



# The relationship between sleep, dissociation and psychotic-like experiences

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## Abstract

**Background:** Sleep disturbances have frequently been associated with the full spectrum of psychosis, from psychotic-like experiences (PLEs) to individuals who meet diagnostic criteria for schizophrenia. Similarly, dissociative experiences have been linked to both sleep disturbances and PLEs.

**Aim:** The aim of this study was to examine the role of dissociation in the relationship between sleep quality and PLEs.

**Methods:** PLEs, dissociative symptoms, and sleep quality were examined in 1677 young adults using self-report measures. A mediation analysis was performed to examine whether dissociative experiences account for some of the relationship between sleep quality and PLEs.

**Results:** Dissociative symptoms significantly mediated the relationship between sleep quality and PLEs, with both age and gender used as covariates.

**Conclusion:** These findings suggest that dissociation may be a key contributor to the relationship between disrupted sleep and PLEs, which could have treatment and identification implications.

## KEYWORDS

dissociation, insomnia, psychosis, sleep disturbance

## 1 | INTRODUCTION

### 1.1 | Sleep and psychosis

Sleep disturbance is a common complaint endorsed by individuals with schizophrenia and has been associated with a number of poor clinical and cognitive outcomes (Cohrs, 2008). Individuals with schizophrenia can experience sleep disturbance as severe as those with primary insomnia and report reduced total sleep time, reduced sleep efficiency, and increased sleep latency and time awake after sleep onset (Cohrs, 2008). Qualitative complaints, such as prolonged sleep latency and greater disturbance in continuity of sleep, have been observed in individuals at clinical high-risk (CHR) for psychosis compared to non-psychiatric controls, which suggests that sleep disturbance may be a core feature of psychotic disorders and not related to antipsychotic treatment (Lunsford-Avery et al., 2013). Fragmented sleep, night anxiety, and night

hallucinations have been found to be associated within help-seeking college-aged students who endorse psychotic-like experiences (PLEs; attenuated, subthreshold positive symptoms of psychosis), suggesting that poor sleep quality exists across the entire psychosis spectrum (Andorko et al., 2017). However, other types of psychopathologies, such as depression and post-traumatic stress disorder (PTSD), have also been associated with poor sleep quality, and may explain some of the relationship between sleep disturbance and PLEs (Ered et al., 2018). As a result, the sleep disturbances in individuals reporting PLEs may be driven by the presence of other psychiatric symptoms.

### 1.2 | Dissociation and sleep

While dissociation has long been associated with trauma and PTSD, sleep alterations also appear to play a prominent role in the

manifestation of dissociative symptoms in both the general population and in clinical samples (van der Kloet, Merckelbach, et al., 2012). Dissociation can be defined as an altered state of consciousness that disrupts awareness, identity and memory, and can result in memory loss, identity confusion and feelings of being detached from oneself (Koffel & Watson, 2009). In a study of undergraduates, it was found that dissociative experiences are linked to bizarre sleep phenomena such as nightmares, vivid dreams, recurrent dreams and hypnopompic imagery (Watson, 2001). Another study examining the link between dissociation and sleep in a non-psychiatric sample found that when participants were deprived of sleep for one night, dissociative symptoms increased significantly, and the relationship between dissociation and fatigue was not mediated by mood (Giesbrecht, Smeets, et al., 2007). In an inpatient sample of participants with a variety of psychiatric diagnoses, dissociative symptoms were strongly associated with sleep disturbances, and improvements in sleep hygiene led to a reduction in dissociative symptoms (van der Kloet, Giesbrecht, et al., 2012).

### 1.3 | Dissociation and psychosis

Dissociation has also been linked to psychosis, and some evidence suggests that dissociation and psychosis belong to a common domain (Koffel & Watson, 2009). One study found significant overlap between measures of schizotypy, specifically positive and disorganized symptoms, and dissociation in a sample of undergraduate students (Giesbrecht, Merckelbach, et al., 2007). Another study of undergraduate students found a significant correlation between scores on the Dissociative Experiences Scale (DES) and positive symptoms of schizotypy, particularly with the Perceptual Aberration Scale and Magical Ideation Scale (Pope, Cameron, Kwapil et al., 2000). On the clinical end of the psychosis spectrum, individuals with schizophrenia have been found to score higher on measures of dissociation compared to non-psychiatric controls, and among schizophrenia patients there is a relationship between dissociation and positive symptoms, but not negative symptoms or general psychopathology (Renard et al., 2017). Dissociative symptoms have been found to mediate the relationship between traumatic life experiences and PLEs when controlling for other forms of psychopathology, and the strength of this relationship appears to differ across ethnic groups (Anglin et al., 2015; Gibson et al., 2018).

Despite the links described above between sleep disturbances, dissociation, and PLEs, no study to our knowledge has examined a statistical mediation model of these variables in individuals who endorse PLEs. Examining the indirect effects of these variables would provide further explanation as to what variables explain the most variance in the relationship between sleep quality and PLEs, which has the potential to influence intervention and treatment strategies. We hypothesized that dissociative symptoms, through statistical mediation, will significantly mediate the relationship between sleep disturbances and PLEs.

## 2 | METHODS

### 2.1 | Participants and procedures

Participants included 1677 young adults between the ages of 18 and 35 recruited through Temple University's online participant recruitment system. Participants provided informed consent and then completed the survey at a computer located within the laboratory. Research staff were available to answer any questions.

### 2.2 | Instruments

#### 2.2.1 | Prodromal questionnaire

The PQ (Loewy et al., 2005; Loewy et al., 2007) is a 92-item self-report questionnaire designed to assess for the presence of a range of subthreshold psychotic symptoms over the previous month while not under the influence of substances. The PQ includes four subscales: positive symptoms (unusual thinking, perceptual abnormalities and cognitive disorganization), negative symptoms (flat affect and social avoidance), disorganized symptoms (odd behaviour), and general symptoms (depression, anxiety and general role functioning). Concurrent validity of the PQ has been assessed using the Structured Interview for Psychosis-risk Syndromes (SIPS; Loewy et al., 2005). The current study utilized the sum of any endorsement of the 45 items in the positive subscale of the PQ, as positive symptoms are the basis of a diagnosis of clinical high risk for interview-based assessments.

#### 2.2.2 | Pittsburgh sleep quality index

The Pittsburgh Sleep Quality Index (PSQI; Buysse et al., 1989) is a 19-item self-report measure of sleep quality over the previous month, and has previously been used to characterize sleep disturbances along the psychosis spectrum. Components of sleep quality assessed include sleep latency, sleep efficiency, sleep duration, sleep disturbance, use of sleep medication, and daytime dysfunction. The PSQI has shown 89.6% sensitivity and 86.5% specificity in distinguishing between good and poor sleepers (participants with and without a diagnosis of a sleep disorder), and has shown convergent validity with physiological measures of sleep, such as home polysomnography (Buysse et al., 1989). The variable of interest was the global PSQI score.

#### 2.2.3 | Dissociative experiences scale

The DES (Carlson & Putnam, 1993) was used to examine dissociative experiences. The DES is a 28-item self-report questionnaire that asks participants to report on a range of dissociative experiences, and is considered to be the gold standard for evaluating dissociation (Braehler et al., 2013). Each question asks about a different dissociative symptom, to which the participant must indicate what percentage

**TABLE 1** Demographics and clinical characteristics

	Overall sample ( <i>n</i> = 1677)
Male, <i>n</i> (%)	407 (24%)
Age (years), mean (SD) (range)	20.12 (2.40) (18–34)
Ethnicity, Hispanic <i>n</i> (%)	123 (7%)
Race <i>n</i> (%)	
American Indian/Alaska Native	6 (0.4%)
Asian	259 (15.5%)
Native Hawaiian/Other Pacific Islander	6 (0.4%)
Black/African American	310 (18.5%)
White	961 (57.3%)
More than one race	79 (4.7%)
Unknown	53 (3.2%)
Total PLEs score, mean (SD) (range)	10.13 (7.50) (0–44)
Total PSQI score, mean (SD) (range)	6.44 (3.24) (0–19)
Total DES score, mean (SD) (range)	13.32 (12.45) (0.00–77.86)
Log transformed DES score, mean (SD) (range)	2.30 (0.90) (0.00–4.37)

Abbreviations: DES, Dissociative Experiences Scale; PLEs, psychotic-like experiences; PSQI, Pittsburgh Sleep Quality Index.

of the time they have that experience on an 11-point scale (0%–100%). The mean score was used for the analysis.

### 2.3 | Data analysis

The dependent variable (PLEs) was first checked for normality by visual inspection of the data and reviewing skewness and kurtosis values. Given that multiple models were examined, the independent variable (sleep quality) and mediator (dissociation) were also examined visually and statistically for normality. DES scores were found to not be normally distributed, and therefore, log transformed DES scores were used for the analysis (DES kurtosis = 3.61, skewness = 1.76; post-log transformation kurtosis = –0.15, skewness = –0.36). Gender and age were explored as potential covariates by determining if they were significantly associated with the main study variables.

Next, bivariate Pearson correlations were conducted to determine if sleep quality was associated with both dissociative experiences and PLEs, and to determine if dissociative experiences were associated with PLEs. Hayes' PROCESS macro for SPSS (Hayes, 2012) was then used to assess for indirect effects. The indirect effect of sleep quality on PLEs accounting for the effect of dissociative experiences was tested using a bootstrap estimation approach with 5000 samples. Significant statistical mediation was determined by a 95% confidence interval of the effect size not including zero (Hayes, 2013) and significance for bivariate analyses was determined by  $p < .05$  (two tailed tests). Because of the cross-sectional nature of the data, to further characterize the relationship between the variables, alternative

models of indirect effects were performed. Specifically, we examined the indirect effect of dissociative experiences on the relationship between PLEs and sleep quality, and the indirect effect of PLEs on the effect of sleep quality on dissociative experiences.

## 3 | RESULTS

Demographics of the sample are presented in Table 1. Bivariate correlations found a significant relationship between PLEs and sleep quality ( $r = 0.312$ ,  $p < .001$ ), as well as PLEs and dissociative experiences ( $r = 0.496$ ,  $p < .001$ ). Sleep quality was also found to be significantly correlated with dissociative experiences ( $r = 0.263$ ,  $p < .001$ ). Age was significantly associated with PLEs ( $r = -0.068$ ,  $p = .005$ ), and dissociative experiences ( $r = -0.049$ ,  $p = .043$ ), but not sleep quality ( $r = 0.041$ ,  $p = .09$ ). There was a significant difference between male and female participants for PLEs, with males reporting higher scores ( $t [1675] = 3.23$ ,  $p = .0010$ ). Gender differences for sleep quality were also significant ( $t [1675] = 2.15$ ,  $p = .03$ ) with females reporting better sleep quality scores, but no significant gender differences were found for dissociative experiences ( $t [1675] = 1.61$ ,  $p = .11$ ). As a result, to take a conservative approach, both gender and age were controlled for in the analysis of indirect effects.

As indicated in Table 2, bootstrapping results showed that there was a significant indirect effect of dissociative experiences on the relationship between sleep quality and PLEs (95% CI = 0.2162, 0.3319),  $R^2 = 0.29$ . Results from alternative models are presented in Table 3. We examined the indirect effect of dissociative experiences on the effect of PLEs on sleep quality (95% CI = 0.0192, 0.0430),  $R^2 = 0.12$ , and the indirect effect of PLEs on effect of sleep quality on dissociative experiences (95% CI = 0.0337, 0.0480),  $R^2 = 0.26$ .

## 4 | DISCUSSION

This is the first study, to our knowledge, to demonstrate a significant indirect effect of dissociative symptoms on the relationship between sleep quality and PLEs. This model is significant even when controlling for gender and age. This finding suggests that although sleep quality is significantly related to PLEs, dissociative experiences may be a key variable contributing to this relationship. These results build upon previous research that has found that other forms of psychopathology account for some of the relationship between sleep quality and PLEs, such as depression and PTSD (Ered et al., 2018). Further, results from this study suggest that sleep disturbances could be a modifiable treatment target for individuals reporting PLEs through the use of cognitive behavioural therapy or pharmacotherapy, especially if these individuals are also experiencing dissociative symptoms.

Our findings also build upon a growing body of research examining overlap in symptoms between schizophrenia-spectrum disorders and dissociative disorders, which may point to a shared neural mechanism. One pathway that could potentially explain the overlap between dissociation and psychosis is through N-methyl-D-aspartate (NMDA)

**TABLE 2** Indirect, direct and total effect of psychotic-like experiences (PLEs) and sleep quality through dissociative experiences

PLEs (n = 1677)						
IV	Mediator	Total effect	Indirect effect	SE	95% CI	R <sup>2</sup>
Sleep Quality	Dissociative experiences	0.7443	0.272	0.0297	0.2162–0.03319	0.29
		–	Direct effect	SE	95% CI	–
		–	0.4723	0.0499	0.3745–0.5701	–

**TABLE 3** Alternative mediation models

IV	Mediator	DV	Total effect	Indirect effect	SE	95% CI	R <sup>2</sup>
PLEs	Dissociative experiences	Sleep quality	0.1396	0.0311	0.0061	0.0192–0.043	0.12
			–	Direct effect	SE	95% CI	–
			–	0.1085	0.0115	0.0860–0.1309	–
Sleep quality	PLEs	Dissociative experiences	0.0752	0.0408	0.0037	0.0337–0.048	0.26
			–	Direct effect	SE	95% CI	–
			–	0.0344	0.0062	0.0222–0.0467	–

Abbreviation: PLEs, psychotic-like experiences.

receptor dysfunction. Ketamine, a non-competitive antagonist of the NMDA receptor, produces positive and cognitive symptoms of psychosis as well as dissociative symptoms in healthy adults (Krystal et al., 1994). Similarly, pre-clinical studies in both rats and fruit flies have found that administration of an NMDA receptor antagonist results in sleep reduction (Revel et al., 2009; Tomita et al., 2015). Another potential mechanism may be  $\gamma$ -aminobutyric acid (GABA)-serotonin interactions. One study demonstrated that when non-psychiatric participants received a drug that simulated a GABA deficit in combination with a drug that stimulates serotonin receptors, participants experienced symptoms of psychosis and dissociation (D'Souza et al., 2006). GABA and serotonin are critical neurotransmitters involved in sleep and wake regulation (Oh et al., 2018). Additionally, dissociative and psychotic disorders both show deficits in sensory gating, which may suggest overlapping altered thalamo-cortical connectivity (Keshavan et al., 2008; Krause-Utz et al., 2017). Another prominent marker of thalamo-cortical disruption that has been demonstrated across the psychosis spectrum is reduced sleep spindle deficits, though spindle density has not yet been investigated in dissociative disorders (Manoach et al., 2016). Overall, these findings suggest that there may be shared neural mechanisms that contribute to dissociation, sleep disruption, and PLEs.

One limitation of this study is that all data collected, including sleep quality data, was collected via self-report measures. The total score for the PSQI is a valid and commonly used measure for sleep; however, sleep data collected via wrist actigraphy or polysomnography may provide a more accurate picture of sleep quality. Additionally, the cross-sectional design limits the conclusions that can be drawn with regard to the temporal nature of the relationship between sleep, PLEs, and dissociative experiences. To further address this limitation, alternative statistical mediation models were conducted to assess for significance. In particular, we examined whether

dissociation mediates the effect of PLEs on sleep quality, and whether PLEs mediates the effect of sleep quality on dissociation. These specific models were chosen to examine the possibilities that (1) PLEs lead to an increase in dissociative symptoms, and that the combination of PLEs and dissociation have a deleterious effect on sleep quality, and (2) whether sleep disturbance leads to an increase in PLEs, which then leads to an increase in dissociation. Due to the overlapping nature of these variables, an argument can be made placing any of the three as the independent, mediating, or dependent variables and, practically, all may be true in different circumstances. Nevertheless, the present study highlights the important association of these variables, which should be followed up in future experimental and longitudinal designs. While longitudinal studies might be more challenging due to the fluctuating nature of sleep quality across the lifespan, it is possible to experimentally restrict sleep in a laboratory setting and measure subsequent dissociative and PLEs. These significant results suggest that the directionality of the association between these variables is not clear, but further supports a strong relationship between these three variables and underscores the necessity of longitudinal research to further characterize these associations through true theoretical mediation. The sample used for this study used university students which may limit generalizability, though it should be noted that the university students were enrolled from is fairly diverse in terms of race, ethnicity and socioeconomic status. This sample was also large and non-help seeking, which increases the external validity of these results.

Future studies should examine factors that contribute to dissociative symptoms in individuals at clinical high risk for psychotic disorders, as well in individuals who meet criteria for psychosis spectrum disorders, and other consequences of the presence of these symptoms. Furthermore, neuroimaging or electrophysiological techniques may be used to elucidate the neural mechanisms associated with

these symptoms. Additionally, both age and gender were significantly associated with variables in this study. Future projects should directly examine how age and gender influence sleep, dissociation, and PLEs, particularly as potential moderators. Our results suggest that both dissociative symptoms and sleep disturbances should be explored as potential modifiable targets for intervention in individuals with distressing PLEs, or those at CHR for psychosis.

## CONFLICT OF INTEREST

The authors declare no conflicts of interest.

## DATA AVAILABILITY STATEMENT

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

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