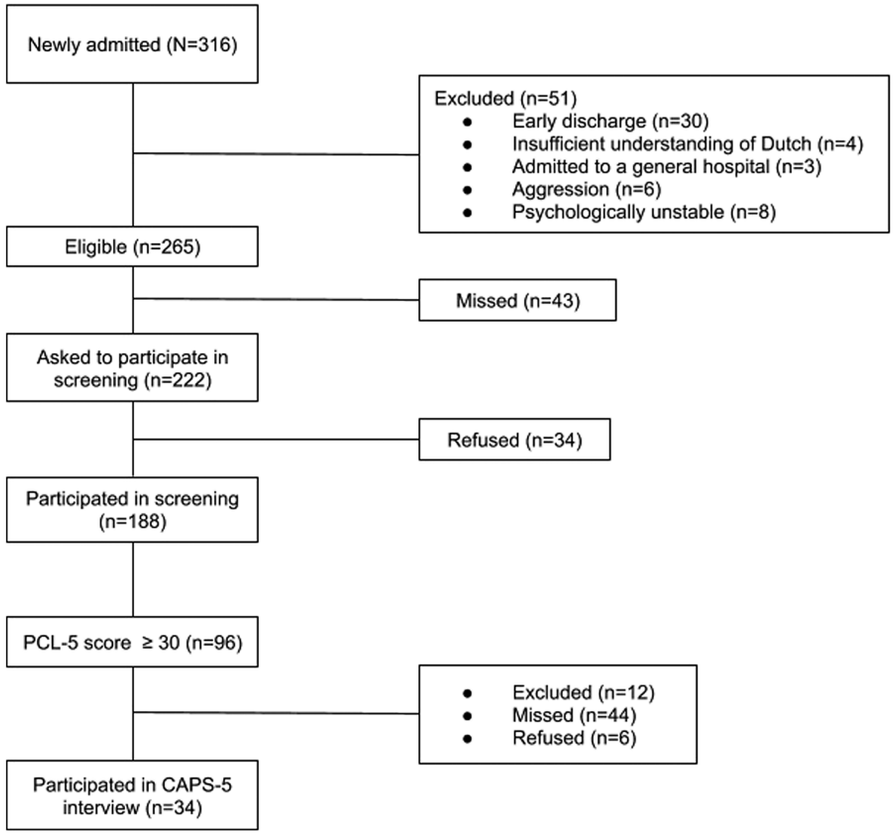

Figure 1. Recruitment and retention of participants in the study. Note: "Missed" refers to those patients who were eligible for screening but not asked to participate, mostly because they were (repeatedly) not available when the interviewers were present. CAPS-5, Clinician-Administered PTSD Scale for DSM-5; PCL-5, PTSD checklist for the DSM-5.

Table 1. Demographic and Clinical Characteristics of the Sample (n = 188)

Characteristic	M (SD), Mdn (IQR), or n (%)
Age (years), M (*SD*)	46.6 (12.3)
Gender (female), n (%)	47 (25.0)
Highest completed level of education	
No or elementary education, n (%)	31 (16.5)
Intermediate education, n (%)	138 (73.4)
Higher education, n (%)	19 (10.1)
Primary problem substance	
Alcohol, n (%)	111 (59.0)
Cannabis, n (%)	25 (13.3)
Cocaine, n (%)	29 (15.4)
Other, n (%)	23 (12.2)
Number of days since admission on screening day, Mdn (IQR)	4 (3-6)
Number of previous admissions for SUD treatment, Mdn (IQR)	2 (1-5)
PCL-5 score, M (SD)	30.2 (19.6)
PCL-5 score ≥ 30, n (%)	96 (51.3)
PSQI score, M (SD)	10.2 (4.8)
PSQI score ≥ 5, n (%)	163 (86.7)
PSQI-A score, M (SD)	5.4 (4.7)
PSQI-A score ≥ 4, n (%)	108 (57.4)
Number of different traumatic events (direct exposure) (LEC-5), Mdn (IQR)	3 (1-5)
Number of different traumatic events (indirect exposure) (LEC-5), Mdn (IQR)	2 (1-3)
Directly experienced ≥1 traumatic event (LEC-5), n (%)	167 (88.8)

PCL-5, PTSD checklist for the DSM-5; PSQI, Pittsburgh Sleep Quality Index; PSQI-A, Pittsburgh Sleep Quality Index Addendum for PTSD; LEC-5, Life Events Checklist; M, mean; Mdn, median; IQR, interquartile range; SUD, substance use disorders.

Finally, in order to address our third study aim—to examine which demographic and clinical variables were associated with PTSD symptom severity—we added the independent variables mentioned in the statistical analyses paragraph to the multiple regression model in blocks; only the final model is shown (see Table 3). Multicollinearity diagnostics showed that all variance inflation factors were below 2, which means there was no multicollinearity between the independent variables. Educational level and primary problem substance were not significantly associated with PTSD symptom severity, did not significantly change the associations of the other variables with PTSD symptom severity, and did not significantly improve the R^2 of the model in any of the other steps and were therefore deleted from the model. The results of the final regression model (Table 3) show that younger age and female gender were associated with more severe PTSD symptoms. Direct and indirect exposure to more traumatic events were also independently associated with more severe PTSD symptoms. Finally, poorer general sleep quality and poorer PTSD-related sleep quality were associated with PTSD symptom severity. Together these variables explained 54% of the total variation in PTSD symptom severity.

Table 2. Direct and Indirect Exposure to Traumatic Events (n = 188)

Traumatic events, n (%)	Direct Exposure	Indirect Exposure
Natural disaster	7 (3.7)	3 (1.6)
Fire or explosion	28 (14.9)	25 (13.4)
Transportation accident	66 (35.1)	38 (20.3)
Serious accident at work, home, or during recreational activities	45 (23.9)	30 (16.0)
Exposure to toxic substances	23 (12.2)	3 (1.6)
Physical assault	110 (58.5)	39 (20.9)
Assault with a weapon	69 (36.7)	21 (11.2)
Sexual assault	40 (21.3)	9 (4.8)
Other unwanted or uncomfortable sexual experience	47 (25.0)	9 (4.8)
Combat or exposure to a war zone	10 (5.3)	5 (2.7)
Captivity	31 (16.5)	1 (0.5)
Life-threatening illness or injury	36 (19.1)	35 (18.7)
Severe human suffering	55 (29.3)	25 (13.4)
Sudden violent death	14 (7.4)	54 (28.9)
Sudden accidental death	4 (2.1)	63 (33.7)
Serious injury, harm, or death you caused someone else	18 (9.6)	2 (1.1)
Any other very stressful event or experience	71 (37.8)	17 (9.1)

Table 3. Final Multiple Linear Regression Model for the Effects of Demographic Factors, Trauma Exposure, and Sleep Quality on PTSD Symptoms in SUD patients (n = 188)

Predictors	β	95% CI for β	*P*
Age (years)	−0.31	−0.47 to −0.14	<.001
Gender (female)	6.81	2.21-11.41	.004
Number of directly experienced traumatic events (LEC-5)	1.59	0.82-2.35	<.001
Number of indirectly experienced traumatic events (LEC-5)	0.73	0.08-1.37	.027
Subjective sleep quality (PSQI)	0.82	0.33-1.31	.001
Subjective sleep quality specific for PTSD (PSQI-A)	1.36	0.84-1.88	<.001

PTSD, posttraumatic stress disorder; SUD, substance use disorder; LEC-5, Life Experiences Checklist; PSQI, Pittsburgh Sleep Quality Index; PSQI-A, Pittsburgh Sleep Quality Index Addendum for PTSD.

DISCUSSION

The aims of the current study were, firstly, to replicate earlier research on the prevalence of direct and indirect exposure to traumatic events, PTSD symptoms, and

clinical diagnoses of PTSD in SUD inpatients after detoxification. Almost all SUD patients (96.3%) had at some point in their life been directly or indirectly exposed to a traumatic event, and most of them (88.8%) had directly experienced a traumatic event themselves. These results correspond with previous studies. Specifically, in a Dutch study of inpatients and outpatients with SUD, 97.4% had been exposed to a trauma meeting the A1 criterion of the DSM-IV PTSD diagnosis.[5] In a British study on SUD inpatients, the prevalence of exposure to an A1 criterion trauma was 94.0%.[3] We also found that approximately half (51.3%) of the patients scored above the cut-off on a screening instrument for PTSD. Of these screen-positive patients, 34 were interviewed, with 20 of them (58.8%) diagnosed with PTSD according to the CAPS-5 interview. If this specific subpopulation is representative of the total study population, the prevalence of PTSD in our study will be 30.2% (0.588 × 51.3%), which is very similar to the above-mentioned Dutch and British studies among treatment-seeking SUD patients with 36.6%[5] and 38.5%[3] PTSD, respectively. Of these 20 diagnosed PTSD patients in the current study, 6 patients were previously diagnosed with PTSD according to their patient files, and 14 were newly diagnosed with PTSD in the context of this research project. It is likely that their PTSD would have remained undetected if this study had not taken place. This is in line with previous studies showing that PTSD often goes undetected in addiction care facilities.[5,34,35]

Together, these findings warrant PTSD screening in all treatment-seeking SUD patients. Only when properly diagnosed, appropriate treatment can be offered. Evidence is accumulating that PTSD can be treated effectively in patients with SUD, for example, with (prolonged) exposure therapy.[36,37]

The second aim of our study was to examine the prevalence of general and PTSD-specific sleep quality in SUD inpatients after detoxification. Of the participants, 86.7% scored above the cut-off on a general sleep quality questionnaire and 57.4% on a PTSD-specific sleep questionnaire. In this group, the high prevalence of clinically significant sleep problems may not only be related to withdrawal from substances[23] and to disturbance of circadian rhythms caused by an irregular lifestyle, but also to the high prevalence of exposure to trauma. A theoretical review has shown that clinically significant insomnia is a highly prevalent and disabling consequence of exposure to traumatic events, which may occur without the presence of full-blown PTSD, but may be an antecedent of the development of PTSD and of substance dependence.[38]

Thirdly, we aimed to investigate whether demographic characteristics, primary problem substance, general and PTSD-specific sleep quality, and direct and indirect trauma history were correlates of the severity of PTSD symptoms. The regression model, which explained 54% of the variance, showed that younger age, female gender, direct and indirect exposure to more traumatic events, and poor subjective general and PTSD-specific sleep quality, but not education or primary problem substance, were independently associated with the severity of PTSD symptoms in SUD patients. Female gender and younger age were previously identified as risk factors in civilians (but not in military populations) in a meta-analysis on PTSD risk factors.[39] Recently, the relationship between poorer sleep quality and more severe PTSD symptoms was also observed in veterans with comorbid PTSD and SUD.[40] Our analyses showed that *indirect* exposure to traumatic events was independently associated with more severe PTSD symptoms, that is, even when adjusted for direct exposure to traumatic events. A recent large community survey in Israel also showed that direct and indirect exposure to trauma were significantly related to the risk of addiction; in the case of combat-related trauma, indirect exposure was even more strongly associated with alcohol and pornography addiction compared to direct exposure.[21] All these findings suggest that indirect exposure to traumatic events is an important determinant of participants' mental health and should be systematically addressed in assessment and therapy. Also, poor general and PTSD-specific sleep quality were both independently associated with PTSD symptom severity. This suggests that the PSQI and the PSQI-A measure qualitatively different concepts; however, each of them can be indicative of PTSD symptoms and therefore warrants attention in the diagnostic assessment of SUD patients.

Our study has both strengths and limitations. The main strengths are that the study was performed in a naturalistic setting with few exclusion criteria and that 85% of the approached patients gave informed consent and participated in our study. The study also has limitations. Due to the limited availability of staff to conduct the CAPS-5 interviews, only one-third of participants with a score of 30 or higher on the PCL-5 could be interviewed. Another limitation is that many patients used sedatives and other medications, which may, to some extent, have influenced our findings. The Dutch versions of the LEC-5 and PLC-5 have not yet been validated; however, they are based on very similar questionnaires with well-established validity. Finally, our study was performed in inpatients and the results can therefore not be generalized to other SUD patient groups.

To conclude, the current study underscores the importance of systematic screening for direct and indirect exposure to traumatic experiences, PTSD, and poor sleep quality in patients admitted for clinical SUD treatment in order to facilitate adequate treatment for these comorbid problems.

Ethics Committee Approval: Ethical committee approval was received from the Ethics Committee of Leiden University (Approval Number: P16.152, Date: 8 July 2016).

Informed Consent: Written informed consent was obtained from all participants who participated in this study.

Peer-review: Externally peer-reviewed.

Author Contributions: Concept – J.v.d.B.; Design – J.v.d.B.; Supervision – J.v.d.B, A.v.E.; Materials – J.v.d.B., J.B., J.M.; Data Collection and/or Processing – J.t.H., J.B., P.t.H., J.v.d.B.; Analysis and/or Interpretation – J.t.H., J.v.d.B.; Literature Review – J.t.H., J.v.d.B.; Writing – J.t.H., J.v.d.B., A.v.E., P.B.; Critical Review – J.v.d.B, A.v.E., J.t.H., P.t.H., P.B., J.B., J.M., B.P., R.M.K.

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REFERENCES

1. Bailey KM, Stewart SH. *Relations among Trauma, PTSD, and Substance Misuse: the Scope of the Problem. Trauma and Substance Abuse: Causes, Consequences, and Treatment of Comorbid Disorders*. 2nd ed. Washington, DC; 2014.
2. Fareed A, Eilender P, Haber M, Bremner J, Whitfield N, Drexler K. Comorbid posttraumatic stress disorder and opiate addiction: a literature review. *J Addict Dis*. 2013;32(2):168-179. [CrossRef]
3. Reynolds M, Mezey G, Chapman M, Wheeler M, Drummond C, Baldacchino A. Co-morbid post-traumatic stress disorder in a substance misusing clinical population. *Drug Alcohol Depend*. 2005;77(3):251-258. [CrossRef]
4. Konkolÿ Thege B, Horwood L, Slater L, Tan MC, Hodgins DC, Wild TC. Relationship between interpersonal trauma exposure and addictive behaviors: a systematic review. *BMC Psychiatry*. 2017;17(1):164. [CrossRef]
5. Gielen N, Havermans RC, Tekelenburg M, Jansen A. Prevalence of post-traumatic stress disorder among patients with substance use disorder: it is higher than clinicians think it is. *Eur J Psychotraumatol*. 2012;3. [CrossRef]
6. De Vries GJ, Olff M. The lifetime prevalence of traumatic events and posttraumatic stress disorder in the Netherlands. *J Trauma Stress*. 2009;22(4):259-267. [CrossRef]
7. Zammit S, Lewis C, Dawson S, et al. Undetected post-traumatic stress disorder in secondary-care mental health services: systematic review. *Br J Psychiatry*. 2018;212(1):11-18. [CrossRef]
8. Back S, Dansky BS, Coffey SF, Saladin ME, Sonne S, Brady KT. Cocaine dependence with and without post-traumatic stress disorder: a comparison of substance use, trauma history and psychiatric comorbidity. *Am J Addict*. 2000;9(1):51-62. [CrossRef]
9. Brown PJ, Wolfe J. Substance abuse and post-traumatic stress disorder comorbidity. *Drug Alcohol Depend*. 1994;35(1):51-59. [CrossRef]
10. Ouimette PC, Brown PJ, Najavits LM. Course and treatment of patients with both substance use and posttraumatic stress disorders. *Addict Behav*. 1998;23(6):785-795. [CrossRef]
11. Hildebrand A, Behrendt S, Hoyer J. Treatment outcome in substance use disorder patients with and without comorbid posttraumatic stress disorder: a systematic review. *Psychother Res*. 2015;25(5):565-582. [CrossRef]
12. American Psychiatric Association. *Diagnostic and Statistical Manual of Mental Disorders*. 5th ed. Arlington, VA: American Psychiatric Association; 2013.
13. HruskaB, Delahanty DL. *PTSD-SUD Biological Mechanisms: Self-Medication and Beyond. Trauma and Substance Abuse: Causes, Consequences, and Treatment of Comorbid Disorders*. 2nd ed. Washington, DC; 2014.
14. Resnick HS, Walsh K, Schumacher JA, Kilpatrick DG, Acierno R. Prior substance abuse and related treatment history reported by recent victims of sexual assault. *Addict Behav*. 2013;38(4):2074-2079. [CrossRef]
15. Richardson JB, St Vil C, Sharpe T, Wagner M, Cooper C. Risk factors for recurrent violent injury among black men. *J Surg Res*. 2016;204(1):261-266. [CrossRef]
16. Testa M, Livingston JA. Alcohol consumption and women's vulnerability to sexual victimization: can reducing women's drinking prevent rape? *Subst Use Misuse*. 2009;44(9-10):1349-1376. [CrossRef]
17. Sartor CE, McCutcheon VV, Pommer NE, et al. Common genetic and environmental contributions to post-traumatic stress disorder and alcohol dependence in young women. *Psychol Med*. 2011;41(7):1497-1505. [CrossRef]
18. Franken I, Van den Brink W. *Handboek Verslaving*. Utrecht: De Tijdstroom; 2009.
19. Gielen N, Krumeich A, Havermans RC, Smeets F, Jansen A. Why clinicians do not implement integrated treatment for comorbid substance use disorder and posttraumatic stress disorder: a qualitative study. *Eur J Psychotraumatol*. 2014;5(1). [CrossRef]
20. May CL, Wisco BE. Defining trauma: how level of exposure and proximity affect risk for posttraumatic stress disorder. *Psychol Trauma*. 2016;8(2):233-240. [CrossRef]
21. Levin Y, Lev Bar-Or R, Forer R, Vaserman M, Kor A, Lev-Ran S. The association between type of trauma, level of exposure and addiction. *Addict Behav*. 2021;118:106889. [CrossRef]
22. Socci V, Rossi R, Talevi D, Crescini C, Tempesta D, Pacitti F. Sleep, stress and trauma. *J Psychopathol*. 2020;26:92-98.
23. Conroy DA, Arnedt JT. Sleep and substance use disorders: an update. *Curr Psychiatry Rep*. 2014;16(10):487. [CrossRef]
24. Sullivan JT, Sykora K, Schneiderman J, Naranjo CA, Sellers EM. Assessment of alcohol withdrawal: the revised Clinical Institute Withdrawal Assessment for alcohol Scale (CIWA-Ar). *Br J Addict*. 1989;84(11):1353-1357. [CrossRef]
25. National Collaborating Centre for Mental Health. *Alcohol-Use Disorders: Diagnosis, Assessment and Management of Harmful Drinking and Alcohol Dependence*. Leicester: The British Psychological Society and the Royal College of Psychiatrists; 2011.
26. Schippers GM, Broekman TG, Buchholz A, Koeter MWJ, van den Brink W. Measurements in the Addictions for

Triage and Evaluation (MATE): an instrument based on the World Health Organization family of international classifications. *Addiction*. 2010;105(5):862-871. [CrossRef]
27. Boeschoten M, Bakker A, Jongedijk R, Olff M. *PTSD Checklist for DSM-5 and Life Events Checklist for DSM-5 with Extended A Criterion – Nederlandstalige Versie*. Diemen: Arq Psychotrauma Expert Groep; 2014.
28. Gray MJ, Litz BT, Hsu JL, Lombardo TW. Psychometric properties of the life events checklist. *Assessment*. 2004;11(4):330-341. [CrossRef]
29. Blevins CA, Weathers FW, Davis MT, Witte TK, Domino JL. The posttraumatic stress disorder checklist for DSM-5 (PCL-5): development and initial psychometric evaluation. *J Trauma Stress*. 2015;28(6):489-498. [CrossRef]
30. Boeschoten M, Bakker A, Jongedijk R, et al. *Clinician Administered PTSD Scale for DSM-5 – Nederlandstalige Versie*. Diemen: Arq Psychotrauma Expert Groep; 2014.
31. Weathers FW, Bovin MJ, Lee DJ, et al. The Clinician-Administered PTSD Scale for DSM-5 (CAPS-5): development and initial psychometric evaluation in military veterans. *Psychol Assess*. 2018;30(3):383-395. [CrossRef]
32. Buysse DJ, Reynolds CF, Monk TH, Berman SR, Kupfer DJ. The Pittsburgh Sleep Quality Index: a new instrument for psychiatric practice and research. *Psychiatry Res*. 1989;28(2):193-213. [CrossRef]
33. Germain A, Hall M, Krakow B, Katherine Shear MK, Buysse DJ. A brief Sleep Scale for Posttraumatic Stress Disorder: Pittsburgh Sleep Quality Index addendum for PTSD. *J Anxiety Disord*. 2005;19(2):233-244. [CrossRef]
34. Dansky BS, Roitzsch JC, Brady KT, Saladin ME. Posttraumatic stress disorder and substance abuse: use of research in a clinical setting. *J Trauma Stress*. 1997;10(1):141-148. [CrossRef]
35. Najavits LM. Theoretical perspective on posttraumatic stress disorder and substance use disorder. *Aust Psychol*. 2005;40(2):118-126. [CrossRef]
36. Back SE, Killeen T, Badour CL, et al. Concurrent treatment of substance use disorders and PTSD using prolonged exposure: a randomized clinical trial in military veterans. *Addict Behav*. 2019;90:369-377. [CrossRef]
37. Norman SB, Trim R, Haller M, et al. Efficacy of integrated exposure therapy vs integrated coping skills therapy for comorbid posttraumatic stress disorder and alcohol use disorder: a randomized clinical trial. *JAMA Psychiatry*. 2019;76(8):791-799. [CrossRef]
38. Sinha SS. Trauma-induced insomnia: a novel model for trauma and sleep research. *Sleep Med Rev*. 2016;25:74-83. [CrossRef]
39. Brewin CR, Andrews B, Valentine JD. Meta-analysis of risk factors for posttraumatic stress disorder in trauma-exposed adults. *J Consult Clin Psychol*. 2000;68(5):748-766. [CrossRef]
40. Colvonen PJ, Ellison J, Haller M, Norman SB. Examining insomnia and PTSD over time in veterans in residential treatment for substance use disorders and PTSD. *Behav Sleep Med*. 2019;17(4):524-535. [CrossRef]