Nightmares are Associated with Greater Perceived Sleep Debt

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Number of words: 1950

Number of References: 15

Author Contributions:

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Nightmares and perceived sleep debt

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The authors declare no conflict of interest.

Abstract

Nightmares are intense emotional experiences that can greatly alter sleep quality and affect most people at some point in their lives. Yet little research has focused on the relationship between nightmares and the subjective experience of sleep quality. In this study, we aimed at investigating the relationship between nightmare frequency, subjective sleep duration, subjective estimation of sleep need and perceived sleep debt.

We found that nightmares are related to altered sleep need perception: frequent nightmare sufferers report the same amount of sleep as those who do not have nightmares, yet they are in a greater perceived sleep debt. That is, they believe they need more sleep than they are getting. This finding demonstrates the importance of clarifying the relationship between subjective sleep experiences and dysphoric dreaming in addition to and beyond normative metrics of sleep quality and duration.

Keywords: *nightmares, sleep quality, subjective sleep quality, perceived sleep debt*

1. Introduction

Subjective sleep experiences are only rarely assessed, with majority of sleep studies generally investigating sleep quantity or sleep architecture (Jain & Glauser, 2014; Ohayon et al., 2017). Sleep experiences, including nightmares, can significantly impact subjective sleep quality in addition to altering sleep architecture (Paul, Schredl, & Alpers, 2015). Further, it has been suggested that collectively we are experiencing an epidemic of “sleep deprivation”, with some scholars going as far as claiming that “we are chronically sleep deprived” (Bonnet & Arand, 1995). This idea has previously been challenged (Harrison & Horne, 1996). Nevertheless, sleep deprivation is a trend of relevance to public health, affecting many aspects of physical health as well as mood and cognition (Killgore, 2010). Beyond measurable sleep indices, perceived sleep quantity and quality can also affect attitudes towards sleep and daytime functioning (Ode-Dusseau, Bradley, & Pilcher, 2010). There is likely an association between objective sleep quality and subjective estimates of sleep. For instance, one study found that half of participants desired more sleep, yet did not report increases in daytime sleepiness (Anderson & Horne, 2008).

Nightmares are a common and distressing phenomenon and are more prevalent in populations with documented levels of sleep deprivation (Lin et al., 2020). Although there is limited evidence that nightmares, along with dysfunctional beliefs without sleep, can increase suicidal ideation and worsen insomnia symptoms (McCall et al., 2013), many aspects of the relationship between nightmares and sleep experiences remains unclear. Research on the relationship between nightmares and perceived sleep quality and quantity is scarce. In this study we aimed to bridge the gap between studies of subjective sleep quality and studies of nightmares. In particular, our goal was to investigate the relationship between perceived sleep debt, subjective sleep quality and nightmare prevalence.

We suggest that the experience of distress caused by nightmares during sleep may lead to a subsequent experience of inadequate sleep quality as well as to a distorted perception of sleep. We therefore hypothesized that individuals with frequent nightmares will have an exaggerated perception of how much sleep they need, will report lower sleep duration as well as lower subjective sleep quality than those without nightmares.

2. Methods

Our online survey consisted of the Pittsburgh Sleep Quality Index (PSQI) (Buysse, Reynolds, Monk, Berman, & Kupfer, 1989), the novel Attitudes Towards Sleep Questionnaire (ATSQ) as well as in-house items collecting demographic and health information. The ATSQ is a new tool that is being piloted to account for first-person sleep experiences and for subjective estimates of sleep quality and quantity and how they affect quality of sleep.

2.1 Participants

A sample size of 218 people was recruited via social media networks such as Reddit and Facebook. The participants were aged 18-80, with a mean age of 30.4 (SD = 11.264). 135 (61.9%) identified as female, 66 (30.3%) identified as male and 10 (4.6%) of participants identified as nonbinary. 9 participants did not specify a gender. Most participants, 158 (73.4%) were white or of European descent and lived in the USA (n=96, 45.6%) and Canada (n=72, 33.02%).

2.2 Measures

Nightmares: To estimate nightmare frequency we used the PSQI item “How many nightmares did you have in the last week?” Participants were then sorted into two groups, those who have nightmares more than once a week (n=76, nightmare group, NM), and those who do not have nightmares on a weekly basis (n=136, control group, CTL).

Average Sleep Duration: Participants were asked to indicate the average amount of sleep they get on both weekends and weekdays. These were combined (weekdays * 5 + weekends * 2) to represent the average amount of sleep they got on a weekly basis.

Ideal Sleep (perceived sleep need): Participants were asked to indicate the maximum number of hours they thought they needed in a night to feel good. This was averaged over a week, (nightly ideal sleep * 7) to compute the ideal amount of sleep participants thought they needed per week.

Perceived Sleep Debt: We defined perceived sleep debt (PSD) as the difference between average and ideal sleep. This was calculated by subtracting ideal sleep from average sleep.

Subjective Sleep Quality: Participants filled out the PSQI survey and were asked to rate their quality of sleep on an average night. Sleep quality was scored on a Likert-type scale from 0-3 with 0 indicating good sleep quality and 3 indicating poor sleep quality.

2.3 Statistical Analyses

Because the data were not normally distributed, Mann-Whitney U tests were run to compare the NM and CTL groups across, average sleep duration, ideal sleep, PSD, and subjective sleep quality. Descriptive statistics were also computed across groups for average sleep duration, PSD, ideal sleep, and sleep quality. Spearman rho correlations were computed to describe the relationship between nightmare prevalence, PSD, ideal sleep, sleep quality, and average sleep duration.

3. Results

3.1 Group differences in relation to subjective sleep indices

There was a difference across groups with regards to ideal sleep and PSD. The NM group reported needing more hours of sleep per week ($M=71.9$, $SD=13.0$), than the CTL group ($M=67.4$, $SD = 9.7$, $W=4,050$, $p=0.014$). In contrast, both groups reported getting similar amounts of sleep on a weekly basis ($W=5,065$, $p=0.876$). Consequently, NM participants had a NM group ($M=26.1$, $SD = 16.9$) and 93% in CTL group ($M=19.0$, $SD=12.4$) reported being in PSD greater than 1 hour per week. As well, the NM group indicated a worse quality of sleep ($W=4,117$ $p=0.008$) than the CTL group. Full results are presented in Table 1 and Figure 1

Table 1. NM and CTL Group Descriptive Statistics and Group Differences Across Sleep Indices

	Group	N	Mean	SD	SE	W	p
Week Average	CTL	135	51.8	8.6	0.7	5,065	0.867
	NM	74	51.5	12.5	1.5		
Ideal Sleep	CTL	133	67.4	9.7	0.8	4,050	0.014*
	NM	76	72.0	13.0	1.5		
PSD	CTL	131	19.0	12.4	1.1	3,685	0.002**
	NM	76	26.1	16.9	1.9		
Sleep Quality	CTL	135	1.2	0.7	0.1	4,117	0.008**
	NM	76	1.4	0.7	0.1		

Note. NM=nightmare group, >1 nightmare/week; CTL=control group, <1 nightmare/week

Note. Mann-Whitney U test. P-values are across NM and CTL groups.

* $p<.05$; ** $p<.01$

3.2 Correlations between nightmare frequency and subjective sleep indices

Positive correlations were observed between nightmare frequency and ideal sleep ($r(205) = 0.170$, $p = 0.017$), nightmare frequency and sleep quality ($r(207) = 0.194$, $p < 0.001$), nightmares and PSD ($r(203) = 0.230$, $p < 0.001$) and PSD and poor sleep quality ($r(205) = 0.390$, $p < 0.001$). Lastly there was a negative correlation between average hours of sleep per week and sleep quality ($r(206) = -0.341$, $p < 0.001$). See Figure 2.

Figure 1: Mann-Whitney U test Raincloud Plots for NM and CTL groups

- a) Average weekly sleep for NM and CTL groups
- b) Ideal sleep differences for NM and CTL groups
- c) PSD differences for NM and CTL groups
- d) Subjective sleep quality score differences for NM and CTL groups

* $p < 0.05$, ** $p < 0.01$

PSD=perceived sleep duration; WeekAvg = average sleep hours per week

Figure 2. Heatmap showing spearman-rho correlation coefficients between sleep indices

Note: Purple indicates a positive correlation, red indicates a negative correlation and white indicates no statistically significant correlation.

* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

PSD = perceived sleep debt; Week Average = average hours of sleep per week

4. Discussion

Of the participants who completed our survey, those with frequent nightmares reported needing more sleep per night than those without nightmares. Yet on average, those with

nightmares did not report getting any less sleep per night than those without. Both those with and without nightmares were in a “perceived sleep debt” – that is they believe they need more sleep than they get. However, nightmare sufferers are in greater perceived sleep debt than control participants, entailing a potentially dysphoric perception of sleep. It has previously been shown that nightmares can cause sleeping difficulties beyond just “getting less sleep”. The present study further supports that idea by showing having more nightmares can lead to a greater subjective estimate of sleep need.

4.1 Perceived Sleep Debt and Sleep Quality

In this paper we introduce the notion of the “perceived sleep debt” as a new way at looking at subjective components of the experience of sleep deprivation. 99% of NM participants and 93% of CTL participants are in some sort of perceived sleep debt; they believe they need more sleep than they get, even when they are getting an objectively normal amount of sleep. This is in line with Anderson and Horne (2008) who found that half of the participants in their study reported needing more sleep, yet they did not indicate an increase in daytime sleepiness. Moreover, few people chose to sleep more when offered a waking alternative. Further, a relationship between perceived sleep debt and lower subjective sleep quality was also observed. This exemplifies the interrelationship between perceived sleep quantity and quality. Those with a lower subjective sleep quality may develop beliefs that they may need more sleep to compensate? for their negative sleep experience.

4.2 Nightmares and Sleep Perceptions

It is well-documented that nightmare experiences can cause psychological distress, disruption of normal life activities and can impact sleep quality (Belicki, 1992). Nightmares have also been associated with insomnia (McCall et al., 2013), and greater sleep deprivation (Lin et al., 2020). It was therefore unexpected that those with frequent nightmares reported getting the same amount of sleep as the control group, suggesting that nightmares did not influence sleep quantity in our sample. However, we found an association between nightmares and perceived sleep debt: individuals suffering from nightmares on a weekly basis reported higher perceived sleep debt, and the number of nightmares per week positively correlated with higher perceived sleep debt. Further, those with frequent nightmares rated their subjective sleep quality as worse

than those without. These results suggest that nightmare sufferers, have an overall more dysphoric relationship with sleep: they experience their sleep as being of lower quality, and they believe that they need significantly more sleep than they do. Despite preliminary evidence that nightmares do not have a large impact on sleep architecture, (Paul et al., 2015), they still seem to have an effect on perceived quality of sleep. While there is considerable variability in individual sleep need, it is not currently known whether nightmare sufferers may benefit from longer sleep duration. In fact, most intense and dysphoric dreams tend to happen during the last REM sleep period later in the morning (Nielsen, 2004) thus longer sleep may increase the likelihood of nightmares. On the other hand, earlier morning awakenings may temporarily decrease nightmare frequency, but may ultimately increase REM sleep debt (Nielsen et al., 2005) and overall allostatic load (McEwen & Karatsoreos, 2015), which can potentially lead to nightmare formation. It is unclear whether nightmare sufferers have a worse objective quality of sleep, or if they have negative sleep experiences and therefore misjudge their sleep quality to be poor. Thus, the relationship between nightmare frequency and perceived sleep need may reflect an underlying dysregulation of sleep perception and sleep quality in nightmare sufferers more broadly. These are issues future research should investigate.

4.3 Limitations and Conclusions

This is the first study showing a relationship between nightmare frequency and perceived sleep debt. Our hypothesis, those with frequent nightmares will have an exaggerated perception of how much sleep they need, will report lower sleep duration, and lower subjective sleep quality than those without nightmares; was partially confirmed. We found nightmare sufferers did have an exaggerated perception of the amount of sleep they need, and had a worse subjective sleep quality, yet they did not report a shorter sleep duration. Our results highlight the importance of investigating subjective measure of sleep quality and quantity in contrast and in addition to objective measures.

Our study was performed on an online self-selected sample, with a relatively small sample size; therefore, the generalizability of our results may be limited. More work is needed to disentangle different aspects of perceived sleep, including sleep perceived sleep debt, sleep-state misperception, and markers of hyperarousal in nightmare sufferers.

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