J. Sleep Res. (2008) 17, 132–139

doi: 10.1111/j.1365-2869.2008.00649.x

Measuring nightmare and bad dream frequency: impact of retrospective and prospective instruments

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Accepted in revised form 29 January 2008; received 20 July 2007

SUMMARY Studies on nightmare frequency have yielded inconsistent results. We compared the frequency of nightmares and bad dreams obtained with retrospective methods (annual and monthly estimates) and with two types of prospective measures (narrative and checklist logs). Four hundred and eleven participants completed retrospective estimates of nightmare and bad dream frequency and recorded their dreams in either narrative or checklist logs for 2–5 weeks. When measured prospectively with narrative logs, nightmare frequency was marginally higher than the 1-year estimate ($P = 0.057$) but not significantly different from the 1-month estimate ($P > 0.05$). Prospective bad dream frequency was significantly greater than the two retrospective estimates ($ps < 0.0005$). There were no significant differences in the frequency of nightmares and bad dreams reported prospectively with narrative versus checklist logs ($ps > 0.05$). However, checklist logs yielded a significantly greater number of everyday dreams per week ($P < 0.0001$). Taken together, the results provide partial support for the idea that when compared to daily logs, retrospective self-reports significantly underestimate current nightmare and bad dream frequency. Prospective studies of dream recall and nightmare frequency should take into account the type of log used, its duration, and the participants' level of motivation over time.

KEYWORDS bad dreams, dream recall, measurement, nightmare, nightmare frequency

Student- and community-based studies indicate that 8–29% of adults report monthly nightmares while 2–6% report weekly nightmares (Belicki and Belicki, 1986; Blagrove *et al*., 2004; Feldman and Hersen, 1967; Hublin *et al*., 1999; Janson *et al*., 1995; Levin, 1994; Mirò and Martinez, 2005; Ohayon *et al*., 1997; Wood and Bootzin, 1990; Zadra and Donderi, 2000). Most of the research on nightmares has focused on the association between nightmare frequency and measures of psychopathology. Most studies have found a positive relation between these variables, but results have varied greatly in magnitude (e.g., Berquier and Ashton, 1992; Blagrove *et al*., 2004; Haynes and Mooney, 1975; Hersen, 1971; Levin, 1998; Levin and Fireman, 2002b; Mindell and Barrett, 2002; Nguyen *et al*., 2002; Schredl, 2003; Schredl *et al*., 1996, 2003; Zadra and Donderi, 2000), and some studies find no relation (Chivers and Blagrove, 1999; Mirò and Martinez, 2005; Wood and Bootzin, 1990).

Inconsistent findings in the field of nightmare research can be attributable to several factors. Three central issues concern the need to differentiate nightmare distress from nightmare frequency, how nightmares are defined, and how nightmare frequency is measured (Blagrove and Haywood, 2006; Levin and Fireman, 2002b; Levin and Nielsen, 2007; Schredl, 2002; Spoormaker *et al*., 2006; Zadra and Donderi, 2000). Examples of how measurement method can affect relationships between key variables include the study of Wood and Bootzin (1990) who found that the magnitude of the association between trait anxiety and nightmare frequency decreased from 0.13 to 0.04 when daily logs were used to measure nightmare frequency instead of retrospective self-reports. Similarly, Mirò and Martinez (2005) found a significant relationship between nightmare frequency and depressive mood when nightmares

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were assessed daily but not when they were measured monthly. The present study focuses on the measurement of nightmare frequency while taking into account recent developments in the operationalization of nightmares.

Traditionally, nightmare frequency has been assessed with retrospective questionnaires that require participants to estimate the number of nightmares experienced in the past. Response scales used in such questionnaires can take different forms, including binary, nominal, ordinal, and open-ended choices (see Levin and Nielsen, 2007 for a review). Moreover, variations exist within each of these categories. For example, retrospective measures using nominal scales can range from three anchors (Thoman, 1997) to eight anchors (Schredl *et al*., 2001). Retrospective measures using ordinal scales vary from four choices (*0 times per month, 1–2 times per month, 3–9 times per month, 10 times per month*) (Haynes and Mooney, 1975) to eight choices (*never, less than once a year, once a year, 2–4 times per year, once a month, 2–3 times per month, once a week, several times a week*) (Schredl, 2003; Schredl and Erlacher, 2004; Schredl *et al*., 2003). The same variability is found in interval scales whereas open-ended choices are relatively homogeneous (e.g., How many nightmares do you recall per month?). Irrespective of the chosen response scales, retrospective reporting of dream recall frequency can be negatively affected by response biases including those stemming from one's attitudes towards dreams (e.g., Beaulieu-Prévost and Zadra, 2005a,b) as well as possible memory failures.

Wood and Bootzin (1990) were the first to use daily logs in addition to retrospective measures to assess nightmare frequency. Prospective daily logs are now considered the gold standard for the measurement of nightmare frequency (Levin and Nielsen, 2007) and are used by an increasing number of researchers even though they require a greater investment of time and resources. One of the more frequently reported findings from these investigations is that when compared with results from daily home logs, retrospective self-reports underestimate current nightmare frequency by a factor of 2.5 to 10 (Blagrove *et al*., 2004; Salvio *et al*., 1992; Wood and Bootzin,1990; Zadra and Donderi, 2000). Moreover, the study by Zadra and Donderi (2000) showed that the underestimation of nightmare frequency was not simply the result of an increase in recalled dreams caused by keeping a dream log, as the underestimation of nightmare frequency greatly exceeded that of normal dream recall and of other types of dreams. However, some studies have found that retrospective estimates of nightmare frequency actually overestimate log-based frequency measures (Pietrowsky and Köthe, 2003; Wood *et al*., 1992).

Although methodological shortcomings associated with retrospective estimates of dream recall and nightmare frequency are increasingly recognized, variations in prospective logs have received little to no attention. Prospective logs vary in duration, and more importantly can take two different forms. First, the checklist format in which participants indicate if there was dream recall and if so, the number and type of dreams recalled. Secondly, the narrative log, in which participants are requested to provide a complete written transcript of each dream recalled. A summary of the duration and type of prospective measures of nightmare frequency reported in the literature is presented in Table 1.

Nightmare frequency data from retrospective reports have been systematically compared with prospective checklist logs but never to narrative logs. Thus, we do not know if narrative logs, with their greater time commitment and need for detailed attention to recalled material yield higher nightmare frequencies in comparison with retrospective reports to the same extent as do checklist logs.

The overall aim of the present study was to clarify these questions by comparing frequency data obtained with different measurement instruments. Consistent with recent findings and recommendations (American Sleep Disorders Association., 2005; Levin and Nielsen, 2007; Zadra *et al*., 2006), nightmares (very disturbing dreams in which the unpleasant visual imagery and/or emotions wake up the sleeper) were differentiated from bad dreams (very disturbing dreams which, though being unpleasant, do not cause the dreamer to awaken) and the frequency of each was tabulated separately. Our first goal was to compare retrospective estimates of nightmare and bad dream frequency with prospectively obtained frequencies. Open-ended questions were used for retrospective estimates and both checklist and narrative logs were used to collect prospective data. We hypothesized that retrospective reports would underestimate nightmare and bad dream frequency compared with frequency data obtained by both types of prospective daily logs. Our second goal was to compare nightmare and bad dream frequency data obtained with checklist versus narrative type logs. As narrative logs require a greater time investment and attention to recalled details, we hypothesized that they would yield higher nightmare and bad dream frequencies than checklist logs.

METHOD

Participants

Participants were undergraduate students, primarily Caucasians, recruited as non-paid volunteers from the same psychology class between 2000 and 2006. Prospective participants were informed that the study concerned the relation between dreams and measures of personality and well-being and that we were interested in both high and low dream recallers and in all types of dreams. Those interested by the study were provided with the required materials and detailed instructions at the beginning of their class. Five-hundred and eighty three students expressed interest in the study, and 411 completed the study (363 women, 48 men; mean age = 22.9 ± 5.2 years). Female to male ratio of 7 : 1 was consistent with the average 6 : 1 sex ratio observed in class enrollment.

Procedure

Participants completed two research protocols. The first protocol contained a 72-item Sleep & Dream Questionnaire

Table 1 Type and duration of prospective measures of nightmare frequency

Log type	*Reference*	*Duration*	*Retrospective measure*	*Estimated nightmare frequency prorated to 1 year*	*Log nightmare frequency prorated to 1 year*	*% Underestimation*
Checklist	Blagrove *et al.* (2004)	2 weeks	Yes; open-ended	19.44 ± 26.28 (1 month)	23.66 ± 38.48	+25%
	Chivers and Blagrove (1999)	2 weeks	No	NA	41.7 ± 54.6	NA
	Krakow *et al.* (2002)	2 weeks	Yes; rating scale	NA	NA	Not specified
	Levin and Fireman (2002a,b)	3 weeks	Yes; rating scale	NA	18.2 ± 25.48 (low nm) – 88.92 ± 73.49 (high nm)	Not specified
	Pietrowsky and Köthe (2003)	4 weeks	Yes; open-ended	4.29 ± 1.17 (occ nm sufferers) – 65.39 ± 11.96 (frequent nm sufferers) (4 weeks) 1.3 ± 0.16 (occ)–35.20 ± 5.15 (frequent) (1 year)	2.21 ± 1.04 (occ) – 49.01 ± 6.5 (frequent)	–44% to + 70%
	Salvio *et al.* (1992)	2 weeks	Yes; open-ended	1.2 (elderly) – 9.3 (students) (SD = NA)	15.29 (elderly) – 23.63 (students) (SD = NA)	+1175%
	Wood *et al.* (1992)	3 weeks	Yes; open-ended	13 – 56.68 (SD = NA)	26 – 53.04 (SD = NA)	–14% to + 100%
	Wood and Bootzin (1990)	2 weeks	Yes; open-ended	12.36 ± 24.0 (1 month) 12.37 ± 7.65 (1 year)	23.63 ± 36.66	1 month: +91% 1 year: +150%
	Zadra and Donderi (2000)	1 month	Yes; open-ended	4.21 ± 7.34 (1 year) 5.76 ± 10.56 (1 month)	11.04 ± 15.24	1 month: +92% 1 year : +162%

NA, not applicable; nm, nightmares.

and several measures of personality and well-being which were included as part of a separate study. Four open-ended questions from the Sleep & Dream Questionnaire required the participants to estimate the number of nightmares and bad dreams they had experienced over the previous year and month. These questions served as the 12-month and 1-month retrospective self-report measures of incidence.

The second research protocol began immediately after the completion of the first and required participants to record all remembered dreams upon awakening on the daily dream log provided for two to five consecutive weeks. The minimal duration of the log was set for 2 weeks as this is minimal requirement for obtaining acceptable stability in the study of dream recall frequency (Schredl and Fulda, 2005). Depending on the cohort, participants completed either a narrative or checklist dream log. Participants completing a narrative log (n = 193) were instructed to provide a complete written description for each remembered dream. Participants completing a checklist dream log (n = 218) had to indicate in the appropriate space if one or more dreams were recalled and to provide a brief title for each dream. Both the narrative and checklist logs required participants to report each dream's main emotion (if any), to rate the emotion's intensity on a 5-point scale, and to note whether the dream was a lucid dream, a nightmare, a bad dream, or a flying dream. Participants were given definitions of a flying dream, a lucid dream, a bad dream, a nightmare, and a sleep terror. Nightmares were defined as very disturbing dreams in which the unpleasant visual imagery and/or emotions *wake you up* (i.e., the dream's unpleasant content woke you up while the dream was still ongoing). Bad dreams were defined as very disturbing dreams which though being unpleasant *do not awaken you* (e.g., you feel that the dream occurred earlier in the night prior to your awakening, you remembered it only after being awakened by external factors such as your alarm clock, or you only remembered the dream later during the day). Participants also received instruction sheets detailing all the pertinent definitions and the procedures to follow for completing the dream logs. If no dreams were recalled on a given day, participants were still required to complete a dream record sheet by indicating the date and noting the absence of any dream recall. Thus, the two types of logs differed only as to whether or not a complete narrative was provided for each remembered dream and both types of logs were completed on a daily basis regardless of whether or not a dream was recalled. Participants completed the questionnaires and dream logs at homes. All participants were identified by an alphanumerical code on all documents to preserve their anonymity.

RESULTS

Nine participants were excluded from the nightmare frequency data as they gave non-quantitative responses on either the 1-month or 12-month retrospective estimates (e.g., answering 'many' or 'over 20') and 24 were excluded because at least one of their frequency values was over 3.29 standard deviations (SD)

above the mean, thereby affecting the validity of the planned statistical analyses (Tabachnick and Fidel, 1996). Sixteen participants were excluded from the bad dream data because of non-quantitative responses on one of the retrospective estimates and 25 excluded because at least one of their frequency scores was over 3.29 SDs above the mean. To examine if the exclusion of the outliers affected the results, we first transformed their scores by assigning them a frequency score equivalent to the ninety-five percentile plus an increment of one for each successive outlier (Tabachnick and Fidel, 1996). We then carried out our analyses both with and without data from these participants and found no major changes in overall result patterns or in the levels of significance attributed to the findings. The results presented for nightmare frequency are thus based on a total of 378 participants (181 of which completed a narrative log and 197 a checklist log) and those for bad dream frequency on 370 participants (179 of which completed a narrative log and 191 a checklist log). As no significant differences in either nightmare or bad dream frequency were found between men and women on retrospective or dream log measures, their data were combined for all analyses.

The duration of prospective logs ranged from 14 to 35 days with a mean of 26.7 days (SD = 7.4) for all participants. The duration of the narrative logs (23.2 ± 5.9 days) was significantly shorter than that of the checklist logs [30.1 ± 7.1 days; $t(349) = 9.79$, $P < 0.0001$]. Overall dream recall frequency data (i.e., inclusion of all recalled dreams) was examined as a function of log type. A significantly greater number of dreams per week was reported on average by the checklist log group (5.8 ± 3.3) than by the narrative log group [4.1 ± 2.3; $t(349) = 5.5$, $P < 0.0001$]. The internal consistency (Chronbach's alpha) for each diary measure was computed for up to 28 consecutive days (Schredl and Fulda, 2005). The narrative logs' internal consistency increased over time from 0.493 (7 days) and 0.667 (14 days) to 0.750 (21 days) and 0.803 (28 days), respectively. The checklist logs resulted in comparable values of 0.442 (7 days), 0.695 (14 days), 0.797 (21 days), and 0.852 (28 days).

To investigate possible effects of participants' motivation in completing either the narrative or checklist logs over time, the mean number of dreams reported per participant per week was examined across the first 3 weeks for both types of logs. There was no significant interaction effect between log type and dream recall as a function of time. There was a significant time effect on the mean number of dreams reported per week [$F(2, 286) = 20.8$, $P < 0.001$]. Bonferroni *post hoc* comparisons revealed significant differences between participants' mean dream recall reported in week 1 versus week 2 as well as between week 1 and week 3 ($ps < 0.001$) but no significant differences between weeks 2 and 3 were observed. Virtually identical results were obtained when data were examined with the sample having completed 4-week logs.

Correlations between log duration (in days) and the mean number of dreams, nightmares and bad dreams reported per week were examined. The mean number of dreams reported was positively correlated with the duration of the checklist logs ($r = 0.165$, $P < 0.05$) but showed a negative association with the duration of the narrative logs ($r = -0.231$, $P < 0.01$). These correlations, however, reveal small effects and no statistically significant relations were found between the duration of the two types of logs and either nightmare or bad dream frequency.

Prevalence of nightmares and bad dreams

Nightmare and bad dream data from the 1-year- and 1-month retrospective measures were first analyzed for all participants. On the 1-year retrospective measure, the mean number of nightmares reported per year was 5.9 (SD = 8.3) and the mean number of bad dreams was 15.8 (SD = 16.5). One hundred and forty three of the participants (38%) reported one or more nightmares on the 1-month retrospective report and 269 (73%) reported one or more bad dreams. The mean number of nightmares reported for the previous month was 0.6 (SD = 0.9). Multiplying by 12 gives an estimated annual mean nightmare frequency of 7.2, an estimate 22% higher than the estimate obtained by the 12-month retrospective report. The effect size (ES) associated with this difference is 0.13. The mean number of bad dreams reported for the previous month was 1.9 (SD = 1.9), which is 44% higher than the estimate obtained by the 12-month retrospective report (ES = 0.35).

Of the 378 participants, 137 (36.2%) included for the nightmare frequency data reported at least one nightmare in the daily prospective logs and 242 of the 370 participants (65.4%) included for the bad dream frequency data reported at least one bad dream. As in previous studies (Wood and Bootzin, 1990; Zadra and Donderi, 2000), the log-based nightmare and bad dream frequency data was prorated to 1 year to facilitate direct comparisons of prospective and retrospective measures. The mean annual number of nightmares and bad dreams reported in the narrative versus checklist logs as well as the two groups' retrospective frequency estimates is presented in Table 2. The mean number of nightmares reported in the narrative logs is 6% lower than the 1-month retrospective estimate (ES = 0.06) and 36% higher than the 1-year retrospective estimate (ES = 0.14). By comparison, the mean number of nightmares reported in the checklist logs is 16% higher than the 1-month retrospective estimate (ES = 0.08) and 20% higher than the 1-year retrospective estimate (ES = 0.10). The mean number of bad dreams reported in the narrative logs is 14% higher than the 1-month retrospective estimate (ES = 0.09) and 72% higher than the 1-year retrospective estimate (ES = 0.43). By comparison, the mean number of bad dreams reported in the checklist logs is 25% higher than the 1-month retrospective estimate (ES = 0.10) and 67% higher than the 1-year retrospective estimate (ES = 0.35).

A 2 × 3 ANOVA with one independent factor (group: narrative versus checklist) and one repeated measure of nightmare frequency (1-year estimate, 1-month estimate pro-rated to 1 year, log-based frequency pro-rated to 1 year) was

Table 2 Mean number of nightmares and bad dreams reported per year

	Type of log	
	Narrative	*Checklist*
Measure		
Log – nightmare	8.8 ± 14.3	8.7 ± 15.5
1-year estimate – nightmare	7.1 ± 10.1	7.3 ± 11.7
1-month estimate – nightmare	9.7 ± 13.6	7.5 ± 12.9
Log – bad dream	27.0 ± 28.9	29.8 ± 38.4
1-year estimate – bad dream	16.5 ± 19.0	18.9 ± 20.7
1-month estimate – bad dream	24.5 ± 26.0	26.3 ± 30.4

n = 188 for narrative nightmare data; n = 206 for checklist nightmare data; n = 185 for narrative bad dream data; n = 199 for checklist nightmare data.

performed to investigate interaction and main effects. There was no significant interaction effect between the type of log and measures of nightmare frequency and no significant main effect on the type of log (*ps* > 0.05). There was a statistically significant effect on type of frequency measure [$F(2, 376) = 39.27$, $P < 0.05$], but the effect size was small (0.01). Bonferroni *post hoc* analyses revealed that the 1-year retrospective estimate was significantly smaller than the 1-month estimate ($P < 0.05$) and marginally different from the log measure ($P = 0.057$) while the 1-month estimate was not significantly different from the log measure ($P > 0.05$). The same analyses were performed for the bad dream frequency data. There was no significant interaction effect between the type of log and measures of bad dream frequency and no significant main effect for type of log, (*ps* > 0.05). There was a statistically significant effect for type of frequency measure [$F(2, 368) = 34.75$, $P < 0.0005$]. The effect size was 0.086, or moderate. Bonferroni *post hoc* analyses revealed that all three frequency measures were significantly different from one another. The 1-year retrospective estimate was significantly smaller than both the 1-month and log measure (*ps* < 0.0005) while the 1-month estimate was significantly smaller than the log measure ($P < 0.05$).

Figures 1 and 2 show a comparison of the results obtained in this study (both types of logs combined) on the estimated

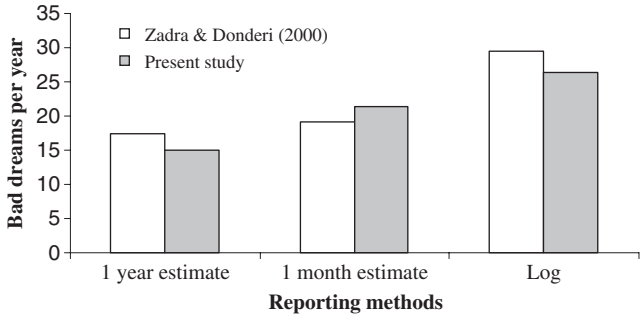

Figure 1. Estimated mean number of bad dreams per year as related to reporting method.

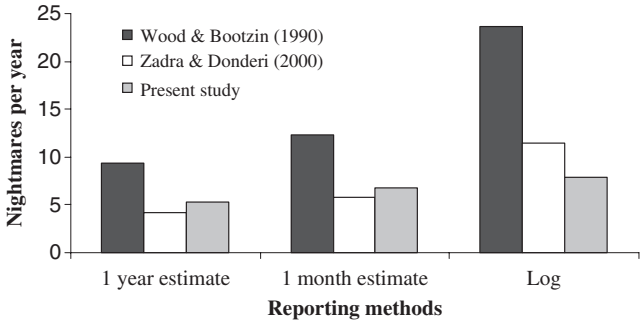

Figure 2. Estimated mean number of nightmares per year as related to reporting method.

mean number of nightmares and bad dreams per year for the three reporting methods with the results reported by Zadra and Donderi (2000) and Wood and Bootzin (1990), wherein the subjects' nightmares were a combination of nightmares and bad dreams as defined in our study. As can be seen from these graphs, the overall pattern of underestimation for nightmares and bad dreams in the present study is consistent with the findings reported by Wood and Bootzin as well as by Zadra and Donderi.

DISCUSSION

The overall aim of this study was to compare nightmare and bad dream frequency data obtained with two types of prospective dream logs (narrative and checklist) and two retrospective estimates (1-year and 1-month). The results from both types of prospective logs indicate that retrospective measures underestimate nightmare and bad dream frequency, except for the 1-month retrospective estimate for nightmares which was not significantly different from the log frequency data. Our general results are consistent with those originally reported by Wood and Bootzin (1990) who concluded that nightmares are more prevalent than was previously believed and with Zadra and Donderi's (2000) finding that bad dreams are even more prevalent than nightmares. The differences obtained in the present study, however are of lesser magnitude. Our results also support Zadra and Donderi's (2000) observation that when compared with 1-year retrospective measures of nightmare and bad dream frequency, 1-month retrospective estimates yield more accurate scores as the values obtained are considerably closer to prospectively obtained frequencies.

Based on their 4-week checklist log data, Zadra and Donderi (2000) noted that although the frequency of both nightmares and bad dreams are underestimated by retrospective measures, the underestimation was greater for nightmares. We obtained different results. Specifically, when checklist log data was compared with the 1-month retrospective estimate, the underestimation was lower for nightmares than it was for bad dreams (16% versus 25%). Comparing narrative log data to the 1-month retrospective estimate yielded opposite results: for nightmares, there was a slight overestimation (6%), whereas for bad dreams there was an underestimation (14%). When log

data was compared with 1-year retrospective estimate, the underestimation was greater for bad dreams than for nightmares (67% versus 20% for the checklist-log group; 72% versus 36% for the narrative-log group). These findings suggest that the degree of underestimation of nightmare frequency approached significance across different types of logs when the 1-year estimate is compared with log-based data, whereas the degree of underestimation of bad dream frequency is significant for both retrospective measures across both types of logs. Although not significant, the tendency for the 1-month nightmare retrospective measure to overestimate narrative log data adds to previous reports showing that people's retrospective estimates can yield overestimations of log-based nightmare frequency (Pietrowsky and Köthe, 2003; Wood *et al*., 1992). Our results are also consistent with the suggestion that nightmares and bad dreams are different manifestations of the same basic phenomenon (Levin and Nielsen, 2007; Zadra and Donderi, 2000), with nightmares representing a rarer but more severe expression. Specifically, participants' increased accuracy in estimating nightmare frequency as opposed to bad dream frequency may be related to the nightmare's greater saliency and rarer occurrence which renders the experience more easily retrievable from memory for retrospective frequency estimates. Why some individuals' retrospective assessments of nightmare frequency show greater accuracy than by others remains an open question. Variables likely involved in people's systematic tendency to overestimate or underestimate dream recall frequency include baseline levels of dream recall, attitude towards dreams (including one's interest in remembering dreams), and a process of selective attention (Beaulieu-Prévost and Zadra, 2005a,b, 2007).

Contrary to our second prediction, checklist logs and narrative logs (which require considerably greater participant involvement) yielded comparable nightmare and bad dream frequencies. Moreover, the recall of everyday dreams was significantly greater in the checklist logs (5.8 $\pm$ 3.3 dreams per week) than in the narrative logs (4.1 $\pm$ 2.3 dreams per week).

One question arising from the present findings is whether the differences between prospective and retrospective measures of nightmare and bad dream frequency results from an underestimation of the retrospective reports, from an increase in recall attributable to the prospective dream logs or to a combination of the two. It is widely accepted that keeping a dream log increases the attention that participants pay to their dreams, and it has been suggested that this in turn increases dream recall frequency (Schredl, 2002; Schredl and Montasser, 1996–1997). The comparison of narrative versus checklist log data in the present study allows us to explore the effect of this attentional bias on dream recall and helps clarify contradictory results reported in the literature. Specifically, Cohen (1969) reported that dream diaries yield higher dream recall frequencies than retrospective estimates but Schredl (2002) found no diary effect. This discrepancy may be accounted by the fact that Cohen's subjects completed checklist dream logs, whereas Schredl employed narrative logs. However, these results, although consistent, go against the idea that the greater the attention paid to one's dreams via a daily log, the greater the dream recall will be. So why does the least demanding type of log yield greater frequencies of general dream recall? A greater number of everyday dreams was reported by the checklist participants than by the narrative participants, whereas no such differences were found with respect to bad dreams and nightmares. This suggests that narrative-log participants having a more time consuming task, do not take the required time to provide a complete narrative of all of their recalled dreams. Instead, they may choose to focus on their more memorable, exciting or salient dreams, which would inevitably include nightmares and bad dreams. By comparison, people completing checklist logs is more likely to record all of their dreams (including relatively banal or poorly recalled ones) as each entry is just as quickly completed regardless of dream type. This hypothesis could be addressed by including a poststudy question on 'omitted dream reports,' particularly with narrative dream logs. Such data could help elucidate whether, as suggested by our results, checklist logs are more reliable than narrative logs in assessing everyday dream recall frequency whereas both types of logs are comparable to investigate nightmare and bad dream frequency. In addition, more work is needed on the test-re-test reliability of retrospective measures of dream recall as well as on the stability of prospectively assessed dream recall frequency for varying log durations (e.g., Schredl and Fulda, 2005).

A related issue which remains largely unexplored concerns potential order effects engendered by having participants to first complete retrospective estimates of dream recall frequency followed by prospective logs. It is possible that questionnaire items sensitize individuals to be over-responsive to their subsequent dream recall, particularly with respect to more salient or disturbing forms of dreaming. Our data on everyday dreams reveal little difference between conditions, but effects may vary across specific types of dreams. For instance, Zadra and Donderi (2000) found that when compared with checklist log data, people's retrospective estimates of flying dreams and lucid dreams, two types of salient but typically positive dream experiences were fairly accurate relative to the underestimation that characterizes estimates of nightmares and bad dreams. Counterbalancing retrospective and prospective measures of everyday dream recall and of specific dream experiences would help address this issue.

A third question which merits further investigation is the extent to which keeping a narrative log increases one's dream recall over time in comparison to checklist logs. In spite of equivalent instructions at the study's outset, our checklist log group completed their prospective daily dream logs for a significantly longer period of time than the narrative log group, and the latter reported a lower mean number of dreams per week. It is possible that when compared to participants completing a checklist log, the level of motivation of the participants completing narrative logs was negatively affected by increases in dream recall and/or the duration of the study. However, we found no significant interaction effects between log type and mean number of dreams reported as a function of

time. In fact, both logs revealed a peak level of dream recall in the first week followed by a lower but stable recall during subsequent weeks. Prospective dream logs may very well increase people's baseline dream recall frequency (Schredl and Montasser, 1996–1997), but additional work is required to clarify this effect as a function of the type of log completed.

To summarize, the results generally support previous findings indicating that retrospective self-reports underestimate prospectively assessed nightmare and bad dream frequency. However, the comparison of checklist versus narrative prospective logs underscores the importance for future studies to consider and actively investigate the impact of the log's actual format and duration on general dream recall, on the types of dreams and details reported, and on participants' overall motivation over time.

ACKNOWLEDGEMENTS

Research supported by a grant to A. Zadra from the Social Sciences and Humanities Research Council of Canada.

REFERENCES

American Sleep Disorders Association. *International Classification of Sleep Disorders, Version 2 (ICSD-2)*. American Sleep Disorders Association, Rochester, MN, 2005.

Beaulieu-Prévost, D. and Zadra, A. Dream recall frequency and attitude towards dreams: a reinterpretation of the relation. *Pers. Individ. Dif.*, 2005a, 38: 919–927.

Beaulieu-Prévost, D. and Zadra, A. How dream recall shapes people's beliefs about the content of their dreams. *North Am. J. Psychol.*, 2005b, 7: 253–264.

Beaulieu-Prévost, D. and Zadra, A. Absorption, psychological boundaries and attitude towards dreams as correlates of dream recall: two decades of research seen through a meta-analysis. *J. Sleep Res.*, 2007, 16: 51–59.

Belicki, K. and Belicki, D. Predisposition for nightmares: a study of hypnotic ability, vividness of imagery, and absorption. *J. Clin. Psychol.*, 1986, 42: 714–718.

Berquier, A. and Ashton, R. Characteristics of frequent nightmare sufferer. *J. Abnorm. Psychol.*, 1992, 101: 246–250.

Blagrove, M. and Haywood, S. Evaluating the awakening criterion in the definition of nightmares: how certain are people in judging whether a nightmare woke them up? *J. Sleep Res.*, 2006, 15: 117–124.

Blagrove, M., Farmer, L. and Williams, E. The relationship of nightmare frequency and nightmare distress to well-being. *J. Sleep Res.*, 2004, 13: 129–136.

Chivers, L. and Blagrove, M. Nightmare frequency, personality and acute psychopathology. *Pers. Individ. Dif.*, 1999, 27: 843–851.

Cohen, D. B. Frequency of dream recall estimated by three methods and related to defence preference and anxiety. *J. Consult. Clin. Psychol.*, 1969, 33: 661–667.

Feldman, M. and Hersen, M. Attitudes toward death in nightmare subjects. *J. Abnorm. Psychol.*, 1967, 72: 421–425.

Haynes, S. N. and Mooney, D. K. Nightmares: etiological, theoretical, and behavioral treatment considerations. *Psychol. Rec.*, 1975, 25: 225–236.

Hersen, M. Personality characteristics of nightmare sufferers. *J. Nerv. Ment. Dis.*, 1971, 153: 27–31.

Hublin, C., Kaprio, J., Partinen, M. and Koskenvuo, M. Limits of self-report in assessing sleep terrors in a population survey. *Sleep*, 1999, 22: 89–93.

Janson, C., Gislason, T., De Backer, W., Plaschke, P., Bjornsson, E., Hetta, J., Kristbjarnason, H., Vermeire, P. and Boman, G. Prevalence of sleep disturbances among young adults in three European countries. *Sleep*, 1995, 18: 589–597.

Krakow, B., Schrader, R., Tandberg, D., Hollifield, M., Koss, M. P., Yau, C. L. *et al.* Nightmares frequency in sexual assault survivors with PTSD. *J. Anxiety Dis.*, 2002, 16: 175–190.

Levin, R. Sleep and dreaming characteristics of frequent nightmare subjects in a university population. *Dreaming*, 1994, 4: 127–137.

Levin, R. Nightmares and schizotypy. *Psychiatry*, 1998, 61: 206–216.

Levin, R. and Fireman, G. Phenomenal qualities of nightmare experience in a prospective study of college students. *Dreaming*, 2002a, 12: 109–120.

Levin, R. and Fireman, G. Nightmare prevalence, nightmare distress, and self-reported psychological disturbance. *Sleep*, 2002b, 25: 205–212.

Levin, R. and Nielsen, T. A. Disturbed dreaming, posttraumatic stress disorder, and affect distress: a review and neurocognitive model. *Psych. Bull.*, 2007, 133: 482–528.

Mindell, J. A. and Barrett, K. M. Nightmares and anxiety in elementary-aged children: is there a relationship?. *Child Care Health Dev.*, 2002, 28: 317–322.

Mirò, E. and Martinez, M. P. Affective and personality characteristics in function of nightmare prevalence, nightmare distress, and interference due to nightmares. *Dreaming*, 2005, 15: 89–105.

Nguyen, T. T., Madrid, S., Marquez, H. and Hicks, R. A. Nightmare frequency, nightmare distress, and anxiety. *Percept. Mot. Skills*, 2002, 95: 219–225.

Ohayon, M. M., Morselli, P. L. and Guilleminault, C. Prevalence of nightmares and their relationship to psychopathology and daytime functioning in insomnia subjects. *Sleep*, 1997, 20: 340–348.

Pietrowsky, R. and Köthe, M. Personal boundaries and nightmare consequences in frequent nightmare sufferers. *Dreaming*, 2003, 13: 245–254.

Salvio, M.-A., Wood, J. M., Schwartz, J. and Eichling, P. S. Nightmare prevalence in the healthy elderly. *Psychol. Aging*, 1992, 7: 324–325.

Schredl, M. Questionnaires and diaries as research instruments in dream research: methodological issues. *Dreaming*, 2002, 12: 17–26.

Schredl, M. Factors influencing the gender difference in dream recall frequency. *Imag. Cog. Pers.*, 2003, 22: 33–39.

Schredl, M. and Erlacher, D. Lucid dreaming frequency and personality. *Pers. Individ. Dif.*, 2004, 37: 1463–1473.

Schredl, M. and Fulda, S. Reliability and stability of dream recall frequency. *Dreaming*, 2005, 15: 240–244.

Schredl, M. and Montasser, A. Dream recall: state or trait variable? Part 1: model, theories, methodology and trait factors *Imag. Cog. Pers.*, 1996–1997, 16: 181–210.

Schredl, M., Pallmer, R. and Montasser, A. Anxiety in school-aged children. *Dreaming*, 1996, 6: 265–270.

Schredl, M., Kronenberg, G., Nonnell, P. and Heuser, I. Brief reports: dream recall, nightmare frequency, and nocturnal panic attacks in patients with panic disorder. *J. Nerv. Ment. Dis.*, 2001, 189: 559–562.

Schredl, M., Landgraf, C. and Zeiler, O. Nightmare frequency, nightmare distress and neuroticism. *North Am. J. Psychol.*, 2003, 5: 345–350.

Spoormaker, V. I., Schredl, M. and Van den Bout, J. Nightmares: from anxiety symptom to sleep disorder. *Sleep Med. Rev.*, 2006, 10: 19–31.

Tabachnick, B. G. and Fidel, A. S. *Using Multivariate Statistics*. HarperCollins College Publishers, New York, 1996.

Thoman, E. B. Snoring, nightmares, and morning headaches in elderly women: a preliminary study. *Biol. Psychol.*, 1997, 46: 275–284.

Wood, J. M. and Bootzin, R. R. The prevalence of nightmares and their independence from anxiety. *J. Abnorm. Psychol.*, 1990, 99: 64–68.

Wood, J. M., Bootzin, R. R., Rosenhan, D., Nolen-Hoeksema, S. and Jourden, F. Effects of the 1989 San Francisco earthquake on frequency and content of nightmares. *J. Abnorm. Psychol.*, 1992, 101: 219–224.

Zadra, A. and Donderi, D. C. Nightmares and bad dreams: their prevalence and relationship to well-being. *J. Abnorm. Psychol.*, 2000, 109: 273–281.

Zadra, A., Pilon, M. and Donderi, D. C. Variety and intensity of emotions in nightmares and bad dreams. *J. Nerv. Ment. Dis.*, 2006, 194: 249–254.