

Dream recall and nightmare frequency in patients with sleep disorders: A diary study

Alexander Dawit Goitom and Michael Schredl

Central Institute of Mental Health, Medical Faculty Mannheim/Heidelberg University, Germany

Summary. As sleep and dreaming are closely intertwined, sleep disorders such as insomnia, restless legs syndrome, sleep-related breathing disorders, or narcolepsy are very likely to have an effect on dream recall, dream quality and nightmare frequency. Previous studies based on questionnaire measures have indeed shown such effects, e.g., heightened dream recall in patients with insomnia, or more frequent nightmares in patients with narcolepsy. The present study measured dream recall frequency, nightmare frequency, and emotional tone of dreams using a 7-day sleep/dream diary that was completed by the patients as part of their clinical routine prior to the first consultation in a sleep center. The sample included 256 patients (138 women, 118 men) with a variety of different diagnoses. In about 55% of the patients, the diagnostic procedure also included two nights with polysomnography. The findings indicate that, overall, patients with sleep disorders showed increased dream recall and nightmare frequencies, and more negatively toned dreams in comparison with healthy controls. This would be in line with the continuity hypothesis assuming that these patients might have experienced more stress during the day. The heightened stress levels might aggravate the sleep disorder and/or be a result of the sleep disorder itself. The findings indicate that studying dreaming in patients with sleep disorders can help patients, i.e., identifying and treating nightmare disorders, and help understand the interactions between waking life, physiological variables, and the dreaming process.

Keywords: Dream recall, nightmare frequency, dream emotions, sleep disorder, nightmare disorder, insomnia

1. Introduction

Dreaming is defined as mental activity during sleep, most prominently present during the rapid-eye movement (REM) state of sleep (Hobson, 2009). It is characterized by manifestations of vivid images, ideas, and sensations which occur involuntarily and are generally outside the control of the dreamer (Schredl, 2018). From early on, it has been theorized that dreaming assists in memory formation, problem solving, and reconditioning emotions and hidden desires, and reflects waking-life issues (Freud, 1900/1991; Wamsley & Stickgold, 2010).

As sleep and dreaming are closely intertwined, one would hypothesize that the presence of a sleep disorder like insomnia, sleep-related breathing disorder, restless legs syndrome, or narcolepsy might affect dream recall, dream quality, and nightmare frequency (Schredl, 2009a). Although sleep disorders are common in the general population (Amara & Maddox, 2017) and were diagnosed in sleep laboratories all over the world (Pelayo & Dement, 2017), research regarding the inter-relationship between dreaming and sleep disorders is still in its infancy and has yielded a mixed picture. One exception is the nightmare disorder (American Academy of Sleep Medicine, 2014) because disturbed dreaming is at the core of this sleep disorder (Nielsen & Levin, 2007). The findings published so far will be reviewed briefly in the following.

Insomnia is characterized by long sleep latencies, frequent nocturnal awakenings, and/or prolonged periods of wakefulness after sleep onset (American Academy of Sleep Medicine, 2014) and is the most common sleep disorder: using the ICSD-3 criteria, the prevalence rates in the general population are estimated to be between 16% to 21% (Lichstein, Taylor, McCrae, & Petrov, 2017). Dream recall frequency was heightened in patients with insomnia compared to healthy controls (Schredl, Schäfer, Weber, & Heuser, 1998). In addition, insomnia patients reported more negative dreams (Schredl et al., 1998). A German multi-center study including 770 insomnia patients confirmed these findings (Schredl et al., 2012). The heightened dream recall frequency in insomnia patients seems plausible in that the chance of recalling a dream after awakening increases with the number of awakenings per night (Schredl, 2007). This is consistent with the arousal-retrieval model of dream recall that states that a period of wakefulness must follow the dream experience for the person to recall it and to allow a transfer of information from short-term into long-term memory (Koulack & Goodenough, 1976). Patients with insomnia not only report more negative dream emotions but nightmare frequency was also higher compared to healthy controls (Schredl, 2009b; Schredl et al., 2012).

The key symptom of the restless legs syndrome is an overwhelming urge to move the legs (sometimes arms or even the whole body are involved) to relieve uncomfortable sensations, primarily when resting, sitting, or sleeping (American Academy of Sleep Medicine, 2014). Previous studies did not find elevated dream recall frequency and nightmare frequency in patients with the restless legs syndrome (Schredl, 2001; Schredl et al., 2012) but dreams in this patient group were more negatively toned compared to healthy controls (Schredl et al., 2012).

Narcolepsy is a neurologic sleep disorder characterized by excessive daytime sleepiness and often also by cata-

Corresponding address:

Michael Schredl, Sleep laboratory, Central Institute of Mental Health, PO Box 12 21 20, 68072 Mannheim, Germany.
Email: Michael.Schredl@zi-mannheim.de

Submitted for publication: May 2020

Accepted for publication: July 2020

DOI: 10.11588/ijodr.2020.2.73036

plexies, sleep paralysis, and hypnagogic hallucinations (American Academy of Sleep Medicine, 2014). In line with the pathological mechanism of an over-active REM sleep system, narcolepsy patients reported higher dream recall, more nightmares, negative dreams in general, and even lucid dreams, i.e., dreams in which the dreamer is aware that s/he is dreaming (Dodet, Chavez, Leu-Semenescu, Golmard, & Arnulf, 2015; Rak, Beitinger, Steiger, Schredl, & Dresler, 2015; Schredl, 1998).

Sleep-related breathing disorders characterized by apneas, oxygen desaturations, and micro-arousals (American Academy of Sleep Medicine, 2014) can also interfere with the dreaming process (BaHammam & Almeneessier, 2019). However, the findings regarding dream recall frequency are mixed (Schredl & Schmitt, 2009, 2019; Schredl et al., 2006) with no clear evidence for increased dream recall in this patient group. Although the idea that shortage of breath during REM sleep can cause nightmares (Boerner, 1855) seems plausible and was supported by the findings that nightmare frequency is related to the apnoe-hypopnea index in REM

sleep (BaHammam, Al-Shimemeri, Salama, & Sharif, 2013), other studies (Schredl et al., 2012; Schredl & Schmitt, 2009; Schredl et al., 2006) failed to demonstrate a clear relationship between severity of the sleep apnea syndrome and nightmare frequency.

To summarize, research so far has demonstrated that the presence of sleep disorders can affect dreaming; the effects can be explained by direct effects, e.g., increased number of nocturnal awakenings increases dream recall frequency in patients with insomnia (Schredl et al., 1998) or indirect effects, e.g., the burden of the disorder can negatively affect waking life and this in turn – according to the continuity hypothesis of dreaming (Schredl, 2003) – would affect dreaming, especially dream emotions and nightmare frequency (Schredl, 2010a). This relationship between daytime mood and negative dream emotions and nightmare frequency have also been shown for patients with mental disorders like depression, schizophrenia, and anxiety disorders (Skancke, Holsen, & Schredl, 2014; Swart, van Schagen, Lancee, & van den Bout, 2013). Compared to the literature on men-

Table 1. Diagnoses of the two patient groups (multiple diagnoses were possible)

Diagnostic groups	Total sample (N = 256)	Subsample with polysomnography (N = 140)
Insomnia disorders	41.80% (N = 107) Probable primary insomnia disorder (N = 64), primary insomnia disorder (N = 43), probable disorder of sleep misperception (N = 1)	44.29% (N = 62) Primary insomnia disorder (N = 58), probable primary insomnia disorder (N = 3), probable disorder of sleep misperception (N = 1)
Sleep-related movement disorders	18.75% (N = 48) Probable restless legs syndrome (N = 27), restless legs syndrome (N = 19), Periodic limb movement syndrome (N = 2)	35.71% (N = 50) Restless legs syndrome (N = 26), Periodic limb movement syndrome (N = 26), probable restless legs syndrome (N = 3)
Hypersomnias	15.23% (N = 39) Probable idiopathic hypersomnia (N = 22), probable narcolepsy (N = 18), idiopathic hypersomnia (N = 2)	8.57% (N = 39) Idiopathic hypersomnia (N = 6), narcolepsy (N = 3), probable narcolepsy (N = 3)
Sleep-related breathing disorders	14.84% (N = 38) Obstructive sleep-apnea syndrome (N = 22), probable obstructive snoring (N = 11), probable sleep-related breathing disorder (N = 5)	20.00% (N = 28) Obstructive sleep-apnea syndrome (N = 26), probable obstructive snoring (N = 1), probable sleep-related breathing disorder (N = 1)
Nightmares	9.77% (N = 25)	12.86% (N = 18)
Other parasomnias	15.23% (N = 39) Somnambulism (N = 17), night terror (N = 13), probable REM sleep behavior disorder (N = 8)	17.86% (N = 25) Somnambulism (N = 10), night terror (N = 10), REM sleep behavior disorder (N = 6)
Circadian sleep-wake disorders	5.86% (N = 15) Circadian rhythm sleep-wake disorders (N = 12), delayed sleep phase syndrome (N = 3)	5.71% (N = 8) Circadian rhythm sleep-wake disorders (N = 6), delayed sleep phase syndrome (N = 1), advanced sleep phase syndrome (N = 1)
Other sleep disorders	19.53% (N = 50) Problematic sleep hygiene (N = 16), probable insufficient sleep syndrome (N = 13), insufficient sleep syndrome (N = 5)	26.43% (N = 36) Problematic sleep hygiene (N = 11), insufficient sleep syndrome (N = 11), shift work-related sleep disorder (N = 5)
Affective disorders	28.91% (N = 74) Recurrent major depression (N = 22), major depressive disorder (N = 22), dysthymia (N = 6)	34.29% (N = 48) Recurrent major depression (N = 19), major depressive disorder (N = 17), dysthymia (N = 3)
Other mental disorders	15.63% (N = 40) Addiction syndrome (N = 14), borderline personality disorder (N = 8), attention deficit-hyperactivity disorder (N = 4), panic disorder (N = 4)	13.57% (N = 19) Addiction syndrome (N = 6), borderline personality disorder (N = 3), attention deficit-hyperactivity disorder (N = 3), panic disorder (N = 3)

Note. Only the most frequent diagnoses (three to four) of each subgroup are listed in the table

tal disorders and dreaming (Kramer, 2000, 2010; Kramer & Roth, 1978), current findings in patients are based on a very small number of studies which often yielded mixed results (Schredl, 2010a).

The present investigation was carried out to study whether sleep disorders influence dream recall and nightmare frequency by using a simple measurement tool – a seven-day sleep/dream diary. Based on previous findings (Schredl & Fulda, 2005), it was expected that the diary measure can assess inter-individual differences reliably.

2. Method

2.1. Participants

Overall, 256 patients (138 women, 118 men) who contacted our outpatient sleep center were included. The mean age of the patients was 42.58 ± 17.00 yrs.; the age range was 13 to 83 years. Of these 256 patients, 140 (73 women, 67 men) were further examined by polysomnographic recordings over two nights in the sleep laboratory. The mean age of this subgroup was 42.63 ± 16.29 yrs. and the age range was 14 to 83 years. The time interval between consultation in the outpatient sleep center and the polysomnographic recording was on average 59.19 ± 51.39 days. The distribution of the diagnoses evaluations is depicted in Table 1. Multiple diagnoses were possible; also probable diagnoses were included, except for probable periodic limb movement disorder evaluated solely by taking the sleep history – because this was often used as differential diagnosis for patients with unclear insomnia complaints.

2.2. Measurements

The sleep/dream diary included 16 items for each of the seven days assessing sleep behavior, subjective estimates of sleep latency, nocturnal awakenings, and time awake after sleep onset, dream recall, dream emotions, nightmares, medication, and substance consumption. First, patients were asked to record the date of the evening. The occurrence of a nap during the day should be documented. In the morning, patients should record the time they went to bed, their sleep latency in minutes, number of nocturnal

awakenings, and the total time they remained awake after sleep onset in minutes. They could comment on nocturnal activities like getting up and should state the time of getting up in the morning. Dream recall was measured with a three-point scale: 0 for no dream recall, 1 for the feeling of having dreamed but without remembering any content, and 2 for dream recall with content. If a dream was recalled, the content is described with just a few words. The emotional tone of the dream is measured with a five-point scale: -2 for strong negative emotions, -1 for negative emotions, 0 for balances emotions, +1 for positive emotions and +2 for strong positive emotions. Whether the dream was a nightmare or not is indicated with 0 for no nightmare experience or 1 for nightmare experience. The last questions of the sleep/dream diary assessed the intake of sleep medication, alcohol, and caffeine.

2.3. Procedure

All participants that were referred to the sleep center of the Central Institute of Mental Health, Mannheim underwent a diagnostic interview (approximately 30 to 45 minutes) including their sleep, medical, and psychiatric histories. If necessary, patients then underwent a standard polysomnographic examination (EEG, EOG, EMG, ECG, respiratory parameters and blood oxygen saturation) for two consecutive nights. The results from both the diagnostic interview and the polysomnographic examination served as the basis for the diagnosis of sleep disorders by certified sleep specialists. Before the appointment for the diagnostic interview, participants were asked to complete the sleep/dream diary for seven nights (the diary was sent to the patients via mail). Several patients did not complete all seven nights. A few patients completed even more than seven nights with the highest number of 16 nights, i.e., patients photocopied the sleep/dream diary. If no dream recall occurred all estimates of emotional tone of the dream and being a nightmare were excluded. Dream recall was transformed into mornings with successful dream recall per week; nightmare frequency as mornings with nightmares per month (30 days). To account for missing values, the first step was to compute the mean values per day and multiply these values with seven (dream recall per week) or 30 (nightmares per month).

Table 2. Categorized dream recall per week and nightmares per month variables

Variables	Dream recall (N = 254)		Nightmare frequency (N = 252)		
	Frequency	Percent	Category (mornings per month)	Frequency	Percent
7	13	5.12%	21 to 30	8	3.17%
6	8	3.15%	11 to 20	13	5.16%
5	14	5.51%	6 to 10	19	7.54%
4	14	5.51%	1 to 5	25	9.92%
3	26	10.24%	0	187	74.21%
2	50	19.69%			
1	23	9.06%			
0	106	41.73%			

Table 3. Ordinal regression analyses for dream recall frequency (outpatient and polysomnography samples)

Variable	Outpatient sample (N = 254)			Subsample with polysomnography (N = 139)		
	SE	χ^2	p	SE	χ^2	p
Age	-.1579	4.7	.0307	-.1497	2.0	.1565
Gender (1 = f, 0 = m)	.0054	0.0	.9372	.0100	0.0	.9158
Insomnia disorders	-.0446	0.3	.5603	-.1521	2.5	.1145
Sleep-related movement disorders	-.0152	0.1	.8194	.0161	0.0	.8671
Hypersomnia disorders	.0027	0.0	.9713	-.1038	1.2	.2737
Sleep-related breathing disorders	.0067	0.0	.9205	.0329	0.1	.7272
Other parasomnias	.0491	0.5	.4857	.0111	0.0	.9044
Nightmare disorder	.1980	9.0	.0027	.2544	7.8	.0051
Circadian rhythm disorders	.0216	0.1	.7396	-.0073	0.0	.9354
Other sleep disorders	-.1185	2.3	.1042	-.1047	1.2	.2670
Mood disorders	-.0571	0.7	.4018	-.0190	0.0	.8406
Other psychiatric disorders	-.0676	1.0	.3201	.0208	0.1	.8164

SE = Standardized estimates

Statistical analyses were carried out with SAS 9.4 for Windows. A visual inspection of the data indicated that only the emotional tone of dreams were normally distributed, whereas dream recall frequency and nightmare frequency were strongly positive skewed (many participants had zero values). Unfortunately, commonly used transformations (square root, logarithm, 1/x) did not improve the skewedness, so we decided to categorize the two variables (see Table 2) in order to compute ordinal regressions. As multiple diagnoses were possible, all diagnostic categories (present vs. not present) were entered simultaneously into the regression analysis. In order to control for age and gender, these two variables were also included.

3. Results

3.1. Dream Recall Frequency

For the 254 participants of the outpatient sample who provided dream recall data (mean number of nights per participant: 6.33 ± 1.87 ; range: 1 to 15), mean dream recall frequency was 1.73 ± 2.05 mornings with successful dream recall per week. The distribution of the categorized variable is depicted in Table 2. For the 166 patients who completed the first seven nights, the internal consistency of the successful dream recall variable was $r = .798$ (Cronbach's alpha). Using the three-point dream recall variable with successful dream recall, content-less dreams, and no dream

Table 4. Effect of sleep and other diagnoses on nightmare frequency for the outpatient and polysomnography samples (ordinal regression analysis)

Variable	Outpatient sample (N = 252)			Subsample with polysomnography (N = 138)		
	SE	χ^2	p	SE	χ^2	p
Age	-.2302	4.7	.0308	-.2624	2.9	.0883
Gender (1 = f, 0 = m)	-.1765	3.3	.0690	-.0705	0.3	.5915
Insomnia disorders	-.2680	5.8	.0157	-.1782	1.9	.1734
Sleep-related movement disorders	.2548	8.6	.0033	.1941	2.2	.1352
Hypersomnia disorders	.0346	0.1	.7167	.0110	0.0	.9229
Sleep-related breathing disorders	.0512	0.4	.5499	.1476	1.4	.2310
Other parasomnias	.0899	1.1	.2967	.0166	0.0	.8881
Nightmare disorder	.4165	30.7	<.0001	.4862	20.7	<.0001
Circadian rhythm disorders	.0281	0.1	.7545	-.0714	0.3	.5782
Other sleep disorders	-.1982	3.6	.0567	-.4383	7.5	.0061
Mood disorders	.1117	1.5	.2254	.1440	1.2	.2801
Other psychiatric disorders	.1162	1.9	.1706	.0917	0.6	.4219

SE = Standardized estimates

Table 5. Effect of sleep disorders on emotional tone of dreams of outpatient and polysomnographic samples (parametric regression analysis)

Variable	Outpatient sample (N = 180)			Subsample with polysomnography (N = 103)		
	SE	t	p	SE	t	p
Age	.0771	1.0	.3169	.0723	0.7	.4784
Gender (1 = f, 0 = m)	.0770	1.0	.3017	-.0384	-0.4	.6862
Insomnia disorders	.1107	1.2	.1871	.1510	1.6	.1238
Sleep-related movement disorders	-.1615	-2.3	.0236	-.1183	-1.2	.2204
Hypersomnia disorders	.0504	0.6	.5534	-.0784	-0.8	.4115
Sleep-related breathing disorders	.1067	1.4	.1516	-.1908	-2.1	.0400
Other parasomnias	.1003	1.3	.1946	.1529	1.6	.1185
Nightmare disorder	-.3487	-7.7	<.0001	-.3987	-4.3	<.0001
Circadian rhythm disorders	-.1250	-1.8	.0804	-.0754	-0.8	.7074
Other sleep disorders	.0749	1.0	.3351	.2064	2.2	.0287
Mood disorders	-.1247	-1.7	.0971	-.1259	-1.3	.2145
Other psychiatric disorders	-.0313	-0.4	.6683	-.0422	-0.5	.6422

SE = Standardized estimates

recall, Cronbach’s alpha amounted to $r = .867$. The ordinal regression indicated an association of age with dream recall frequency (significant for the larger outpatient sample), but no significant gender differences were observed (see Table 3). Considering sleep disorder classifications, no influences of diagnoses on dream recall frequency were found for the outpatient and the polysomnography samples; except for the nightmare group that showed higher dream recall (see Table 3).

3.2. Nightmare frequency

In the outpatient sample with 252 participants who provided nightmare data (mean of 6.05 ± 1.93 nights; range: 1 to 14), mean nightmare frequency was 2.78 ± 6.24 nightmares per month. The distribution of the categorized variable is depicted in Table 2. The internal consistency for seven days was $r = .823$ ($N = 128$ patients completing the protocol the first seven days). Neither age nor gender showed significant associations with nightmare frequency (see Table 4). For the outpatient sample, patients with insomnia and other sleep disorders reported nightmares less often when compared to other patients, whereas the patients with sleep-related movement disorders reported nightmares more often (see Table 3). In the sample with polysomnographic validated diagnoses, nightmares occurred less often in patients with other sleep disorders (see Table 4). As expected the nightmares group did report nightmares more often compared to the other patients: 9.89 ± 8.12 nightmares per month ($N = 25$) vs. 2.00 ± 5.48 nightmares per month ($N = 227$) in the outpatient sample and 10.10 ± 8.70 nightmares per month ($N = 18$) vs. 2.00 ± 5.21 nightmares per month ($N = 120$) in the sample with polysomnographic validated diagnoses.

3.3. Emotional tone of dreams

In the 180 patients reporting at least one dream, the average emotional tone of -0.28 ± 0.88 was significantly

negative (Wilcoxon Signed Ranks test: $z = -4.1$, $p < .0001$, $N = 180$, effect size = 0.642). Excluding the patients diagnosed with a nightmare disorder (ambulatory assessment) yielded a smaller but still significant difference (-0.15 ± 0.85 ; Wilcoxon Signed Ranks test: $z = -2.1$, $p = .035$, $N = 156$, effect size = 0.317).

Age and gender were not associated with the emotional tone of dreams (see Table 5). Patients with depression tended to report more negatively-toned dreams (statistical tendency) compared to the other patients of the outpatient sample. The patients with sleep-related movement disorders reported more negatively-toned dreams, as did the patients with polysomnographically diagnosed sleep-related breathing disorders. The group with other sleep disorders (polysomnography group) reported more positively dreams. Again, nightmare disorder was – as expected – related to negative dream emotions.

4. Discussion

Compared with representative samples (Schredl, 2008, 2010b, 2013; Schredl, Berres, Klingauf, Schellhaas, & Göritz, 2014), the patient sample reported higher dream recall and nightmare frequencies. Moreover, the emotional tone of the dreams was negatively toned whereas in samples of healthy individuals using diaries the dreams are slightly more positive than negative (Schredl et al., 2012; Sikka, Feilhauer, Valli, & Revonsuo, 2017). The strongest effects were found for the nightmare disorder group – as expected, but also patients with sleep-related movement disorders reported more nightmares and more negatively toned dreams whereas “less severe” disorders like problematic sleep hygiene, insufficient sleep syndrome reported nightmares less often than patients with other sleep or mental disorders.

From a methodological viewpoint, it has to be mentioned that despite the overall sample size of $N = 256$, several diagnostic groups included only a very small number of patients, e.g., only three patients with narcolepsy with diagnoses based on two nights of polysomnography and a multiple

sleep latency test. Given previous findings (Rak et al., 2015), one would expect significant changes in dreaming in these patients which might have shown up in a larger sample. It should also be mentioned that we used sleep/dream diaries instead of questionnaires. Previous studies (Aspy, Delfabro, & Proeve, 2015; Robert & Zadra, 2008) indicated that dream recall frequency and nightmare frequency might be underestimated by retrospective questionnaires, but Zunker et al. (2015) demonstrated that the difference between retrospective and prospective measures was relatively small (effect size of $d = 0.101$). The internal consistencies for measuring dream recall frequency and nightmare frequency were high (about $r = .80$ or higher) and, thus, indicate that a seven-day sleep diary is sufficient to measure inter-individual differences reliably (cf. Schredl & Fulda, 2005).

The mean value of dream recall frequency in our patient group was 1.73 ± 2.05 mornings per week ($N = 254$) and was considerably higher than for a representative sample with about 0.80 ± 1.48 mornings per week ($N = 1844$; Schredl et al., 2012). This is in line with a previous study (Schredl et al., 2012) including $N = 4,001$ patients with sleep disorders. One plausible explanation for increased dream recall in sleep disordered patients might be the increased number of nocturnal awakenings (cf. Schredl et al., 1998). It would be interesting to correlate the dream data with variables of sleep continuity in future studies. If the number of nocturnal awakenings is associated with dream recall frequency, this would support the arousal-retrieval model of dream recall (Koulack & Goodenough, 1976) postulating that periods of wakefulness after dreaming are necessary to store the dream in long-term memory. As diaries might over-estimate dream recall frequency (Aspy, 2016), especially in low dream recallers (Schredl, 2002), it would be valuable to study a sufficiently large sample of healthy individuals completing the sleep/dream diary.

Also, nightmare frequency with a mean of 2.78 ± 6.24 per month ($N = 252$) was higher compared to figures of representative samples (0.37 ± 1.37 ; $N = 915$; Schredl, 2013) and (0.34 ± 1.50 ; $N = 2019$; Schredl, 2010b). This marked difference is not likely to be explained by methodological issues since the difference between diary measures (present study) and questionnaire measures (representative surveys) are rather small (see above). Even without the patients with nightmare disorder, nightmare frequency is still elevated (2.00 ± 5.48 mornings per month). This increased nightmare frequency in patients with sleep disorders has been reported previously (BaHammam & Almeneessier, 2019; Schredl, 2009b; Schredl et al., 2012). On the one hand, heightened nightmare frequency might be directly related to sleep parameters like apnoe-hypopnoe index in REM sleep (BaHammam et al., 2013) but also to daytime stress (cf. Nielsen & Levin, 2007): in the case of sleep disorders this could be tiredness and/or sleepiness during the day. In a sample of $N = 83$ patients with NREM parasomnias, daytime stress levels correlated positively with nightmare frequency (Schredl, 2020). Given the etiology of insomnia disorders (Perlis, Ellis, DeMichele Kloss, & Riemann, 2017) one might speculate as to whether stressors that play a role in developing insomnia may also increase nightmares.

Our study also revealed that the patient group reported more negative than positive dream emotions – a finding that is in line with the multi-center study (Schredl et al., 2012). In healthy participants dreams are on average more positive than negative (Schredl, 2009c; Sikka et al., 2017). Accord-

ing to the continuity hypothesis (Schredl, 2003), this finding would reflect the more negatively toned waking life of the patients, due to disorder-related symptoms.

The sleep disorder that clearly showed the most prominent effects on dreams was – as expected – the nightmare disorder: these patients reported higher dream recall, more negatively toned dreams, and – of course – many more nightmares. From a clinical viewpoint, the easy-to-use sleep/dream diary might help in identifying, diagnosing, and treating patients with nightmare disorders – as this condition is still under-diagnosed and under-treated (Nadorff, Nadorff, & Germain, 2015; Schredl, 2010c).

Interestingly, the differences regarding nightmares and negative dream emotions within the patient group were not very pronounced (except for the nightmare disorder group). However, patients with sleep-related movement disorders reported more nightmares and more negatively toned dreams which might reflect the depressive symptoms (Cho, Kim, & Lee, 2017) and/or low quality of life (Silva Graciela et al.) often found in restless legs patients, whereas patients with milder types of sleep disorder like problematic sleep hygiene (a precursor to primary insomnia) or insufficient sleep syndrome showed fewer nightmares and more positive dream emotions. This would fit in with the notion that the burden due to the disorder might be reflected in dreams – this would be in line with the continuity hypothesis of dreaming (Schredl, 2003). The finding that depressive patients report more negative dream emotions also fits within this framework (Skancke et al., 2014). However, the analysis also indicates that despite the overall sample size of $N = 256$, it would take much larger samples in order to study the differences between different sleep disorders.

Both dream recall frequency and nightmare frequency declined with age in our sample; as this was also reported for population-based German samples (Schredl, 2008, 2013; Schredl et al., 2014) this underlines the validity of the present findings. However, gender differences in dream recall frequency and nightmare frequency documented by meta-analyses (Schredl & Reinhard, 2008, 2011) were not found. One might suspect that the presence of sleep disorders might mask gender effects and much larger samples would be necessary to study the interaction effects of gender and sleep disorders on the dreaming process.

To summarize, the current study showed that the sleep/dream diary approach can measure inter-individual differences in dream recall frequency, nightmare frequency, and dream emotions reliably. The findings indicated that patients with sleep disorders, in particular patients with nightmare disorder, reported higher dream recall frequencies, more often nightmares, and negatively toned dreams in patients with sleep disorders in comparison with healthy controls. For detecting differences between different sleep disorders the sample size was still too small, so larger studies are needed. The understanding of the inter-relationship between sleep disorders and dreaming might help to understand the continuity between waking and dreaming as well as the effects of sleep physiology on dream characteristics on the one hand and, on the other hand, help with the diagnosis and treatment of sleep disorders, e.g., closing the gap regarding under-treated nightmare disorders.

References

- Amara, A. W., & Maddox, M. H. (2017). Epidemiology of sleep medicine. In M. Kryger, T. Roth & W. C. Dement (Eds.), *Principles and practice of sleep medicine* (6th edition) (pp. 627-637). Philadelphia: Elsevier.
- American Academy of Sleep Medicine. (2014). *The international classification of sleep disorders. (ICSD-3)*. Darien, IL: AASM.
- Aspy, D. J. (2016). Is dream recall underestimated by retrospective measures and enhanced by keeping a logbook? An empirical investigation. *Consciousness and Cognition*, 42, 181-203.
- Aspy, D. J., Delfabbro, P., & Proeve, M. (2015). Is dream recall underestimated by retrospective measures and enhanced by keeping a logbook? A review. *Consciousness and Cognition*, 33, 364-374.
- BaHammam, A. S., Al-Shimemeri, S. A., Salama, R. I., & Sharif, M. M. (2013). Clinical and polysomnographic characteristics and response to continuous positive airway pressure therapy in obstructive sleep apnea patients with nightmares. *Sleep Medicine*, 14(2), 149-154.
- BaHammam, A. S., & Almeneessier, A. S. (2019). Dreams and Nightmares in Patients With Obstructive Sleep Apnea: A Review. [10.3389/fneur.2019.01127]. *Frontiers in Neurology*, 10, 1127.
- Boerner, J. (1855). *Das Alptrücken: Seine Begründung und Verhütung*. Würzburg: Carl Joseph Becker.
- Cho, C.-H., Kim, L., & Lee, H.-J. (2017). Individuals with Restless Legs Syndrome Tend to have Severe Depressive Symptoms: Findings from a Community-Based Cohort Study. *Psychiatry Investigation*, 14(6), 887-893.
- Dodet, P., Chavez, M., Leu-Semenescu, S., Golmard, J.-L., & Arnulf, I. (2015). Lucid dreaming in narcolepsy. *Sleep*, 38(3), 487-497.
- Freud, S. (1900/1991). *The interpretation of dreams (Org.: Die Traumdeutung)*. London: Penguin Books.
- Hobson, J. A. (2009). REM sleep and dreaming: towards a theory of protoconsciousness. *Nature Reviews Neuroscience*, 10(11), 803-813.
- Koulack, D., & Goodenough, D. R. (1976). Dream recall and dream recall failure: an arousal-retrieval model. *Psychological Bulletin*, 83, 975-984.
- Kramer, M. (2000). Dreams and psychopathology. In M. H. Kryger, T. Roth & W. C. Dement (Eds.), *Principles and practice of sleep medicine* (pp. 511-519). Philadelphia: W. B. Saunders.
- Kramer, M. (2010). Dream differences in psychiatric patients. In S. R. Pandi-Perumal & M. Kramer (Eds.), *Sleep and mental illness* (pp. 375-382). Cambridge: Cambridge University Press.
- Kramer, M., & Roth, T. (1978). Dreams in psychopathologic patient groups. In R. L. Williams & I. Karacan (Eds.), *Sleep disorders: diagnosis and treatment* (pp. 323-349). New York: John Wiley & Sons.
- Lichstein, K. L., Taylor, D. J., McCrae, C. S., & Petrov, M. E. (2017). Insomnia: Epidemiology and risk factors. In M. Kryger, T. Roth & W. C. Dement (Eds.), *Principles and practice of sleep medicine* (6th edition) (pp. 761-768). Philadelphia: Elsevier.
- Nadorff, M. R., Nadorff, D. K., & Germain, A. (2015). Nightmares: Under-Reported, Undetected, and Therefore Untreated. *Journal of Clinical Sleep Medicine*, 11(7), 747-750.
- Nielsen, T. A., & Levin, R. (2007). Nightmares: a new neurocognitive model. *Sleep Medicine Reviews*, 11, 295-310.
- Pelayo, R., & Dement, W. C. (2017). History of sleep physiology and medicine. In M. Kryger, T. Roth & W. C. Dement (Eds.), *Principles and practice of sleep medicine* (6th edition) (pp. 3-14). Philadelphia: Elsevier.
- Perlis, M. L., Ellis, J. G., DeMichele Kloss, J., & Riemann, D. (2017). Etiology and pathophysiology of insomnia. In M. Kryger, T. Roth & W. C. Dement (Eds.), *Principles and practice of sleep medicine* (6th edition) (pp. 769-784). Philadelphia: Elsevier.
- Rak, M., Beitinger, P., Steiger, A., Schredl, M., & Dresler, M. (2015). Increased lucid dreaming frequency in narcolepsy. *Sleep*, 38(5), 787-792.
- Robert, G., & Zadra, A. L. (2008). Measuring nightmare and bad dream frequency: impact of retrospective and prospective instruments. *Journal of Sleep Research*, 17, 132-139.
- Schredl, M. (1998). Dream content in patients with narcolepsy: preliminary findings. *Dreaming*, 8, 103-107.
- Schredl, M. (2001). Dream recall frequency and sleep quality of patients with restless legs syndrome. *European Journal of Neurology*, 8, 185-189.
- Schredl, M. (2002). Questionnaire and diaries as research instruments in dream research: methodological issues. *Dreaming*, 12, 17-26.
- Schredl, M. (2003). Continuity between waking and dreaming: a proposal for a mathematical model. *Sleep and Hypnosis*, 5, 38-52.
- Schredl, M. (2007). Dream recall: models and empirical data. In D. Barrett & P. McNamara (Eds.), *The new science of dreaming - Volume 2: Content, recall, and personality correlates* (pp. 79-114). Westport: Praeger.
- Schredl, M. (2008). Dream recall frequency in a representative German sample. *Perceptual and Motor Skills*, 106, 699-702.
- Schredl, M. (2009a). Dreams in patients with sleep disorders. *Sleep Medicine Reviews*, 13, 215-221.
- Schredl, M. (2009b). Nightmare frequency in patients with primary insomnia. *International Journal of Dream Research*, 2, 85-88.
- Schredl, M. (2009c). Recall frequency of positive and negative dreams in a representative German sample. *Perceptual and Motor Skills*, 108, 677-680.
- Schredl, M. (2010a). Do sleep disorders affect the dreaming process? Dream recall and dream content in patients with sleep disorders. *Sleep Medicine Clinics*, 5(2), 193-202.
- Schredl, M. (2010b). Nightmare frequency and nightmare topics in a representative German sample. *European Archives of Psychiatry and Clinical Neuroscience*, 260, 565-570.
- Schredl, M. (2010c). Nightmares: An under-diagnosed and undertreated condition? Commentary on Li et al. Prevalence and correlates of frequent nightmares: a community-based 2-phase study. *Sleep*, 33, 733-734.
- Schredl, M. (2013). Nightmare frequency in a representative German sample. *International Journal of Dream Research*, 6, 119-122.
- Schredl, M. (2020). Dreaming in NREM parasomnias: An empirical study. In J. F. Pagel (Ed.), *Parasomnia dreaming: Exploring other forms of sleep consciousness* (pp. 55-72). New York: Nova Science.
- Schredl, M., Berres, S., Klingauf, A., Schellhaas, S., & Göritz, A. S. (2014). The Mannheim Dream questionnaire (MADRE): Retest reliability, age and gender effects. *International Journal of Dream Research*, 7, 141-147.
- Schredl, M., Binder, R., Feldmann, S., Göder, R., Hoppe, J., Schmitt, J., Schweitzer, M., Specht, M., & Steinig, J. (2012). Dreaming in patients with sleep disorders: A multicenter study. *Somnologie*, 16, 32-42.
- Schredl, M., & Fulda, S. (2005). Reliability and stability of dream recall frequency. *Dreaming*, 15, 240-244.
- Schredl, M., & Reinhard, I. (2008). Gender differences in dream

- recall: a meta-analysis. *Journal of Sleep Research*, 17, 125-131.
- Schredl, M., & Reinhard, I. (2011). Gender differences in nightmare frequency: a meta-analysis. *Sleep Medicine Reviews*, 15, 115-121.
- Schredl, M., Schäfer, G., Weber, B., & Heuser, I. (1998). Dreaming and insomnia: Dream recall and dream content of patients with insomnia. *Journal of Sleep Research*, 7, 191-198.
- Schredl, M., & Schmitt, J. (2009). Dream recall frequency and nightmare frequency in patients with sleep disordered breathing. *Somnologie*, 13, 12-17.
- Schredl, M., & Schmitt, J. (2019). Dream recall frequency, nightmare frequency, attitude towards dreams, and other dream variables in patients with sleep-related breathing disorders. *Somnologie*, 23(2), 109-115.
- Schredl, M., Schmitt, J., Hein, G., Schmoll, T., Eller, S., & Haaf, J. (2006). Nightmares and oxygen desaturations: is sleep apnea related to heightened nightmare frequency? *Sleep and Breathing*, 10, 203-209.
- Sikka, P., Feilhauer, D., Valli, K., & Revonsuo, A. (2017). How you measure is what you get: Differences in self- and external ratings of emotional experiences in home dreams. *American Journal of Psychology*, 130(3), 367-384.
- Silva Graciela, E., Goodwin James, L., Vana Kimberly, D., Vasquez Monica, M., Wilcox Peter, G., & Quan Stuart, F. Restless Legs Syndrome, Sleep, and Quality of Life among Adolescents and Young Adults. *Journal of Clinical Sleep Medicine*, 10(07), 779-786.
- Skandke, J., Holsen, I., & Schredl, M. (2014). Continuity between waking life and dreams of psychiatric patients: A review and discussion of the implications for dream research. *International Journal of Dream Research*, 7, 39-53.
- Swart, M. L., van Schagen, A. M., Lancee, J., & van den Bout, J. (2013). Prevalence of nightmare disorder in psychiatric outpatients. *Psychotherapy and Psychosomatics*, 82(4), 267-268.
- Wamsley, E. J., & Stickgold, R. (2010). Dreaming and offline memory processing. *Current Biology*, 20, R1010-R1013.
- Zunker, M., Althoff, H. K., Apel, J., Lässig, H. S., Schültke, L., & Schredl, M. (2015). Comparing questionnaire and diary measures for eliciting nightmare frequency. *International Journal of Dream Research*, 8, 129-134.