Comparing questionnaire and diary measures for eliciting nightmare frequency

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Summary. Studies investigating the prevalence of nightmares have generally found higher frequencies in studies using daily logbooks or diaries compared to retrospective reports, raising the question as to whether retrospective questionnaires lead to an underestimation of nightmare frequency, possibly due to the suppression of the frightening nightmare experience or if keeping a diary enhances recall. In this study, 71 participants filled in a questionnaire about their sleep, dreams, and emotions during the day in the beginning phase of the study and were then asked to keep a checklist diary for two weeks. The results show that there is a small but non-significant increase in nightmare estimates and much more pronounced differences in overall dream recall frequency and in other aspects of daily life, such happiness and pain sensations. No effect of emotional tone on the differences in the questionnaire and diary measures was found. The present findings imply that the increase in nightmare frequency using diary measures instead of retrospective questionnaires might be a result of the increase in overall dream recall frequency. The differences in the other variables might be attributable to attentional effects. For future research, we suggest eliciting current stress levels and attitudes toward nightmares in order to study whether these variables might affect the difference between diary and questionnaire measures.

Keywords: Nightmare freuqency, dream recall frequency, retrospecitve mearsures, prospective measures

1. Introduction

Nightmares are defined as extended, extremely dysphoric, and well-remembered dreams that usually involve threat to survival, security, or physical integrity (American Academy of Sleep Medicine, 2014). As occasional nightmares are experienced by almost everyone at some point in their lives (Schredl, Berres, Klingauf, Schellhaas, & Göritz, 2014), the diagnosis of a nightmare disorder also includes the additional criteria that the nightmares and/or the sleep disturbances related to the nightmares cause clinical significant distress and/or impairment in social, occupational, or other important areas of functioning (American Academy of Sleep Medicine, 2014). The prevalence of the nightmare disorder in the general population is estimated to be about 5% (Schredl, 2013). The etiology of nightmares is best explained by a disposition-stress model (Levin & Nielsen, 2007) and effective treatment strategies are available (Augedal, Hansen, Kronhaug, Harvey, & Pallesen, 2013).

For measuring nightmare frequency in the context of empirical studies, two approaches were used: retrospective scales and dream diaries. An eight-point scale eliciting nightmare frequency with categories ranging from never to almost every morning showed high retest reliability (rtt = .75) in two studies (Schredl et al., 2014; Stumbrys, Erlacher, & Schredl, 2013). In the first study (Stumbrys et al.,

2013), there was no significant difference regarding nightmare frequency between the means of the first and second measurement point (4 weeks apart), but a reanalysis of the data of the second study (Schredl et al., 2014) indicated there was a significant decrease from 2.50 ± 2.03 to 2.28 ± 2.03 (Sign Rank test: S = 100997, p < .0001, N = 2329). If, however, retrospective measures were compared with daily logs, Wood and Bootzin (1990) were the first to report that diary measures yielded much higher nightmare frequencies compared to retrospective estimates (see Table 1). The other studies (Blagrove, Farmer, & Williams, 2004; Robert & Zadra, 2008; Salvio, Wood, Schwartz, & Eichling, 1992; Zadra & Donderi, 2000), also listed in Table 1, confirmed the findings of Wood and Bootzin (1990) with the exception of the narrative dream log group in the study of Robert and Zadra (2008). One should keep in mind that the studies presented in table 1 used different definitions (or no specific definition) regarding nightmares which might affect the prevalence of nightmares (Blagrove & Haywood, 2006) but this analysis focusing only on the difference between retrospective and diary measures were elicited in the same sample and, thus, different definitions might not have a strong effect on within-subject differences.

Given the marked differences between retrospective and prospective measures, the question arises as to how these differences can be explained. Aspy, Delfabbro, and Proeve (2015), reviewing the disparity between retrospective measures and log measured of dream recall frequency, outlined two possibly explanations: underestimation of the retrospective measures and enhancement effects of the log measures. The fact that the retrospective measures — asking for estimations about the last 12 months — yielded lower figures than estimates for a one-month interval would be in line with the theory of the availability heuristic put forward by Tversky and Kahneman (1973). I.e., longer time intervals

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Table 1. Measuring nightmare frequency using questionnaire and diary measures

	Type of dream	Year estimates M ± SD	Month estimate/year estimate	Month estimates M ± SD	Diary/ month estimates	Diary measure M ± SD	Diary/year estimate
Wood & Bootzin (1990)	nm	9.36 ± 13.90	132.00%	12.37 ± 24.00	190.78%	23.6 ± 36.66	252.14%
Zadra&Donderi (2000)	nm	4.21 ± 7.34	137.00%	5.76 ± 10.56	191.67%	11.04 ± 15.24	262.23%
	bd	17.35 ± 19.03	111.00%	19.20 ± 21.12	153.00%	29.40 ± 28.20	169.00%
Salvio et al. (1992)	nm elderly	1.20[1]				15.30[1]	1275.00%
	nm students	9.30[1]				23.60[1]	253.76%
Robert & Zadra (2008)	nm narrative	7.10 ± 10.10	136.62%	9.70 ± 13.60	90.72%	8.80 ± 14.30	123.94%
	nm checklist	7.30 ± 11.70	102.74%	7.50 ± 12.90	116.00%	8.70 ± 15.50	119.18%
	bd narrative	16.50 ± 19.00	148.48%	24.50 ± 26.00	110.20%	27.00 ± 28.90	163.64%
	bd checklist	18.90 ± 20.70	139.15%	26.30 ± 30.40	113.31%	29.80 ± 38.40	157.67%
Blagrove et al. (2004)	nm			19.44 ± 26.28	121.71%	23.76 ± 38.68	

All measurements (year estimates, month estimates (multiplied with 12), and diary measures (recalculated regarding the diary interval are expressed as nightmares per year; 1 = no SD reported; nm = nightmares; bd = bad dreams

reduce the availability of the data points and, thus, increase the cognitive effort regarding accurate estimation and bias these estimates.

Another possible factor for underestimation, at least in the case of general dream recall, is related to attentional processes. Usually, dream diaries are completed in the morning as soon as possible after awakening because all kinds of interferences between awakening and recording the dream can reduce dream recall dramatically (Cohen & Wolfe, 1973), i.e., paying attention during the critical period while keeping a diary can increase recall since the retrospective estimation might be based on time periods that included distractions and interferences. Another hypothesis is that retrospective measures might be biased by personality dimensions (Beaulieu-Prevost & Zadra, 2005; Bernstein & Roberts, 1995) because these personality measures, e.g., absorption, thin boundaries, showed higher correlations with retrospectively measured dream recall when compared to figures obtained from diary measures (Beaulieu-Prevost & Zadra, 2005). In the case of nightmares, Wood and Bootzin (1990) reported that individuals with high trait anxiety might recall their nightmares more easily compared to individuals with low trait anxiety using retrospective measures whereas there was no difference between the two groups if prospective measures were used. This might reflect an attitude towards nightmares, e.g., if I am an anxious person I should have a fair number of nightmares.

The other line of thinking focuses on the recall-enhancing effects of keeping a dream diary (Aspy et al., 2015). Whereas no difference in dream recall frequency was found in a retest study (Schredl, 2004a) in which the dream recall frequency scale was part of a comprehensive sleep questionnaire, a significant increase was found in a dream study measuring attitude towards dreams and retrospectively dream recall frequency (Schredl, Brenner, & Faul, 2002). Also, simple encouragement can also increase dream recall frequency (Halliday, 1992; Redfering & Keller, 1974) and, thus, support the idea that focusing on dream recall by keeping a diary can increase it. Interestingly, Zadra and Robert (2012) found a higher increase from retrospective estimates of dream re-

call in the first five days of keeping a narrative dream log (including recording the dreams which can take a lot of time) compared to a checklist dream log (just filling in whether there was a dream (or several dreams) or not). For narrative dream logs, dream recall typically decreases after the first week (Schredl, Wittmann, Ciric, & Götz, 2003; Zadra & Robert, 2012), indicating that motivational factors might be involved in the measurement of dream recall frequency using diaries. Schredl (2004b) found that the increment from retrospective measured dream recall to diary dream recall in low dream recallers who usually showed the largest increases (Schredl, 2002; Zadra & Robert, 2012) is significantly related to a positive attitude towards dreams, supporting the idea that motivation might play a role in the dream log enhancement effect.

To summarize, the empirical studies found higher nightmare frequencies for diary measures compared to retrospective measures, probably due to a combination of underestimation for the retrospective measures and enhancement effects of dream log measures.

The objective of the present study is to investigate whether the difference of using retrospective questionnaires compared to diary measures of nightmare frequency is specific for nightmares or can be found in other dream-related variables like general dream recall or lucid dreaming frequency and non-dream-related variables, e.g., experiencing emotions or pain. We also correlated the differences between diary variables and questionnaire variables in order to look for specific patterns, e.g., a high correlation between the increases in all variables might indicate that motivational aspects of keeping the diary diligently are of importance.

2. Method

2.1. Participants

Overall, 71 Participants completed the questionnaire and a diary (49 women and 21 men, 1 gender missing). Participants were volunteers, either students recruited in psychology classes or friends of the experimenters. The sample included 66 psychology students, one social worker, one

self-employed person and one lawyer (2 missing values). The ages ranged from 18 to 54 years and the mean was 22.40 ± 6.85 years (1 missing value).

2.2. Questionnaire

Participants filled in a questionnaire at the beginning of the study. Apart from general demographic data (age, sex, occupation) it was subdivided into day and night portions. To provide retrospective measures, they were asked about the number of mornings that had recalled dreams in the previous two weeks. In addition, they were to state the numbers of mornings in which they recalled a positive dream, a lucid dream, a bad dream, or a nightmare, respectively. . The following definitions were included in the questionnaire: "Positive dreams include persistent strong positive emotions." "In lucid dreams, the dream ego is – while dreaming – aware that s/he is dreaming. " "Nightmares are dreams with strong negative emotions that cause awakening." "Bad dreams include strong negative Emotions like anxiety, disgust, or sadness but do not immediately cause awakening."

In the day-part, they were asked on how many days they had felt overwhelmed by their tasks, how many days they felt like they managed their tasks well, and how many days they had felt sadness, happiness, and physical pain.

Additionally, they were asked about the mean hours of sleep (during the week and on weekends), the amount of minutes it took to fall asleep and the number of times they woke up at night during the previous two weeks.

2.3. Diary

All the participants kept a checklist diary over a two week period. Every evening, the participants were asked how often during the day they felt they could not manage their tasks, how often they felt that they managed their tasks well, and how often they felt sadness, happiness, and physical pain. The second part was to be filled in the following morning, asking about the total number of dreams in the preceding night. In addition, the numbers of positive, lucid, bad dreams, and nightmares were elicited. The same definitions that were presented within the questionnaire were repeated in the diary. If they remembered a dream, participants were to describe it in just a few words. For the analysis, the mornings with one dream or dream type were added separately. Similarly, days with at least one of the daytime parameters were summed up.

Also, hours of sleep, minutes it took to fall asleep, and frequency of nocturnal awakenings were elicited. In order to compare the sleep data to the questionnaire data, mean sleep duration for weekdays and weekends were computed separately.

2.4. Procedure

Participants were told that the study investigated well-being during the day and night to avoid distorted results through focusing effects, i.e., the focus should not be on dreams and/or nightmares. First, participants completed the questionnaire which consisted of questions about the prior two weeks. To prevent recall effects and avoid different daily schedules due the Easter holidays, participants kept the diary for two weeks after a pause of three to four weeks after filling in the questionnaire. The experimenters were students but the participants were younger psychology students

in other classes. They received a certificate for about 2.5 hours participation time; bachelor students need to collect 30 hours of participating in experiments during the course of their studies. Statistical analysis was carried out using the SAS 9.4 software for Windows.

3. Results

Comparison of the retrospective and diary reports revealed a significant increase in the overall DRF, positive and negative dreams and all measures of emotions during the day, ranging from 150% in good task management to 282% in the feeling of being overwhelmed by tasks (see table 2). However, for the number of nightmares and lucid dreams the increase (123% to 135% of the retrospective estimate in the diary) with very small effect sizes was not significant. The amount of sleep on the weekend and sleep latency were significantly lower in the diary, whereas sleep duration during the week and frequency of nocturnal awakenings did not show significant differences.

For the ten variables (5 dream variables, 5 day-time variables), the baseline levels (questionnaire measure) was correlated with the difference of questionnaire and diary figures using the effect sizes. The correlation was marginally significant ($r=.579$, $p < .10$), i.e., variables with relatively high frequencies in the beginning showed higher increases than variables with low frequencies.

The comparison of questionnaire and diary measures revealed small to medium correlation coefficients, e.g., DRF, frequency of positive dreams, whereas the frequency of negative dreams, lucid dream, and nightmares were not significantly correlated (see Table 2). All sleep variables showed medium correlations, ranging from $r = .392$ for sleep duration on weekends to $r = .595$ for sleep latency. All day-time variables, except successful management of tasks, revealed medium correlations, ranging from $r = .369$ for sadness to $r = .498$ for pain.

Lastly, the difference scores (questionnaire vs. diary) for the five dream-related measures and the five day-time variables were correlated (Spearman Rank correlations). Whereas the difference in general dream recall was significantly related to the differences in positive dreams, lucid dreams, negative dreams, and nightmares, the four dream-related variables (excluding general dream recall) were not intercorrelated with each other. Of the 25 correlation coefficients between the five dream-related variables and the five daytime variables, only two were statistically significant, i.e., an increase in positive dreams was related to an increase of days with pain and a decrease of days with happiness was related to an increase in nightmares. Three of the ten correlation coefficients between the daytime variables were significant (happiness – good task management, pain – good task management, pain – happiness), e.g., if the number of days with happiness increases the number of days with good task management also increased.

4. Discussion

The findings show significant increases in overall DRF, positive and negative dreams, as well as increases in all daytime variables. Even though the increases in nightmare and lucid dream frequency were not significant, their magnitude was comparable to previous studies (Robert & Zadra, 2008; Wood & Bootzin, 1990; Zadra & Donderi, 2000). The estimates of the sleep-related variables tend to decrease using

Table 2. Differences between questionnaire and diary measures and correlations

	Questionnaire M ± SD	Diary M ± SD	Effect size	t value	Rank Correlation	Diary/ques-tionnaire
Hours of sleep during the week	7.44 ± 0.85	7.37 ± 0.63	-0.089	-0.7	.506***	99.06%
Hours of sleep on the weekend	8.12 ± 1.31	7.52 ± 0.90	-0.486	-4.1***	.392**	92.61%
Minutes it took to fall asleep	20.79 ± 16.28	15.67 ± 12.24	-0.329	-2.8**	.595***	75.37%
Frequency of nocturnal awakenings	1.24 ± 1.35	0.95 ± 0.57	-0.228	-1.9	.542***	76.61%
Dream recall frequency	3.75 ± 2.58	6.93 ± 2.80	1.070	9.0***	.389**	184.80%
Positive dreams	1.97 ± 1.75	3.82 ± 2.49	0.740	6.2***	.409**	193.91%
Negative dreams	1.06 ± 1.11	2.17 ± 1.82	0.557	4.7***	.136	204.72%
Nightmares	0.20 ± 0.55	0.27 ± 0.59	0.101	0.9	.214	135.00%
Lucid dreams	0.55 ± 1.00	0.68 ± 1.27	0.092	0.8	.156	123.64%
Feeling of being overwhelmed by tasks	2.94 ± 2.90	8.30 ± 3.81	1.423	11.9***	.467***	282.31%
Feeling of managing tasks well	7.65 ± 3.90	11.45 ± 2.83	0.824	4.9***	.153	149.67%
Sadness	1.77 ± 2.16	4.38 ± 3.61	0.849	7.2***	.369**	247.46%
Happiness	4.49 ± 3.12	9.75 ± 3.61	1.505	12.7***	.479***	217.15%
Physical pain	2.11 ± 2.50	4.92 ± 3.66	0.839	71***	.498***	233.18%

* $p < 0.05$; ** $p < 0.01$; *** $p \leq 0.0001$

the diary method, with a significant decline in sleep duration during the week and the minutes it took to fall asleep.

First, the increase in nightmare frequency (small effect size) was considerably smaller compared to the other dream variables (except lucid dreaming). As the increases in positive and negative dreams are comparable, the explanation that specifically anxious individuals overestimate their frequency of negatively toned dreams, put forward by Wood and Bootzin (1990), i.e., a mood congruency recall bias, seems unlikely. In addition, the emotional tone of the measured daytime emotions did not affect the magnitude of the increase, i.e., the largest effect sizes were found for the feeling of being overwhelmed and happiness. As about 75% of the participants reported cognitive avoidance as their strategy in dealing with their nightmares ("I try to forget my nightmares as soon as possible.") (data not included in the publication; Schredl, 2010), it would be interesting to compare differences regarding retrospective measures and prospective measures between groups with high avoidance and low avoidance.

How can these large increases for dream recall and the daytime variables be explained? Whereas for the increase of dream recall the dream log enhancement effect (Aspy et al., 2015) can be at least partially responsible, the even more pronounced increases in the daytime variables must have other causes (it does not seem plausible that keeping the diary enhances the frequency of pain sensations or feelings of happiness). As put forward in the introduction, one plausible line of thinking is the effect of attention, i.e., if the participant knows that these emotions will be elicited every evening, s/he is paying more attention to them. A possible strategy to test this hypothesis empirically might be a paradigm in which the diary is kept first and after some period of time (to avoid simple recollection of the diary answers) a retrospective questionnaire is presented. If there is still a much lower

value of the retrospective measure, the problem is that such feelings as measured in the study and dream recall is easily forgotten if not recorded immediately.

The extrapolated annual nightmare frequency of 5.20 in the retrospective measure and 7.02 in the diary approach is comparable to the ones found in previous studies and, thus, supports the validity of the present findings. For lucid dream frequency, the increase of 1.2 times is comparable to the figure reported by Zadra and Donderi (2000), again supporting the validity of the present findings.

A limitation of the study is the pattern of low correlations between diary and questionnaire measures, especially for nightmare frequency and lucid dreaming frequency. This might point to low reliability of the scales. Although Schredl and Fulda (2005) showed that two-week logs showed sufficient reliability ($rtt = .818$), similar studies for nightmare frequency are lacking; one might expect that longer time periods are necessary because nightmares occur less frequently than other kinds of dreams. Similarly, the retest reliability of the retrospective measurement of nightmare frequency in this study has not been determined, the reported retest reliability of $rtt = .75$ was for an eight-point scale with a wider time interval (months) (Stumbrys et al., 2013). Although the daytime measure showed substantial correlations between the diary and questionnaire methods, it should kept in mind that these scales were constructed for the purpose of this study and have not been explored for reliability and validity.

The idea of using only two-week intervals for the study was also based on the fact that the stress levels of the students increase close to the end of the semester which consists of written exams and, thus, possible nightmare frequency, since current stress is strongly related to nightmare frequency (Schredl, 2003). In order to control for possible effects of the studies when longer time intervals are used (including semester breaks and/or periods with examina-

tion), it would be useful to include stress measures in the nightmare studies, otherwise the increase in the diary period which always followed the period of retrospective estimates might be explained by students' increased stress levels. In our study, we found similar increases in stress-related daytime measures and daytime measures of positive emotions (likely an effect of monitoring), so it seems likely that the diary period in the middle of the semester was not characterized by overall increased stress levels.

In the present study, there was a time interval of two to three weeks between completing the questionnaire and keeping the diary due to the Easter holidays (since the students did not attend lectures in this time period it was omitted). This might have reduced possible recall effects of the questionnaire measures on the diary keeping. As stated above, it would be very interesting to use retrospective measures after keeping the diary (including a sufficiently long time interval to reduce recall of the diary entries) and investigate possible differences between these two measures.

The correlation between baseline level and increase i.e., variables with high prevalence showed higher increases from questionnaire to diary, supports the availability heuristic (Tversky & Kahneman, 1973) since it takes more resources to recall the exact frequency of something that occurs often, people may tend to underestimate their frequency. However, this is not in line with the findings that low dream recallers report the largest increases by keeping a dream diary (Schredl, 2002); this finding would support the dream log enhancement effect and/or the effect of paying attention (described above) which can be more pronounced in low recallers compared to individuals who already recall dreams several times a week.

A rather unexpected finding was the small number of correlations between the diary-questionnaire differences of the 10 measures (5 dream-related measures and 5 daytime measures). The positive correlations between increases in general dream recall and the four dream subtypes (positive, negative, and lucid dreams and nightmares) are self-explanatory. The low number of significant correlations between the dream-related measures and daytime measures – even if accounting for low reliabilities for the measures – did not support the notion that there is a general effect of enhanced attention for all diary measures. These findings warrant further study.

The rather low correlations of retrospective and diary report for all variables (dream, sleep and day-time measures) might also be a result of the unstable lifestyles of the students, especially in view of the sleep variables. Regarding dream recall frequency, for example, other studies generally reveal higher correlations (r = .557; Schredl, 2002) and (r = .645; Zadra & Robert, 2012). Zadra and Donderi (2000) reported a correlation of r = .59 for nightmare frequency whereas Salvio et al. (1992) only found correlations of r = -.1 and r = -.11 when comparing the logbook and a retrospective report of the previous year. It would be very interesting to study populations with more regular sleep/wake cycles.

For research, small differences between retrospective and prospective measures are of interest with regard to developing reliable and valid measurement instruments. On the other hand, from a clinical viewpoint, it does not make a huge difference whether an individual reports four nightmares per year on the retrospective measure and 6 nightmares per year during the diary period. I.e., it would be very interesting to study whether the diagnoses of a nightmare

disorder (American Academy of Sleep Medicine, 2014) is more likely after the individuals kept a nightmare log for four weeks compared to the standard diagnostic procedure of simply taking a sleep history including the nightmare frequency estimates.

To summarize, we found a small increase in nightmare frequency from a retrospective measure to a diary measure, but this increase, however, is relatively small compared to the increase of overall dream recall frequency and the frequency of emotions in the waking state. Most likely attentional processes play an important role in explaining these findings. As this study is one of the first looking at factors that might affect the difference between retrospective and prospective measures of nightmare frequency, several topics should be addressed in future research. First, reliability of retrospective scales and nightmare logs should be studied and – if necessary – improved. Second, it is important to control for possible confounders like current stress levels, especially since the diary period always follows the period of the retrospective estimates. It would be interesting to study whether attitudes towards nightmares (e.g., cognitive avoidance) or other personality variables like conscientiousness are related to the questionnaire-dream log difference. Including other dream-related and non dream-related variables in the study would make sense (see the findings of the present study). It could also be tested to see whether retrospective measures of nightmare frequency are mood-dependent, e.g., by inducing a more negatively toned mood compared to a control condition. Another interesting approach would be to use retrospective measures that include a period in which the participant has kept a diary and compare these data to those from participants who did not keep a diary. This might help to find out whether retrospective reports or logbooks are more accurate regarding the "true" nightmare frequency or whether the truth is somewhere in-between.

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