



CLINICAL REVIEW

Nightmares: from anxiety symptom to sleep disorder

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Summary The DSM-IV-TR definition of nightmares—extremely frightening dreams from which the person wakes up directly—is unnecessarily narrow. Other emotions (anger, grief) have also been reported in nightmares, and direct awakening from a bad dream seems to be unrelated to increased distress. In addition, assessment of nightmares is problematic. Polysomnographic recordings have an ameliorating effect on nightmare frequency, retrospective measurements tend to underestimate nightmare frequency, and persons with frequent nightmares may feel reluctant to fill out (daily) prospective measurements. For studying nightmares, it is necessary to distinguish idiopathic nightmares from posttraumatic nightmares, which are part of a posttraumatic stress reaction or disorder that may result from experiencing a traumatic event. Both types of nightmares have been associated with an elevated level of periodic limb movements, although only posttraumatic nightmares seem to be related to more and longer nocturnal awakenings. Nightmares have also been repeatedly associated with the general level of psychopathology, or the so-called personality factor neuroticism. Nightmare distress, the impact on daily functioning caused by nightmares, may function as a mediating variable. Several studies in the last decades have shown that nightmares can be treated with several cognitive-behavioral techniques. The cognitive-restructuring technique imagery rehearsal therapy is the treatment of choice for nightmares, although a randomized controlled trial with an attention control-group has not yet been carried out. Nightmares are more than a symptom of a larger (anxiety) syndrome and need to be viewed from a sleep medicine perspective: nightmares are a highly prevalent and separate sleep disorder that can and should receive specific treatment.

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Abbreviations DSM-IV-TR, Diagnostic and Statistical Manual for Mental Disorders, edition IV, text revision; IRT, Imagery Rehearsal Therapy; LDT, Lucid Dreaming Treatment; NREM, Non Rapid Eye Movement; PTSD, Posttraumatic Stress Disorder; REM, Rapid Eye Movement.

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Introduction and definition(s)

The *Diagnostic and Statistical Manual for Mental Disorders, edition IV-TR*,¹ defines a nightmare as an ‘extremely frightening dream’ from which a person wakes up directly. After a nightmare orientation is

fast and the nightmare leaves a detailed memory 'usually involving threats to survival, security, or self-esteem'.¹

Nightmares are highly visual and have a complicated plot. Nightmares differ from night terrors since the latter phenomenon is not accompanied by visual images, and orientation after a night terror may take several minutes, while there is often amnesia for the night terror itself.¹ Night terrors occur during slow wave sleep, nightmares usually occur during REM sleep,² although nightmares can also occur during NREM sleep.^{3,4}

In the literature, however, definitions of nightmares have differed in the use of two criteria. The criterion 'extremely frightening dream' can be broadened to include other negative emotions as well, since other distressing negative emotions are also present in nightmares;^{5,6} one systematic content analysis found incidences of 61.6% for fear/anxiety and 38.4% for other negative emotions (e.g. anger, grief) in nightmares.⁷ Moreover, direct awakening from a nightmare is not always seen as a necessary criterion (see Table 1).

Findings on this awakening criterion have been conflicting. One study found no relationship between direct awakening from a frightening dream and associated distress,⁸ whereas another study found that bad dreams that awoke the sleeper were more strongly related to several psychopathology and well-being measures than negative dreams that did not awaken the sleeper.⁹ Schreuder et al.¹⁰ found that direct awakening from a bad dream resulted in higher Symptom checklist-90 (SCL-90) total-scores (psychoneuroticism/general psychopathology) and higher scores on several posttraumatic complaints. Yet, most participants in this study—posttraumatic stress disorder (PTSD) patients—had both types of very disturbing dreams, questioning whether direct awakening should be a necessary criterion for the clinical diagnosis.

Recently Blagrove et al.¹¹ suggested that nightmares (bad dreams awakening the sleeper) may be more intense, but that bad dreams and nightmares

are confounded by the same negative emotional tone. Their study showed that the frequency of dreams with a negative effect (bad dreams) is a better index of low well-being than nightmare frequency.

At this moment the inclusion of the criteria 'extremely frightening dream' and 'direct awakening' from that dream in the DSM-IV-TR are questionable. However, research on the definition should not only focus on nightmare-associated distress and well-being, but also on characteristics (e.g. sleep correlates) of nightmares and bad dreams. For example, what if researchers found that nightmares and night terrors have similar relationships with low well-being? This would not imply that these two disorders are the same phenomenon. The same may apply to bad dreams and nightmares. Correlations of bad dreams and nightmares with well-being do not tell us whether these are two different phenomena or two different types of the same phenomenon. Yet, rather than excluding bad dreams from the DSM-IV-TR, a code should be used to differentiate nightmares with or without direct awakening, and researchers should clearly distinguish bad dreams from nightmares.

In accordance with Zadra and Donderi,⁹ we use the following definitions of nightmares and bad dreams in this review: *nightmares* are very disturbing dreams that awaken the sleeper; *bad dreams* are very disturbing dreams that do not awaken the sleeper.

In addition, we will distinguish two types of nightmares: posttraumatic and idiopathic nightmares. Experiencing a traumatic event may result in a PTSD, and posttraumatic nightmares are part of PTSD—see section *Etiology/Associated features*. Moreover, posttraumatic nightmares can also occur as part of a posttraumatic stress reaction without complete PTSD. Idiopathic nightmares are - nightmares unrelated to a traumatic event or PTSD.

Assessment

Polysomnography

Polysomnographic recordings in the sleep laboratory yield a serious problem: nightmares tend to occur less often in this setting.² As noted by Woodward et al.,¹² several studies have found a low incidence of posttraumatic nightmares in the sleep laboratory—about 1-10% per night.^{3,4,13-17} The artificial setting of the sleep laboratory may influence the contents of dreams, as two studies found that dreams recalled in the sleep laboratory

Table 1 Different definitions of very disturbing dreams

	Emotion criterion	
	Fear/Anxiety (DSM-IV-TR)	All negative emotions
<i>Direct awakening criterion</i>		
No direct awakening	frightening/anxiety dream	bad dream
Direct awakening (DSM-IV-TR)	Nightmare	nightmare

are less charged with affect than dreams recalled at home.^{18,19}

A recent study²⁰ tested whether the frequency of posttraumatic nightmares would also decrease when polysomnography was recorded with an ambulant method. The twelve participants of the study—inpatients of a psychiatric clinic for the treatment of organized violence—stayed in the clinic during the 2×24 h polysomnographic recordings. The nightmare incidence in these participants, as measured with daily logs that were filled out for seven consecutive days, was 34.5%. The nightmare incidence during the recordings was only 8%, which was significantly lower. The findings of this pilot-study suggest that polysomnographic recordings outside the sleep laboratory, but within the psychiatric clinic also decrease nightmare frequency.

The best way(s) to adequately measure nightmares with polysomnographic recordings could be to conduct polysomnography for a longer period so participants can adjust to the artificial setting and/or to conduct polysomnographic recordings with an ambulant method in the home environment.

Self-report

Retrospective questionnaires and prospective logs are the most common instruments for assessing various nightmare characteristics. Both have serious limitations. Questionnaires lead to a lower reported frequency of both bad dreams²¹ and nightmares⁹ than logs, most probably due to an underestimation of nightmare frequency via questionnaires. This underestimation is thought to occur by forgetting over time—a daily log causes more attention to be focused on nightmares.²² The questionnaires used in the above studies had a relatively long retrospective duration: one month and/or one year.^{9,21}

Although logs seem to be the method of choice for assessing nightmare characteristics (in particular nightmare frequency), one study found that persons with frequent nightmares were reluctant to keep a log.²³ Moreover, logs seem to increase dream recall in general by an increased focus on dreams—it is possible that logs may also increase nightmare frequency via the same mechanism.²²

One study²⁰ compared a short-term retrospective questionnaire (past seven days) with a log and did not find an underestimation of nightmare frequency when measured with this short-term questionnaire. Moreover, the correlation between prospective and retrospective

nightmare frequency was high ($r=0.92$). The major limitation of this study was that the questionnaire was filled out after 7 consecutive days of keeping a log—the fact that participants did not forget their nightmares could have been due to their log and not to the short-term duration of the questionnaire. These findings need to be further investigated.

One advantage of self-report measurements is that they can distinguish nightmare frequency from nightmare distress. Nightmare frequency and nightmare distress are two related but independent constructs.²⁴ Why this distinction is relevant will be discussed in the section *Etiology/Associated features*.

Prevalence

Prevalence estimates of nightmares in the general population vary. Nielsen and Zadra²⁵ estimated that 4-8% of the general population has a 'current problem' with nightmares. The *International Classification of Sleep Disorders*²⁶ estimates a prevalence of 'perhaps 1%'. Bixler et al.²⁷ found a prevalence of 5.3% for nightmares (defined as bad dreams) whereas Klink and Quan²⁸ found a prevalence of 8.1% with the same definition and questions. It is unclear, however, whether these nightmares occurred frequently (e.g. several times a week or month) or occasionally. Two more recent studies found a nightmare-prevalence of around 3-4%,^{29,30} although one study did not clearly define nightmares but rather asked participants whether they had 'nightmares'.²⁹

Different criteria or thresholds can be helpful in understanding the varying prevalence-estimates for nightmares. For example, Hublin et al.³⁰ found that 3% had nightmares weekly, and around 10% had nightmares monthly. These findings were confirmed by a recent study (Spoormaker et al., submitted manuscript) where 2.2% of the general Dutch population suffered 'much' or 'very much' from nightmares, whereas 7% suffered 'a little' from nightmares.

More women than men report to have nightmares;³¹ the DSM-IV describes the ratio within 2-4:1.³² However, women have a higher dream recall as well,^{29,33} which inevitably leads to a higher recall of nightmares. In addition, Klink and Quan²⁸ found an equal prevalence of nightmares in elderly men and women. As nightmares had the highest prevalence in young adult females, this cross-sectional study indicated that nightmares may decline with age in women.

Etiology/Associated features

Genetic factors and persistence

The only published study examining the genetic aspects of nightmares, a nationwide twin-cohort study in Finland, has found a genetic influence on nightmares.³⁰ For childhood nightmares genetic effects accounted for an estimated proportion of 0.45, whereas this proportion was around 0.37 in adult nightmares.

Interestingly, this study also found that about 80–90% of adults who had had nightmares in childhood reported still having nightmares ‘at least sometimes’. Although this finding could have been affected by a recall bias, because nightmares in childhood were measured retrospectively, two other studies are also indicative of a childhood onset of nightmares. In a study with thirty participants with frequent nightmares, a childhood or adolescence onset of nightmares was reported to be ‘usual’.³⁴ Another study found that about half of all children did not report any change in nightmare frequency in a three-year-period (from age thirteen to sixteen), whereas it increased (and decreased) for about a quarter.³⁵ In general, nightmare frequency increased in girls and decreased in boys. Moreover, anxiety at age thirteen could predict nightmare frequency at age sixteen. However, of the six items measuring ‘anxiety’ only two items were specific anxiety/fear items, so it is probable that this ‘anxiety’ actually reflects emotional disturbances in general (general psychopathology or neuroticism, see section *Associated mental complaints and personality factors*).

These findings suggest that nightmares may persist over a longer time, although the frequency may change. Future studies should use a longitudinal design to investigate this childhood onset; it would be interesting to address maintenance factors as well. For example, several cognitive and behavioral responses have been reported to be associated with the persistence of nightmares as a sleep disorder: cognitive avoidance (avoiding to think about the nightmare since ‘it was only a dream’³⁶), sleep unhygienic behaviors (e.g. irregular sleep schedules³⁷) or conditioned responses (e.g. fear of going to sleep or returning to sleep after a nightmare³⁸).

Posttraumatic Stress Disorder (PTSD)

Experiencing a traumatic event may result in posttraumatic nightmares that are part of a posttraumatic stress reaction or PTSD. PTSD

consists of three clusters: (a) intrusion: re-experiencing the traumatic event in nightmares or flashbacks; (b) avoidance of stimuli that could be reminders of the traumatic event; and (c) hyperarousal (e.g. insomnia, increased tension during the day).¹ Posttraumatic nightmares are part of the re-experiencing cluster, and are one of the major complaints of persons who have PTSD.^{10,39,40} A prevalence of around 60% for nightmares was found in PTSD patients.⁴¹ Another study found a prevalence of 56% for nightmares in PTSD patients who had experienced their (war-related) trauma more than 40 years earlier¹⁰ indicating that, if not treated, posttraumatic nightmares are a life-long complaint as well.

Sleep correlates

Nightmares disrupt sleep^{34,42} and have been associated with other sleep disorders such as night terrors,⁴³ chronic insomnia,⁴⁴ and sleep-disordered breathing,⁴⁵ although the latter finding applied to posttraumatic nightmares only. In the general population, nightmares have been associated with breathing problems (asthma)²⁸ and increased snoring.²⁹ Gross and Lavie⁴⁶ showed that dreams after an apneic event were more negatively toned than other dreams in apnea patients. An apneic event (or rather its associated distress) might induce negative emotions in dreams and increase the frequency of nightmares.

Very few polysomnographic studies have focused on sleep correlates of idiopathic nightmares.^{2,4,47,48} Almost all studies focused exclusively on persons with posttraumatic nightmares, i.e. PTSD patients. As PTSD is a mental disorder characterized by a highly disrupted sleep,⁴⁹ findings from persons with posttraumatic nightmares may differ from persons with idiopathic nightmares. Sleep correlates of PTSD are not a focus of this review, rather we address the sleep correlates of nightmares, and in particular similarities or differences between posttraumatic and idiopathic nightmares.

Hartmann described one major difference: posttraumatic nightmares seem to occur earlier in the night than idiopathic nightmares.⁵⁰ Four out of fifteen recorded posttraumatic nightmares occurred in the first 3 h of sleep, and none occurred in the last hours of sleep. In contrast, four out of eight idiopathic nightmares occurred in the last hours of sleep, when REM periods are longer. Moreover, posttraumatic nightmares were associated with more limb movements than idiopathic nightmares.

This latter finding, however, was not replicated by a recent study⁴⁸ that compared these two types of nightmares and included a healthy control group as well. The three groups did not differ on any of these measures: total sleeping time, sleep-onset latency, REM latency, REM efficiency, REM density, REM percentage, SWS percentage, and the number of micro-arousals. Yet, *both* types of nightmares were associated with an elevated number of periodic limb movements. Persons with posttraumatic nightmares experienced more and longer nocturnal awakenings—and thus a lower sleep efficiency—than persons with idiopathic nightmares and the control group. Insomnia seems to be related to posttraumatic nightmares in particular, and might (partly) be a function of a process caused by posttraumatic stress. It has often been suggested that a lowered arousal threshold characterizes sleep in PTSD,^{13,40,48} although other studies have found an increased arousal threshold.^{51,52}

Due to the strict inclusion criteria, however, this study had relatively small sample sizes and a limited statistical power for testing the differences among the three groups. Further, research is necessary; future studies should also focus on differences in the frequency of apneic events in persons with posttraumatic and idiopathic nightmares. Moreover, sleep correlates of idiopathic nightmares need to be studied with both objective and subjective sleep measurements. The relationship between periodic limb movements and (posttraumatic) nightmares needs to get more theoretical attention.

Drug-induced nightmares

Nightmares can also be drug-induced. In a review on drug-induced nightmares, Thompson and Pierce⁵³ noted that beta-blockers and alpha-agonists account for 34% of the clinical trials with reported nightmares as an adverse effect, a finding supported by a recent review⁵⁴ where beta-blockers affecting norepinephrine receptors were found to most likely lead to nightmare complaints.

One limitation for both studies was that causality could not be determined. With the Naranjo algorithm⁵⁵ that describes causality as definite, probable, possible, or doubtful, almost all included pharmacological agents were described as probably or possibly inducing nightmares. The only agent described as a definite/significant nightmare-inducer was a selective serotonin reuptake inhibitor (SSRI-paroxetine). Other SSRIs—and dopamine-agonists—were mostly rated as probable nightmare inducers. Associations of nightmares with agents

affecting GABA and acetylcholine (cholinergic antagonists) were mostly rated as possible. More research is needed to examine the relationships between pharmacological agents and nightmares and the underlying biochemical mechanisms.

Associated mental complaints and personality factors

Nightmares have been associated with anxiety and depressive disorders in insomniacs⁴⁴ and with affective complaints in PTSD patients,⁵⁶ although the relationship between depression and nightmares was inverse (i.e. PTSD patients with posttraumatic nightmares had lower levels of depression than PTSD patients without posttraumatic nightmares).

In other populations (e.g. samples with students, healthy adults, or persons with frequent nightmares), small relationships have also been found between nightmares and anxiety,^{9,35,38,57-59} nightmares and depression,^{58,59} and nightmares and psychotic characteristics.^{34,57} Not all studies have found relationships between mental complaints and nightmares⁶⁰ or bad dreams.^{21,24} Two studies have reported that nightmares were predictors of suicide in adults⁵⁹ and of suicidal behavior in adolescents⁶¹ when controlled for other possible confounding factors. One limitation of both studies was that they did not control for PTSD, although PTSD has been associated with suicidal behavior and suicide attempts.^{62,63}

Moreover, nightmares have been related to psychiatric disorders (the higher the frequency of nightmares, the higher the likelihood of a co-morbid psychiatric disorder)³⁰ and to the general level of mental complaints (general psychopathology).⁶⁴ This can be understood by the personality-factor neuroticism—neuroticism and general psychopathology are similar concepts (e.g. Zadra and Dondeni⁹ found a correlation of 0.66 between these two variables). There is mounting evidence that neuroticism is associated with nightmares,^{9,11,34,64-66} although not all studies have found this relationship.^{67,68} There are, however, limits to the generalizability of these findings: the studies mostly consisted either of small clinical samples of persons with frequent nightmares or of undergraduate student samples.

The type of measurement may also be relevant, because most retrospective studies have found a relationship between nightmares and neuroticism. It has been suggested that persons who score high on neuroticism are more likely to remember and report their nightmares with retrospective

measurements.²¹ For example, Bernstein and Belicki⁶⁹ found that the level of negative emotions in dreams correlated with neuroticism when measured retrospectively but not when measured prospectively. Yet, three prospective studies have also found a correlation between nightmares and neuroticism,^{9,11,66} so a recall bias for persons who score high on neuroticism via a retrospective method of measurement can only partly explain the heterogeneous findings considering the nightmares-neuroticism relationship.

Recently, Schredl⁶⁶ has shown that the association between neuroticism and nightmares is mediated by state anxiety. As opposed to the trait-like variable neuroticism, state anxiety is an indication of the current level of anxiety/stress. Stress increases the frequency of negative emotions in dreams^{70,71} and the frequency of bad dreams and nightmares.⁷² One hypothesis states that persons who score high on neuroticism experience more stress and therefore more nightmares,⁶⁶ although the nature of this process remains unclear and needs more theoretical and empirical attention.

In addition to the method of measurement and mediating stress, another variable has been shown¹¹ to be of major importance: nightmare distress.

Nightmare distress

Nightmare distress^{21,24} denotes the impact of nightmares (e.g. on daily functioning). Nightmare distress is weakly related to nightmare frequency²⁴ and seems to be an almost trait-like variable with correlations to trait but not state anxiety⁷³ and neuroticism.⁷² Nightmare distress has also been associated with physical complaints⁷² and with stress-related symptoms.⁹ Blagrove et al.¹¹ have shown that nightmare distress is a mediating variable for the relationships of nightmare frequency with various mental complaints. When controlled for nightmare distress,

neither retrospective nor prospective nightmare frequency was related to any mental complaints or personality factors any more. Well-being measurements were more strongly related to nightmare distress than to nightmare frequency. The authors suggested that 'there may be attributional or confounding effects of nightmare distress on nightmare frequency and its correlations'.

However, when nightmare distress was controlled for, the frequency of *bad dreams* remained weakly but significantly related to anxiety, depression, and neuroticism—showing that the distinction between nightmares and bad dreams is a useful one.

One limitation of this study considered the assessment of nightmare distress with the (most frequently used) Nightmare Distress Scale by Belicki.²⁴ The response-format of this scale is based upon frequencies. For example, responses to an item like 'Do your nightmares affect your well-being' can be 'never, rarely, sometimes, often, always'. An answer on such a format is likely to be confounded by nightmare frequency.⁷⁴ The correlation of nightmare frequency with nightmare distress may thus be too high, and indeed, another nightmare distress scale using an intensity-scale had a lower correlation with nightmare frequency.⁷⁴ At least partly, nightmare frequency and Belicki's nightmare distress seem to be tapping into the same variance. It is not surprising that controlling for nightmare distress decreases the correlation of nightmare frequency with neuroticism.

At this moment, causal interpretations cannot yet be made due to the cross-sectional design of these studies—experimental studies are necessary (Table 2). The concept of nightmare distress needs to be evaluated as well: is it a mental complaint or a personality trait? Is it measured correctly? And can nightmare distress be affected by treatment?

Table 2 Etiology of nightmares.

Genetics	Genetic influences accounted for 37% of the variance in adult nightmares in a large-scale twin-study. ³⁰
Trauma	Experiencing or witnessing a traumatic event may result in posttraumatic nightmares. ^{1,10,39-41}
Drugs	Drugs affecting the neurotransmitters norepinephrine, serotonin, and dopamine are most likely to induce nightmares. ^{53,54}
Stress/state anxiety	Stress increases the frequency of nightmares. ^{66,70-72}
Personality factors	Neuroticism is associated with nightmares, but this relationship is mediated by state anxiety and nightmare distress. ^{11,66}
Maintenance factors	Nightmares tend to persist through cognitive avoidance and sleep unhygienic behaviors. ³⁶⁻³⁸

Interventions

Pharmacological interventions

The last review on nightmares (1993)⁷⁵ concluded that cognitive-behavioral treatment is the treatment of choice for nightmares. This conclusion is supported by studies into the pharmacotherapeutic treatment of posttraumatic nightmares, which have shown a poor response to treatment.⁷⁶

In recent years, however, several studies⁷⁷⁻⁸⁰ have indicated that Prazosin seems to reduce posttraumatic nightmare frequency. Prazosin, an alpha-1 adrenergic antagonist, has been used for treating hypertension. It may work through inhibiting the elevated noradrenergic levels reported in PTSD [81]. Most studies supporting Prazosin were pilot-studies with promising results; one was a placebo-controlled study. In this study [80] Prazosin significantly reduced nightmares, sleep disturbances, and PTSD-severity (no changes in the placebo-group). In addition, Prazosin was tolerated very well. It is worth noting that nightmares returned when Prazosin was discontinued. In addition, these promising findings should be interpreted with caution, since the sample size was very small (only ten war-veterans participated), and a larger study with more statistical power is necessary to determine the effects of Prazosin.

Cognitive-behavioral interventions

Targeting anxiety

Several cognitive-behavioral techniques are effective in decreasing nightmare frequency. Monitoring nightmares, relaxation therapy, and exposure exercises decreased nightmare frequency and the nightmare induced fear [23,82,83], although exposure has shown the best outcomes [84]. In the latter study, a self-help manual was mailed that instructed participants to write down the nightmare after awakening and to re-experience it in imagination. Exposure reduced nightmare frequency more than relaxation-therapy (no reduction in the waiting-list group). However, the high number of dropouts (almost sixty percent in the self-exposure group) was very problematic and indicates a reluctance of persons with frequent nightmares to work with their nightmare-images just to relieve the anxiety.

Restructuring the nightmare

Imagery Rehearsal. According to Marks [85], a cognitive-behavioral treatment for nightmares should work on exposure, abreaction, and mastery.

Cognitive restructuring techniques provide mastery and exposure by instructing ways to alter the storyline of the nightmare—the nightmare-script. One technique is called imagery rehearsal therapy (IRT) [23,85,86].

In Krakow et al.'s most recent effect-study [87], participants (sexual assault survivors with PTSD and posttraumatic nightmares) received two 3-h sessions (one week interval) and a 1-h follow-up session 3 weeks later. In the first session, the participants were instructed to think about nightmares and to explore (and discuss) the possibility that although nightmares 'may be trauma-induced, they may also be habit-sustained'. Imagery skills were discussed and practiced: pleasant imagery exercises and cognitive-behavioral tools for dealing with unpleasant images that might emerge. In the second session, participants were instructed to write down a self-selected nightmare that was not too intense (preventing too much exposure)—and to change the nightmare anyway they wished. The participants could choose any alteration of the nightmare, and were told to write it down as well as rehearse it in session. They had to keep rehearsing the new nightmare 'mentally' at home and should not work on more than two different nightmares a week.

IRT has shown good results in randomized controlled trials, with effect sizes (standardized mean differences) larger than one for nightmare frequency reduction after one to three group sessions [37,86,87]. Accordingly, IRT improved the subjective sleep quality and decreased PTSD-symptom-severity. Two studies with a longer follow-up (18 and 30 months) showed that the effects of IRT were maintained over a longer period [88,89].

One limitation of IRT considered the dropout rates, which ranged from 25 to 40%. In one study, the dropout rate was almost significantly higher in the treatment-group than in the control-group [87]. Moreover, the control-group of most studies consisted of a waiting-list group that received no treatment at all: professional attention could have decreased nightmare frequency as well. Instead of a waiting-list, one study on IRT used a control-group that recorded their nightmares. Although they received no treatment or professional attention at all, even this recording group reported a significantly lower nightmare frequency at follow-up [8]. Although this reduction in nightmare frequency was smaller than the reduction by IRT (47% versus 72%), the difference was insignificant. One other study did not find any significant differences between IRT and combined exposure and relaxation in the reduction of nightmare frequency, but this could have been due to the small sample size (23 participants completed

follow-up measurements). Moreover, it has yet to be determined whether IRT shows effects on objective sleep parameters. A pilot-study with twelve nightmare patients did not find any changes on polysomnographic parameters after IRT [90], but larger samples are necessary to replicate these findings. At this moment, only one (uncontrolled) study on imagery rehearsal has been conducted by an independent group [91], although it showed similar (long-term) effects [91,92].

Lucid dreaming. An alternative cognitive-restructuring technique is called lucid dreaming treatment (LDT). Lucid dreaming means realizing that one is dreaming in the dream itself. Lucid dreaming has been verified by volitional eye-movements during REM sleep [93] and is a learned cognitive skill [94,95]. Especially, because nightmares can spontaneously 'trigger' lucidity in nightmares [96], lucid dreaming may be an appropriate technique for treating nightmares.

With LDT, participants are taught to become lucid in their nightmare through various daily exercises. Nightmares often have a recurrent theme or situation (our own unpublished data indicate that almost all of the 135 participating undergraduate students with nightmares reported that at least some of their nightmares had a repetitive thematic content; on average 60% of the nightmares had a repetitive theme). Participants with nightmares are instructed to *intend* before falling asleep that the next time they will be in this recurrent situation, they are going to remember that they are only dreaming (a related exercise is imagining the recurrent situation while thinking that it is only a dream). With these exercises, lucidity should be induced in the nightmare. Once participants realize that they are *only dreaming* in their nightmare, the anxiety may decrease. Moreover, they can perform actions in the nightmare itself that alter the storyline of the nightmare. As a consequence, persons will experience fewer nightmares and less fear of nightmares.

Evidence for LDT is scant; only some series of cases have been conducted. Yet, they have shown promising results [97,98], although one series of cases with systematic measurements did not find any changes in sleep quality and anxiety measurements at follow-up, just a reduction in nightmare frequency (after one individual LDT session) [98]. A recurring—odd—finding was that for some participants, nightmares changed and became less frequent without obtaining lucidity. It is probable that mastery of nightmares and nightmare self-efficacy are even more important than already thought.

Randomized controlled trials are necessary to evaluate LDT in larger samples and to evaluate its therapeutic factor(s).

The theoretical fundament of cognitive-restructuring treatment needs to be expanded, and the finding that IRT decreases PTSD-symptom severity and improves sleep quality needs to be conceptually evaluated. At this moment, IRT is the treatment of choice for nightmares.

Implications

A sleep medicine perspective on nightmares

As Krakow et al. [37] noted, it is still a prevailing view in the (mental) health care that nightmares are secondary to another disorder (e.g. PTSD or another anxiety disorder). In this psychiatric view, nightmares are a symptom of a larger syndrome: a nightly symptom of anxiety. This means that nightmares need not be treated (and diagnosed) specifically. For example, Kaplan and Sadock [99] state in their *Synopsis of Psychiatry*: 'No specific treatment is usually required for nightmares.' In addition, the DSM-IV-TR has a separate diagnosis for nightmares but nightmares can only be diagnosed when they 'do not occur exclusively during the course of another mental disorder' [1].

This excludes posttraumatic nightmares from a separate diagnosis and, as a consequence, from clinical attention. This is a missed opportunity since an efficient treatment for nightmares has been documented very well: IRT. IRT does not only reduce nightmare frequency but also PTSD-symptom-severity, while it improves the subjective sleep quality. These broad effects of a specific nightmare therapy suggest that nightmares are a key-element of PTSD and may, together with other (REM) sleep disturbances, very well be the hallmark of PTSD, as suggested by Ross et al. [39]. It seems, therefore, warranted to diagnose posttraumatic nightmares and to include IRT in PTSD-treatment.

Additionally, idiopathic nightmares rarely receive specific treatment in the general or mental health care, although nightmares are highly prevalent and very persistent in the general population. Around 3-4% have nightmares often, and about 10% occasionally. The percentage reporting to never have nightmares was around 30% in the large-scale Finnish twin-study [30]. Although nightmares may be viewed as the result of emotional problems, relationships

between nightmares and mental complaints have been small or absent in the general population.

Moreover, strong relationships and high comorbidities with other mental disorders would not mean that nightmares are not a separate sleep disorder. Co-morbidities with other mental disorders are high for depressive disorders, anxiety disorders, and psychophysiological insomnia. These are also separate disorders warranting specific treatment. Since nightmares seem to be persistent and since nightmares can be treated efficiently, it is even more valuable for professionals to diagnose and treat nightmares.

It is therefore necessary to adopt a sleep medicine perspective on nightmares. Nightmares disrupt sleep, cause distress, and impair daily functioning. Without treatment, nightmares persist in disrupting sleep via several conditioned responses or sleep unhygienic behaviors. Nightmares should be viewed as a distinctive sleep disorder that can and should be addressed with specific treatment. The DSM-IV-TR already has a separate diagnosis for (idiopathic) nightmares; we suggest professionals use it more frequently.

Theoretical implications: nightmares and the cognitive-behavioral framework

Surprisingly, studies focusing on the development of psychological (and physiological) theories for nightmares have been scant. Some treatment studies have introduced several interesting concepts that need to get further theoretical attention.

The behavioral view holds that nightmares are a learned behavior [37]. The best support comes from the results of cognitive-behavioral treatment studies showing that nightmares can be *unlearned*. Moreover, the finding that nightmares are less frequent in an artificial setting like the sleep laboratory suggests that persons may have more control over their nightmares than perceived. Of course, as nightmares are not accompanied by any overt behavior, nightmares are a learned *cognitive* behavior.

Another somewhat more cognitive view focuses more on the representation of recurrent nightmares [97,98,100]. Recurrent nightmares are thought to be represented in a particular storyline, a script. This script consists of a series of expectations. The storyline of the nightmare has been experienced so often that the person knows exactly what to expect next in the nightmare (e.g. in the same unpublished study on nightmares as mentioned previously, having nightmares with a recurrent theme was associated with stronger expectations and predictions about the storyline of the nightmare). That is

why, for example, posttraumatic nightmares are often a replay of the original traumatic event. One neutral (visual) stimulus during REM sleep may activate the nightmare-script—thus starting a nightmare. The finding that cognitive-restructuring techniques show better effects in reducing nightmares than other cognitive-behavioral techniques (e.g. relaxation, exposure) supports this view, especially since one study showed that changing elements of the nightmare seemed to be the effective factor of IRT [101].

Both approaches can be helpful in better understanding the nature, origin, and persistence of nightmares. At this time, both of these developing theories on nightmares should get more attention.

Conclusion

In summary, many findings on nightmares are preliminary and this developing field of sleep medicine needs to be further investigated. The DSM-IV-TR definition of nightmares needs to be refined since two criteria seem unnecessarily narrow; nightmares are not restricted to fear or anxiety alone and direct awakening is not related to increased waking distress. Bad dreams that do not awaken the person should be included in the definition, preferably with an extra code for the presence of direct awakening.

Polysomnographic recordings of nightmares decrease nightmare frequency, but a longer adaptation period or an ambulant method may solve this limitation. Retrospective questionnaires with a relatively long duration (past month or more) lead to underestimations of nightmare frequency, whereas retrospective questionnaires with a shorter duration (e.g. past 7 days) and prospective logs may not. It has therefore been difficult to assess the prevalence of nightmares and the prevalence of nightmare *sufferers*, but three studies found a percentage of 3-4%. Nightmares can be posttraumatic as part of posttraumatic stress reaction, idiopathic, or drug induced. Posttraumatic nightmares are associated with more and longer nocturnal awakenings, and both posttraumatic and idiopathic nightmares seem to be associated with periodic limb movements—a finding that needs further attention. Findings on relationships with other mental complaints have been conflicting, but there is mounting evidence that nightmares are related to specific mental complaints and to the general level of mental complaints/the personality-factor neuroticism.

State anxiety and nightmare distress may function as mediating variables.

Nightmares can be treated with several cognitive-behavioral techniques; one type of these techniques target anxiety (e.g. relaxation and desensitization techniques) and another type focus on changing the repetitive storyline of nightmares (cognitive-restructuring techniques). The cognitive-restructuring technique IRT is the treatment of choice for nightmares, with very promising (long-term) effects in just one to three sessions. The mechanisms of this technique need to be further developed into a cognitive-behavioral theory. In addition, the promising effects of the pharmacological agent Prazosin need to be evaluated in larger placebo-controlled trials.

Nightmares deserve to be viewed from a sleep medicine perspective; they are not merely a nightly symptom of anxiety, but a separate sleep disorder that can and should receive specific treatment.

Practice points

1. Emotions in nightmares are not limited to fear or anxiety alone: anger and grief are also frequently reported emotions. When studying nightmares, *bad dreams* (very disturbing dreams that do not awaken the sleeper) should be distinguished from *nightmares* (very disturbing dreams that awaken the sleeper).
2. Nightmares are difficult to assess. For recording nightmares with polysomnography in the sleep laboratory it may be helpful to have an adaptation period of several days.
3. Both idiopathic and posttraumatic nightmares seem to be associated with an elevated level of periodic limb movements, whereas only posttraumatic nightmares seem to be associated with more and longer nocturnal awakenings.
4. The association of nightmares with neuroticism is probably mediated by the current level of stress (state anxiety) and by nightmare distress.
5. Nightmares can be effectively treated with IRT.
6. A sleep medicine perspective on nightmares provides a better view than a psychiatric perspective. Nightmares should be viewed as a distinct sleep disorder that can and should be addressed with specific treatment.

Research agenda

1. The current clinical definition for nightmares is unsatisfactory. Studies should address whether bad dreams and nightmares are different phenomena or different types of the same phenomenon. Not only related constructs, but also polysomnographic correlates would be valuable.
2. The ameliorating effect of polysomnographic recordings on nightmare frequency should be investigated with an ambulant method of measurement preferably in the home environment.
3. The associations of both posttraumatic and idiopathic nightmares with periodic limb movements and sleep apneic events need to be examined more closely, and these relationships need theoretical attention. Other sleep complaints associated with nightmares need to be addressed as well.
4. More research is needed on the causality of drug-induced nightmares. The effects of Prazosin need to be evaluated in a larger placebo-controlled trial, and its pharmacological mechanism needs to be addressed as well.
5. Randomized controlled trials with an attention control-group and a longer follow-up are necessary to evaluate cognitive-restructuring techniques such as IRT. LDT still needs to be studied with a randomized controlled trial; a comparison between LDT and IRT should be helpful in examining whether lucidity during nightmares increases the effectiveness of cognitive-restructuring treatment. The effects of IRT on objective sleep parameters need to be investigated as well.
6. A conceptual framework for nightmares needs to be developed.

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