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## CLINICAL REVIEW

## A systematic review of variables associated with sleep paralysis

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## SUMMARY

Sleep paralysis is a relatively common but under-researched phenomenon. While the causes are unknown, a number of studies have investigated potential risk factors. In this article, we conducted a systematic review on the available literature regarding variables associated with both the frequency and intensity of sleep paralysis episodes. A total of 42 studies met the inclusion criteria. For each study, sample size, study site, sex and age of participants, sleep paralysis measure, and results of analyses looking at the relationship(s) between sleep paralysis and associated variable(s) were extracted. A large number of variables were associated with sleep paralysis and a number of themes emerged. These were: substance use, stress and trauma, genetic influences, physical illness, personality, intelligence, anomalous beliefs, sleep problems and disorders (both in terms of subjective sleep quality and objective sleep disruption), symptoms of psychiatric illness in non-clinical samples (particularly anxiety symptoms), and psychiatric disorders. Sleep paralysis appears to be particularly prevalent in post-traumatic stress disorder, and to a less degree, panic disorder. Limitations of the current literature, directions for future research, and implications for clinical practice are discussed.

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## Introduction

Sleep paralysis involves a period of time at either sleep onset or upon awakening from sleep during which voluntary muscle movements are inhibited. Ocular and respiratory movements remain unaltered and perception of the immediate environment is clear [1]. These episodes are frequently associated with a variety of hallucinations, such as a sense of an evil presence (known as intruder hallucinations), pressure felt on the chest (incubus hallucinations), and illusory feelings of movement (vestibular-motor (V-M) hallucinations) [2]. Sleep paralysis is a global phenomenon, with terms for sleep paralysis existing in over 100 cultures [3]. In many places, sleep paralysis experiences are interwoven with a culture's folklore [4,5]. Episodes of sleep paralysis have been suggested as an explanation for supposed paranormal phenomena such as witchcraft [6], demonic assault [7], and space alien abduction [8,9]. Fear and distress are typically associated with episodes [2], though feelings of bliss are sometimes reported [10].

A review of lifetime prevalence rates of sleep paralysis in the general population estimated prevalence to be approximately 8%, though individual study estimates greatly vary from 2 to 60% [11]. The lack of a 'gold standard' measure of sleep paralysis is likely part of the reason for this [3] and the problem is amplified by the fact that the precise phrasing used to ask about sleep paralysis has been shown to affect the reported prevalence rate [12]. Averaging over multiple studies, no effects of age have been found and sex differences show mixed results [11]. Finally, there are slightly higher lifetime prevalence rates of sleep paralysis in non-Caucasian compared to Caucasian groups [11].

In addition to limitations with the measures used to assess sleep paralysis, another outstanding problem is the lack of consistency with terminology. Sleep paralysis is a common symptom of narcolepsy, a neurological disorder. Narcolepsy is characterised by excessive daytime sleepiness, cataplexy (sudden, brief, bilateral losses of muscle tone in response to strong emotions such as laughter or anger [13]) and disturbed nocturnal sleeping patterns [14]. Therefore, the term *isolated sleep paralysis* is preferred when sleep paralysis is present in the absence of a diagnosis of narcolepsy [3]. Some authors also use the term *fearful isolated sleep paralysis* to indicate cases where episodes are causing clinically significant fear

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and/or distress [3]. Finally, when episodes occur repeatedly, the term *recurrent (fearful) isolated sleep paralysis* can be used, though there is no agreement on exactly how often episodes need to occur in order to be considered recurrent [15,16].

The causes of sleep paralysis are likely to be multifactorial [17]. It is therefore important for clinicians and researchers to understand the factors that may influence the frequency and intensity of episodes. Here, we systematically review the available literature regarding variables associated with sleep paralysis. It is hoped that this review will provide a resource to both clinicians, who shall have a better understanding of this common experience, and also researchers interested in formulating new research questions.

## Methods

A literature search was performed using OvidSP on the following databases: *Ovid MEDLINE* (1946 – September 2015); *PsycINFO* (1806 – September 2015); *Journals@Ovid Full Text* (– September 2015); and *PsycARTICLES Full Text* (– September 2015). The following search terms were used: “sleep paralysis”, “isolated sleep paralysis”, “parasomnia not otherwise specified”, “hypnagogic”, “hypnopompic”, “parasomnia”, “sensed presence”, and “incubus”.

There was no restriction made on the age of articles included in this review. For all identified articles published since 2000, reference lists were also scanned to see whether we had missed any articles suitable for inclusion in this review. Furthermore, manual searches were conducted of all journals containing more than five of the studies identified via the database searches. Where this happened, only articles published since 2000 were scanned for reasons of feasibility. These steps allowed us to reduce the possibility of non-indexed studies being missed.

For inclusion in this systematic review, studies were required to meet the following criteria:

- 1) Results are presented as a full original research paper published in a peer-reviewed journal.
- 2) Sleep paralysis is clearly defined, and it is clear that sleep paralysis has been identified in the sample, and is not another phenomenon (e.g., night terrors, hypnagogic/hypnopompic hallucinations with no paralysis, nightmares).
- 3) The presence of sleep paralysis in the sample was measured either via a continuous measure of frequency or a binary sleep paralysis present/absent measure.
- 4) An association has been explored between sleep paralysis and other variable(s). Either a comparison between groups (e.g., sleep paralysis vs no sleep paralysis) or an association between sleep paralysis frequency/intensity and the variable(s) under study.
- 5) Single case studies were excluded.
- 6) Review, commentary, or opinion articles not including any original data were excluded (but reference lists from such papers were checked, in line with the search strategy).
- 7) Only English language articles were included.

In total, 35 articles were identified that matched all the inclusion criteria. One article was found by searching article reference lists, and one was obtained through personal correspondence. Furthermore, an additional five articles that also matched all the inclusion criteria were recommended by a reviewer. Therefore, a total of 42 articles were included in this report. The process for selecting studies is displayed in the [Supplementary materials](#). From the included studies, the following data were extracted: Sample size and study site, sex and age of participants, sleep paralysis measure, and results of analyses looking at the relationship(s) between sleep paralysis and associated variable(s).

## Results

The articles included in the review can be found in [Table 1](#). The studies identified come from a wide range of different research groups, providing a highly international and cross-cultural sample.

Studies looking at associations between sleep paralysis and other variables are found in [Table 2](#). Associations between sleep paralysis and variables specifically related to sleep-related factors are displayed in [Table 3](#), with associations with other sleep disorders shown in [Table 4](#). [Table 5](#) shows associations between sleep paralysis and symptoms of psychiatric illness. Finally, [Table 6](#) shows associations with psychiatric disorders and medication. Overall, the majority of studies looked at sleep paralysis frequency alone, with fewer studies examining variables associated with the intensity and/or vividness of sleep paralysis and associated hallucinations.

### Demographics

Relationships between demographic variables and sleep paralysis are shown in [Table 2](#). Generally, studies that have investigated age differences in sleep paralysis prevalence have found no significant effect of age [17–21]. Similarly for sex differences the majority of studies found no significant effects [17–19,22–27]. Two large-scale surveys of Asian adolescents did find significant sex differences, with higher prevalence in females though the reported differences were very small. Munezawa and colleagues found an 8.2% prevalence for males and 8.4% for females. Ma et al. found a prevalence of 6.1% for males and 7.4% for females [24,28]. In a study of Hmong immigrants, higher odds of experiencing sleep paralysis were found in male participants (odds ratio (OR) = 1.61), though the exact prevalence rates for both sexes were not reported [21]. Finally, a study in an American sample found that males were more likely to have experienced lifetime isolated sleep paralysis than females, but there were no differences in lifetime fearful or recurrent fearful isolated sleep paralysis episodes [29]. With regards to ethnicity, evidence is also mixed. One study found African American individuals experienced a higher incidence of sleep paralysis compared with Caucasians [30]. A second study found that non-Caucasians had a higher prevalence of fearful and recurrent fearful isolated sleep paralysis compared to Caucasians [29]. Two other studies however found no significant effect of ethnicity [23,31].

Presence of sleep paralysis was shown to be higher in rural compared to urban areas in a survey of Chinese adolescents [28]. Having a higher amount of available money had a small but significant association with the presence of sleep paralysis (10.9% of participants with ¥5000 or more available to them experienced sleep paralysis compared with 7.3% who had less than ¥5000 available) in one Japanese sample, as did regularly eating breakfast, with those who ate breakfast everyday reporting a lower incidence of sleep paralysis (7.5%) compared to those who ate breakfast occasionally (10.8%) [24], though findings are inconsistent [21,32]. It is unclear why these variables should be associated with sleep paralysis. Some research suggests that food timing may be important in the synchronisation of internal circadian clocks [33]. It is possible that by eating breakfast only occasionally, circadian clocks are disrupted leading to an increased incidence of sleep paralysis.

### Drinking alcohol, smoking, and substance use

Relationships between substance-use variables and sleep paralysis are shown in [Table 2](#). It is unclear whether sleep paralysis is associated with general substance use. In two large nationwide samples in China (N = 11,754) and Japan (N = 90,081) it was found that those who reported drinking at least one alcoholic drink per day over the last month were significantly more likely (9–12%) than

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