

Exploring the relationship between mood, bad dreams and nightmares

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## Preface

I would like to thank my main supervisor, professor Wei Wang, for leading the project and providing us with ideas of inspiration when formulating research questions and for providing us with the Nightmare Experience Questionnaire. I would also like to thank our secondary supervisor, senior lecturer Torhild Anita Sørengaard, for her necessary contribution in processing and organizing the raw data into manageable datasets, and for guiding and helping us through a complex project. Finally, I'd like to give a special thanks to our student assistants, Tiffany Lussier and Eline Eyde Lüder-Larsen, for their continual hard work in making this project possible.

## Abstract

The aim of this study was to explore the relationship between self-reported mood before bedtime, and bad dreams and nightmares. Firstly, there was an interest in whether reports of lower mood were associated with higher frequencies of bad dreams and nightmares. Secondly, whether reports of lower mood before bedtime was associated with reports of more negative emotional content in the nightmare. And lastly, whether reports of lower mood before bedtime was associated with reports of more physical impairment due to the nightmare. While the literature clearly confirms a higher prevalence of nightmares and bad dreams in cases of psychological disorders, few studies have investigated the mediating role of mood in the general population. Through an online survey that lasted 28 days, participants reported their mood prior to bedtime and any experience of bad dreams or nightmares. To assess the emotional content within the nightmare and the physical impairments thereof, the Nightmare Experience Questionnaire was used. Small significant correlations were found between mood and bad dream and nightmare frequency. Additionally reports of lower mood was associated with reports of higher scores in nightmare-induced loss of appetite. Based on the analysis of the data gathered, we have little to no evidence to confirm or deny any of the three hypotheses set for this project. The causes of these results are discussed mainly with regards to the design features of this project. The implications these results bear for future research is first and foremost that we need more research on the relationship between the interplay between mood, bad dreams and nightmares.



## 1. Introduction

A dream might give you the most wonderful experience of euphoria, spectacular feelings of regularity, or the most dreadful feeling of anxiety and hopelessness. They span from sexual dreams, through regular bland dreams, to bad dreams and nightmares. They're concrete, abstract, meaningful, or meaningless – and often a good mix in-between. How we interpret, perceive and experience the different flavors of this altered conscious experience is in the field of dream-research subject to an array of interesting explanations. Regarding bad dreams and nightmares, the most clear-cut dynamic we know of can be found in its relationship to PTSD (Levin & Nielsen, 2007; Ağargün et al., 1998). Here, nightmares are seen as a necessary symptom for the diagnosis of PTSD, stemming from a broad range of plausible traumatic events, ranging from combat exposure to natural disasters (Neyland et al., 1998; Mellman et al., 1998) Furthermore, other psychiatric disorders like depression and anxiety have also shown an increase in nightmare prevalence (Ağargün 1998; Mume, 2009). As of late, this continuous tendency has also been noted by Solomonova and colleagues (2021) linking an upsurge in nightmare frequency with higher levels of stress, depression, and anxiety from the onset of COVID-19. Some findings even suggest that bad dreams and nightmares in and of themselves may exacerbate or trigger increased stress response (Garcia et al., 2021) and contribute to daytime distress (Levin & Fireman, 2002; Gieselmann et al., 2020) – all in all suggesting a bidirectional relationship. These findings propose that the contents and frequency of our dreams somewhat map on to personally and emotionally significant experiences, as well as the overall state of our psychological well-being. Seen as though individuals are known to differ in their susceptibility to negative and positive environmental influences, more research is warranted addressing the relationship between waking and sleeping states (Belsky & Pluess, 2009).

### *1.2 Sleep cycles and dreams*

During sleep our brain goes through multiple sleep cycles. A cycle is built up of distinct stages, each with its own unique electrical signature which we can measure using electroencephalography (EEG). These electrical signatures, referred to as brain waves, are what give substance to the phases called rapid eye movement sleep (REM) and the three non-rapid eye movement sleep phases (NREM 1-3). We typically go through four to six sleep cycles in one night. Most of our dreams occur during REM sleep as brain activity is nearing

the activity of a wakeful brain, although some dreams may occur with higher emotional intensity and less vivid content as one progress through NREM phases (Aru, Siclari, Phillips & Storm, 2020).

### *1.3 Nightmares, bad dreams, and night terrors*

What separates a nightmare from a bad dream is not that easy to define. As for this study, participants had to apply their own understanding of what kind of dream they'd had at time of reporting. We differentiate between these two in our questionnaire, among others, which implies that there are some inherent differences that our participants can reliably recognize. There are hosts definitions regarding nightmares scattered in the literature, generally varying in three aspects: what type of emotion that is experienced within the nightmare, specific awakening criterion, and the differentiation from night terrors. Nilsen and colleagues (2000), for example, differentiated nightmares from bad dreams based on whether the dream awakened the participant. Woods and Bootzin (1990) used another definition where nightmares were seen as "a dream that frightens the dreamer". Other studies (Dunn & Barret, 1998; Schredl & Göritz, 2018; Zandra, Pilon & Donderi, 2006) have found that fear seems to be present in most cases of nightmares (estimated prevalence of 80-85%), albeit not the only emotion present. Other emotions like anger, sadness, embarrassment, and disgust also seem to be important contributors to the experience. Therefore, the differentiation between nightmares and bad dreams is assumed to be marked by a lower or higher emotional intensity.

Night terrors are also characterized by elevated emotional intensity but are considered a parasomnia or an undesired occurrence during sleep. These episodes are often paired with sleep walking, screaming and shouting, and wide-eyed unconscious stares. People having a night terror is often hard to wake up, and if awakened show clear signs of confusion and even tend to be emotionally inconsolable. They also appear to have little or no memory of the experience the day after, as opposed to what we typically see in nightmares. Additionally, nightmares and night terrors happen at different stages of sleep, with nightmares typically occurring during REM, and night terrors during the NREM phases (Mayo Clinic; National Health Service, 2021).

#### *1.4 Grounds for a hypotheses of continuity*

Dreams do not occur in a vacuum. Researchers have taken on the task to find regularly occurring themes within dreams and have found evidence for 55 different dream themes that are quite stable over different sample populations (Mathes, Schredl & Göritz, 2014; Yu, 2016). Others have gone searching for negative waking affect linking dreaming states to waking states and found evidence for continuity between dream content and psychological well-being (Pesant & Zandra, 2006; Zandra & Donderi, 2000). That is, people reporting more unpleasant affect and thus lower psychological well-being (e.g. neuroticism, trait anxiety and depression) were more likely to experience bad dreams and nightmares. In addition, the frequency at which nightmares are experienced have been shown to be significantly correlated with measures of psychological well-being (Blagrove, Farmer & Williams, 2004) Furthermore, psychopathologies such as depression and schizophrenia are associated with an overall increase in nightmare prevalence (Mume, 2009; Ağargün et al., 1998). These findings suggest that there are some continuities between dreaming and waking states, and thus indicate a hypothesis of continuity.

#### *1.5 Affect, emotion, and mood.*

Affect, emotion and mood are all terms to describe different states of feeling. These terms are used throughout the entire text. In our daily language they're often used interchangeably, and therefore a proper definition and distinction of the terms are necessary in avoiding any misconceptions. Affect can be seen as an overarching term for describing states of feeling, like emotions and moods. The affective state may vary in level of arousal, duration, intensity, and pleasantness. In this, they're important regulators of cognition and behavior throughout different situations and contexts. Emotions and mood mostly differ in their duration and to what extent they're directed toward specific causes. Emotions are seen as reactive, goal directed mechanisms, to an external stimulus – like anger directed towards a disrespectful coworker. Mood, on the other hand, last longer and is more diffuse. An elevated feeling of anger or happiness for an extended period without no apparent reason, could qualify as a moody state. Seen this way, the emotions and moods we experience on a regular basis, in a given timeframe, characterizes our affect. Affect experienced over a longer period of time might then represent subjective well-being (Niven, 2013).

The pleasantness and arousal of affective states will then give us further indicators of an individual's well-being. Anxiety, for example, is an emotional state that holds low levels of pleasantness and relatively high levels of arousal or activation. Depending on what might have caused the nervous system to activate, we'll see different levels of arousal and pleasantness. Being held at gunpoint will for most people induce extreme levels of unpleasant feelings, be it anger, fear or both. However, these are situations we do not go about experiencing every day. Day to day stressors like work-related deadlines or social conflicts produce different levels of arousal and pleasantness/unpleasantness in people. Some people may be more prone than others to experience positive or negative affect, reflecting both the aggregate action tendencies of their emotions and the broad avoid/approach tendencies moods give rise to. Angry and fearful emotions may be associated with fighting, freezing or notions of dangerous outcomes, while unpleasant moods are associated with a general tendency to avoid given stimuli (Niven, 2013).

## 2. Present study

The purpose of this study was to explore the relationship between nightmares, bad dreams, and mood in the general population. Based on the previously presented research, the affective and emotional continuity between waking and sleeping states seem to be well documented. Having established the relationship between affect, emotions and mood, this study hopes to find some resemblance to the cited literature concerning self-reported mood prior to bedtime. The specifics of these predictions are presented in hypotheses one, two and three listed below.

Knowing what factors might influence and maintain the frequency of bad dreams and nightmares may help us gain a better understanding of its' dynamics. Down the line, this may lead us to better treatment plans for those especially afflicted by nightmares. Likewise, exploring hypotheses on the continuity between mood and emotional content in our nightmares might contribute to this notion. Lastly, measures of concrete physical impairments following nightmares, like loss of sleep or appetite, might help us better understand it's contribution to the complex picture of an individual's well-being. Accordingly, this study first aims to explore the relationship between self-reported mood prior to bedtime and the frequency of bad dreams and nightmares. And secondly, it aims to

explore the relationship between mood and the negative emotional contents and physical effects of nightmares.

**Hypotheses 1** – Participants reporting lower degrees of mood have higher frequencies of nightmares and bad dreams.

**Hypotheses 2** – Participants reporting lower degrees of mood before bedtime will report having more negative emotional content in their nightmare.

**Hypotheses 3** – Participants reporting lower degrees of mood before bedtime will report having more physical impairment due to their nightmare.

### 3. Method

#### *3.1 Design and Participants*

The research questions were examined using a longitudinal design over a 28-day period. A convenience sample composed of 87 participants (Male = 40, Female = 47, Mean Age = 29.27, Range = 20-78) were recruited to the survey. Amongst these 87 participants, only 66 continued reporting after the initial base-line questionnaire. The daily version of the survey was filled out 1034 times by 66 respondents. Therefore, we saw an overall response rate of 55% calculated for the entire duration of the project. Each participant then contributed an average of 16.5 responses.

#### *3.2 Procedure*

Participants were recruited by the 11 students in the research-group. A convenience sampling method was used to recruit participants. Different means for reaching out to potential participants were used, where there was a clear emphasis on utilizing one's personal network for recruitment. For example, the students used Facebook posts, or simply asked friends, family or colleagues by message or face to face if they'd like to partake in the project. The people who voiced their interest received an email containing some information stating the general purpose and duration of the study, and some instructions concerning the two links provided in the email leading to two separate parts of the online survey hosted by

Nettskjema.no. As the survey was online, it enabled the participant so to respond in private and at their leisure. The front page of the first included a consent form containing a more in-depth presentation of the project, as well as what their participation in the project would involve. Additionally, information was given stating the voluntary and anonymous nature of their participation in the research project.

Participants were then asked to create an anonymous username which they would be using for the entire duration of the project. Following this procedure, a form containing some demographic questions (Age, Gender, Relationship Status and Level of General Sexual Satisfaction) were administered. From here on out, participants were to fill out the second and main part of the online survey provided in link number two given in the mail. Data collection started 11.03.22 and lasted until 08.04.22.

### *3.3 Instruments*

The second part of the survey consisted of two parts. One containing an item measuring mood before bedtime and what type of dream the participant experienced. Another part expanded on the details of the nightmare experience.

#### *3.3.1 Dream record instrument*

The first part contained the question “Which of the options best describes your mood before going to bed?”. Answer options were “Low mood”, “Neutral”, and “Good mood”. To prepare this item for the correlation analysis, a mean was calculated for each participant on self-reported mood before bedtime. For the ANOVA, mood differences were kept as categories as opposed to a calculated mean. Additionally, there was another question with the option of checking off what type of dream they’d experienced. Options were “Ordinary dream”, “Nightmare”, “Sexual dream”, “Bad dream”, and “Other”. Checking off either “Sexual dream” or “Nightmare” would reveal the second part of the questionnaire with questions expanding further on the details of the dream experience. Frequencies of both bad dreams and nightmares for each participant was summed up in one variable to prepare it for the correlation analysis.

#### *3.3.2 Nightmare Experience Questionnaire*

The Nightmare Experience Questionnaire (NEQ) (Chen et al, 2014) seeks to measure the effects of nightmares on the physical, psychological, and behavioral aspects of the individual.

The lack of a structure-validated questionnaire to measure the effects of nightmare content on physical, psychological and behavioral aspects pushed the researchers to develop a tool that would allow for a more precise characterization of nightmares in both healthy people and psychiatric patients (Chen et al, 2014). The questionnaire holds a total of 20 items, each of which is loading on one out of four different subsequent factors: (1) Physical Effect, (2) Negative Emotion, (3) Meaning interpretation and (4) Horrible Stimulation. However, for this project only factors one and two are used. A five-point Likert scale is used to answer the questions: 1-very unlike me, 2-moderately unlike me, 3-somewhat like and unlike me, 4-moderately like me, and 5-very like me (Chen et al., 2014).

In the development of this questionnaire, Chen and colleagues (2014) conducted a study comprising a total of 321 Chinese undergraduate students, all of whom were free from any somatic or psychiatric illnesses. There were 160 males (mean age: 20.13 years, range: 18-25 years) and 161 females (Mean age: 19.97, range: 18-29). Participants originally had to complete a matrix of 95 items measuring different aspects of the nightmare experience. After factor analyzing the data, five items with top loadings on each target factor were chosen to comprise The Nightmare Experience questionnaire. Originally, the questionnaire was developed by Chinese researchers and therefore written in Chinese. It has since been translated to both English and Norwegian. Although the translation from Chinese to English was done by the authors themselves, the student group refined the English translation making it easier to understand. Additionally, it was translated to Norwegian – making it possible to answer it in both languages. The questionnaire underwent some additional small alterations regarding questions having some implications to diagnostic criteriums used in the sleeping disorder insomnia. For example, the question “I always suffer from insomnia due to having nightmares” was changed to “I suffered from poor sleep due to my nightmare” because insomnia is a clinical term and measuring it with clinical scales would require approval from an ethics committee (REK). Additionally, the two items “I felt frightened in my nightmare” and “I was scared in my nightmares” seem almost identical when translated to Norwegian. Both load “Negative Emotion”, resulting in a decision to remove “I was scared in my nightmare” from the analysis. Therefore, the factor “Negative Emotion” only contain four items.

### *3.3.3 Physical effect*

The physical effect factor of the NEQ seeks to measure the degree of physical impairment nightmares leave on the person experiencing it. This is what is referred to as nightmare outcome in the text. These questions are designed to encompass and measure deficits in physical health, appetite, and other daily activities after nightmares. The higher the score, the more physical impairment is assumed to be present for the individual. Included in this bracket were questions like “My appetite has changed because of my nightmare”, or “I find that I cannot deal with today’s activities after having a nightmare”. This part of the questionnaire is considered to be valid and have previously shown a satisfactory internal consistency ( $\alpha = .85$ ) (Chen et al, 2014). In this study  $\alpha = .46$ , which is a low score (Field, 2018).

### *3.3.4 Negative emotion*

The negative emotion factor of the NEQ seeks to measure the degree of negative emotion experienced in the nightmare. This is what is referred to as nightmare content in the text. These questions are designed to describe how frightened, scared, or helpless the individual felt during the nightmare. Higher scores indicate more negative emotion. Included in this bracket were questions like “I felt helpless in my nightmare” or “I felt frightened in my nightmare”. This part of the questionnaire is considered to be valid and has shown a satisfactory internal consistency ( $\alpha = .80$ ) (Chen et al, 2014). In this study  $\alpha = .83$ , which is a high score (Field, 2018).

For this study, and by extension of the limitations our research design puts on our ability to detect and control for these subtle variables, it is assumed that nightmares are characterized by a markedly elevated negative emotional intensity. Bad dreams are therefore assumed to be characterized by a lesser elevation of emotional intensity (Zandra, Pilon & Donderi, 2006)

## *3.4 Statistical Analysis*

To conduct the statistical analysis, version 28 of IBM SPSS was used. An initial two-tailed correlation analysis was conducted to explore the relationship between number of bad dreams and nightmares, and self-reported mood before bedtime. Exploring the first hypotheses further, the reported frequencies of the different mood categories were compared with both nightmare and bad dream frequencies. Exploring hypothesis two and three, a one-way between subjects ANOVA was run with differences in mood reported before bedtime as the independent variable, and items on the subscales of both “Negative Emotion” and “Physical

Effect” as dependent variables. Prerequisites for running an ANOVA were partially met; the mood samples were independent of each other; the sample distribution of means for our data show both deviations and conformity to normal distributions; and we have homogeneity of variances. To determine location and significance of group differences, a Tukey HSD post-hoc test was run.

### *3.5 Ethics*

At the end of each time the survey was filled out, the participants were given the option to give or withhold their consent, permitting or preventing any further use of their data for the purpose of this bachelor project. The study was submitted to the Norwegian Center of Research Data (NSD) in January and was approved 09.03.22. On the 25.04.22, all usernames were deleted from our databases.

## 4. Results

### *4.1 Descriptive statistics and correlations*

Table 1 shows the frequencies of nightmares and bad dreams, and the percentage prevalence drawn from the entire sample. Over the duration of the project, a total of 132 cases of bad dreams and nightmares were reported. Given the 1034 entries we received, we see a combined prevalence of 12.76 %. Among these, 44 cases (4.2%) were nightmares, and 82 cases (7.9%) were bad dreams. Of the 44 nightmare cases, eight people reported having had low mood before bedtime, 17 neutral mood, and 19 good mood. Of the 82 bad dream reports, 19 reported low mood before bedtime, 40 neutral mood, and 23 good mood. Since these are only descriptive statistics it'd be premature to arrive at any conclusion regarding the hypotheses on bad dream/nightmare frequency and mood. Therefore, a correlational analysis testing probabilities was run needed.

**Table 1**

*Overview of nightmare and bad dream frequency in relation to self-reported mood before bedtime.*

	Nightmare frequency	Bad Dream frequency
Low mood	8	19
Neutral	17	40
Good mood	19	23
Sum	44	82
% Of the entire sample	4.2	7.9

*Note: n = 69 for nightmares and bad dreams. n = 66 for mood.*

Table 2 shows means, standard deviations and correlations for total number of nightmares/bad dreams, mean of self-reported mood before bedtime, age, and gender. There was a significant positive correlation of .317 between total number of nightmares/bad dreams ( $n = 69$ ,  $M = 1.74$ ,  $SD = 1.96$ ) and self-reported mood before bedtime ( $n = 66$ ,  $M = 2.25$ ,  $SD = 0.39$ ). Age and gender had no significant relationship to these two variables.

**Table 2**

*Descriptive statistics and correlations between mood and bad dreams/nightmares.*

	M	SD	1	2	3.	4.	N
1. Total number of nightmares/bad dreams	1.74	1.96	-				69
2. Mean of self-reported mood before bedtime	2.25	0.39	<b>.317**</b>	-			66
3. Age	29.27	(12.73)	-.097	-.068	-		85
4. Gender	1.46	-	.204	.610	-	-	87

*Note: \*\* =  $p < .01$ . Gender coded as a trichotomous variable (1 = female, 2 = male, 3 = other) No participant identified themselves as "other" gender.*

#### 4.2 ANOVA descriptive statistics for NEQ subs-scales

Table 3a shows an overview of standard deviations, mean and *N* of mood groups for answers on NEQ items belonging to the subscales of “Physical effect” and “Negative emotion”.

**Table 3a**

*Overview of standard deviations, mean and N of mood groups for answers on NEQ items loading “Physical effect” and “Negative emotion” (N = 69)*

NEQ items	Mood	Frequency	Mean	SD
<u>Physical effect</u>				
I suffered from poor sleep due to my nightmare	Low mood	8	2.25	1.48
	Neutral mood	16	2.63	1.2
	Good mood	19	2.16	1.25
	Total	43	2.35	1.27
I feel physically weak after having this nightmare	Low mood	8	2.63	1.59
	Neutral mood	17	2.29	1.53
	Good mood	19	1.95	1.22
	Total	44	2.20	1.4
I always consider that my life is deeply influenced by nightmares	Low mood	8	1.38	0.74
	Neutral mood	16	1.35	0.70
	Good mood	19	1.74	1.04
	Total	43	1.52	0.87
I find that I cannot deal with today’s activities after having a nightmare	Low mood	8	1.75	1.65
	Neutral mood	16	1.29	0.98
	Good mood	19	1.26	0.65
	Total	43	1.36	0.89
My appetite has changed because of my nightmare	Low mood	8	2.50	1.1
	Neutral mood	17	1.41	0.71
	Good mood	19	1.47	0.91
	Total	44	1.64	0.94

		Negative Emotion		
I could hardly escape the dilemma in my nightmare	Low mood	8	3	1.51
	Neutral mood	17	2.82	1.66
	Good mood	19	2.63	1.57
	Total	44	2.77	1.56
I felt frightened in my nightmare	Low mood	8	3.50	1.69
	Neutral mood	17	3.94	1.03
	Good mood	19	3.79	1.22
	Total	44	3.80	1.23
I felt powerless to face the problem in my nightmare	Low mood	8	3.75	1.75
	Neutral mood	17	3.24	1.39
	Good mood	19	3.53	1.26
	Total	44	3.45	1.38
I felt helpless in my nightmare	Low mood	8	3.50	1.69
	Neutral mood	16	3.88	1.31
	Good mood	19	3.58	1.17
	Total	43	3.67	1.3

#### 4.3 ANOVA inferential statistics for NEQ sub-scales and mood

Table 3b shows the results of a one-way between-subjects ANOVA of the three mood groupings and eight items loading on “Negative Emotion” and “Physical Effect” of the NEQ. A test of homogeneity of variances based on the mean were for all groups non-significant, which tells us that we can assume equal variances across the groups. This means that we can assume that the variance of the outcome (NEQ item) is steady as the predictor changes (mood) (Field, 2018). The degree of self-reported mood before bedtime had a significant impact on whether participants reported that their appetite had changed because of the nightmare,  $F(2, 41) = 4.86, p = .013, \eta_p^2 = .192$ . The group with the lowest average scores on appetite change were the neutral mood group ( $n = 17, M = 1.41, SD = 0.712$ ), with those reporting good mood scoring just higher ( $n = 17, M = 1.64, SD = 0.905$ ). Participants scoring highest were the low mood group ( $n = 8, M = 2.50, SD = 0.712$ ). As shown in table 3c, a Tukey HSD post-hoc test revealed these differences to be significant between low and neutral mood with mean difference of 1.088 ( $p = .015$ ), and between low mood and good mood with

a mean difference of 1.026 ( $p = .020$ ). The difference between neutral and good mood were not significant,  $p = .975$ . No other group differences were significant in relation to the rest of the NEQ items. The reasons for running this post-hoc test where that we assume equal variances across the groups, we have many comparisons, there are differences in groups sizes, and that we have a small sample size.

**Table 3b**

*ANOVA of mood categories on NEQ items (N = 69)*

NEQ Items		<i>df</i>	<i>F</i>	<i>Sig.</i>	Effect size ( $\eta_p^2$ )
<u>Physical Effect</u>					
I suffered from poor sleep due to my nightmare	Between groups	2	0.605	.551	.029
	Within groups	40			
	Total	42			
I feel physically weak after having this nightmare	Between groups	2	0.669	.503	.033
	Within groups	41			
	Total	43			
I always consider that my life is deeply influenced by nightmares	Between groups	2	1.001	.376	.047
	Within groups	41			
	Total	43			
I find that I cannot deal with today's activities after having a nightmare	Between groups	2	0.920	.407	.043
	Within groups	41			
	Total	43			
My appetite has changed because of my nightmare	Between groups	2	<b>4.486</b>	<b>.013</b>	<b>.192</b>
	Within groups	41			
	Total	43			
<u>Negative Emotion</u>					
I could hardly escape the dilemma in my nightmare	Between groups	2	0.163	.850	.008
	Within groups	41			
	Total	43			
I felt frightened in my nightmare	Between groups	2	0.339	.714	.016
	Within groups	41			
	Total	43			

I felt powerless to face the problem in my nightmare	Between groups	2	0.407	.668	.019
	Within groups	41			
	Total	43			
I felt helpless in my nightmare	Between groups	2	0.301	.742	.015
	Within groups	40			
	Total	42			

Note:  $p < .05$  are put in bold. Effect sizes are Eta-squared. For exact frequency on items, see table 3a.

**Table 3c**

Post-hoc test of mood group differences on NEQ item for loss of appetite ( $N = 69$ )

Mood categories	Mean differences		
	1.	2.	.3.
1. Low mood	-	1.088*	1.026*
2. Neutral mood		-	-0.062
3. Good mood			-

Note: \* =  $p < .05$ . Run with Tukey HSD post-hoc test.

## 5. Discussion

### *5.1 Summary of results*

The purpose of this study was to explore the continuity between waking and sleeping states. An initial correlation analysis found small significant correlations between the sum of bad dreams/nightmares and self-reported mood before bedtime. Reports of lower moods were not associated with a higher frequency of bad dreams and nightmares. Neutral and positive moods both had higher frequencies of nightmares and bad dreams than the low mood group did.

Analysis of group differences in mood on NEQ “Negative emotion” and “Physical effect” scores indicated that there were significant group differences only on one item measuring changes in appetite as a function of having had a nightmare. The only significant difference was from low mood to the other two groups, suggesting that low mood and nightmare-induced loss of appetite coincide at a higher rate than with the other groups. Finally, reports of nightmares in this study are somewhat in line with wider reports of its prevalence in the general population. We report a 4.2% prevalence, whilst meta-analysis shows a prevalence of 5% (Schredl & Reinhard, 2011).

### *5.2 On the correlations*

Nightmares and bad dreams are not the same. When doing a correlational analysis, one should preferably not treat these as one ratio/variable. The correlation coefficient becomes an imprecise denominator when we’re mixing variation from two separate constructs into one ratio. In doing so, we’re practically assuming different constructs to have the same causal mechanism, showing equal variance – something which we are not when investigating origins of bad dreams and nightmares. This is not to say that correlation analysis infers causal mechanisms, but rather that the underlying theoretical and empirical assumptions point to differences in frequency and mechanics, which suggests they should have different correlations to mood. When looking at the raw data frequencies, we see that they behave differently in relation to mood. Unfortunately, due to some circumstantial constraints, we were not able to assess the dataset in this way. This may be just one of the reasons as to why we see this positive correlation. However, since they’re both constructs of sympathetic activation and might in that way share some common variation, I’ll argue in the following paragraphs that other explanations are needed to better understand why the coefficient turned out the way it did.

### *5.3 Response bias and mood item operationalization as factors in non-significant results*

Since participants had the opportunity to select “neutral mood”, we might see a response bias effect where participants select it for the convenience of not having to actively consider their answer (Moori et al., 2017). Deploying a seven-point Likert scale extending the current item, for example, would in theory have allowed us to make predictions of *how* low levels of mood had to be for there to be an increased chance of nightmare and bad dream experience. Also, not having a mid-way (neutral) point in our scale might reduce possible mid-way response bias – possibly enhancing the validity of the participants answer. If there is response bias underlying some of our data, this will have caused correlations to rise in a generally positive direction in relation to our first hypothesis. The specific causes of these biases can not only be because of the mere presence of a mid-way or neutral option, but an effect possibly magnified by the time-lag between experiencing the mood before bedtime and reporting it the day after. Assuming there are individual differences in recall accuracy caused by time-lags we’re unable to control for with this design, one could argue that response bias poses a considerable threat to the validity of our data. Moods are inherently vague, possibly making them hard to measure and recall precisely. On the contrary, moods last over longer periods, and might seem on the surface to be a good fit for recall accuracy the day after. However, moods, and especially emotions, have substantial influence on our cognitive processes in ways that are way too complex to cover in this text (Tyng, Amin, Saad, & Malik, 2017). For these reasons, one might consider administering the mood item before bedtime to avoid some of the problems related to response bias.

Mood might not be an ideal measure in determining continual relationships to bad dreams and nightmares. Mood as we define it in this project, is a prolonged, slightly elevated emotional state. It is more diffuse, and less goal directed than emotions are (Niven, 2013). Combined with the fact that our mood item only contains three categories, one of which is “neutral”, we might not be able to pick up on emotional and affective variation that might be essential in establishing a meaningful empirical ground for the type of hypothesized continuity between waking and sleeping states. As shown by the previously cited literature (e.g Blagrove, Farmer & Williams, 2004; Pesant & Zandra, 2006; Garcia et al., 2021; Gieselmann et al., 2020; Solomonova et al., 2021), some of the driving forces behind nightmare and bad dream frequency have been found to be intertwined with personally significant experiences and the overall state of our psychological well-being. Therefore, one explanation as to why our results do not replicate, is that mood and the way we measure it, do

not reflect the kind of emotional, affective, and situational contingencies that often have been observed to give rise to nightmares and bad dreams. People are not made up of one state of mood and it certainly must be seen as a less than ideal representation of people's overall well-being. A participant might have had a daunting, stressing, or bad experience during the day, but also report being in a relatively good or neutral mood before bedtime. If the participant then reports a nightmare or a bad dream following that very same day, we'll actually miss out on rather important information that may factor into the equation. Although, our results are not sufficient evidence to suggest that there is no relationship between lower moods and the frequency of nightmares and bad dreams given our low sample size and mood operationalization. Operationalizing our item for mood in a more nuanced way would have given us the opportunity to get finer details of the relationship to nightmares and bad dreams. "Low mood" is here encompassing all possible variations of below average mood, which is a lot of potential variation not accounted for. And seen as though previous research has shown nightmares to contain a range of emotions, although predominantly fear, we could benefit from including finer measures of directionality and type within the mood concept (Dunn & Barret, 1998; Zandra, Pilon & Donderi, 2006). These could have been questions differentiating to what degree the moody state was characterized by anger, sadness, embarrassment, disgust, or fear. Accordingly, correcting for these errors, a negative correlation might have surfaced – that is, as mood goes down, nightmare/bad dream frequencies rise.

#### *5.4 Predictive value, statistical power and type 2 errors*

The  $F$ -ratio tests the overall fit of a linear model to a set of observed data. It sums the predictive power of all our independent variables, in this case mood groups, and determines that it is unlikely that all the coefficients equal zero. If the group means are the same, then our ability to predict the observed data, in this case NEQ subscale item scores, will be poor – hence a low  $F$ -value. If means differ, our ability to predict the observed data will increase, resulting in a higher  $F$ -value (Field p.527, 2018). Therefore, as  $F$ -ratios rise, the probability of random effects producing the same or a more extreme result decreases as more of the variation in outcome (NEQ subscale items) can be explained by our independent variables (mood). This makes  $p$ -values and  $F$ -values dependent of each other. When looking at our results, all but one item produces non-significant  $F$ -values. It is tempting to accept the null hypotheses pertaining to both hypotheses two and three, that self-reported mood before bedtime have next to no predictive value (absent significant effects) in determining how

much negative emotion we experience in our dreams, or the degree of physical impairment we experience in consequence. Based on the data gathered, I'll argue that we cannot accept or reject any of our hypotheses. Firstly, when we consider the challenges outlined earlier with regards to response bias and the way we operationalize our mood item, it becomes clear that an items' poor predictive value might rise out of such conditions. Secondly, questions might be raised whether the effects of mood are too small for a low powered study to detect them. The rationale behind this line of thought stems first and foremost from the definition we use in describing what mood is (Niven, 2013). Since it is less concrete and goal directed, one might expect it to produce the low and mostly non-significant effect-sizes we observe in relation to "Negative Emotion" and "Physical Effect". As sample size rise, we gain statistical power, and our ability to detect significant smaller effects increase (Button et al., 2013; Rossi, 1990). Future research aiming to explore this relationship should therefore consider having a bigger sample size. In doing so, we'll also reduce the chance of committing a type 2 error, which is a recurring problem with low powered studies (Open Science Collaboration, 2015). This error occurs when we assume there is no effect in the face of true effects – a false negative. Although, just increasing the sample size without any adjustments of the mood item as described earlier, could end in the same low non-significant effects observed here.

#### *5.5 On the low Cronbach's alpha of NEQ "physical effect"*

There could be many reasons why the Cronbach's alpha score was low. It is an index of internal consistency reliability of a set of items, that reflects the degree of variance within one item, and the covariance between a particular item and any other item within our measurement instrument. The average of these values is what gives us our alpha coefficient (Field p.882, 2018). This definition implies that the coefficient reflects the degree to which we measure one underlying unidimensional construct. If the alpha is low, there is reason to believe that a number of items do not measure the same construct. However, one should be careful making such inferences when we're not certain there is only one factor that underlies the data (Cortana, 1993). That is, if there are things that influence how participants respond to certain items pertaining to "Physical Effects" of nightmares, adhering to design features for example, it would be counter intuitive to deem the instrument useless. One of these we've already covered when looking at possible confounds in the appetite item. As an extension of this, the appetite item was the only item, that if removed from the reliability analysis, would raise the alpha coefficient of the construct (from .46 to .50). Removing the item would indeed make the alpha higher, although maybe for the wrong reasons. Controlling for confounds

(like mentioned previously with regards to mood) and improving our design instead of removing the item might be a more viable option moving forward.

Another potential source of influence on the alpha coefficient might arise from the translation that was done to ready the instrument. It might be that some participants did not know how to properly answer a question because we phrased it in a way that takes some effort and consideration to answer, and that this might cause some confusion. As an example, the item «Jeg følte meg fysisk svak på grunn av marerittet» / “I feel physically weaker after having this nightmare” might be a bit vague. Maybe using the words “exhausted” or “utslitt” would have made it easier to understand, possibly producing more reliable patterns in our data. And for the item “I find that I cannot deal with today’s activities after having a nightmare” / «Jeg opplever at jeg ikke kan takle dagens aktiviteter etter å ha hatt et mareritt», we’re not at all in control of what kind of activities participants refer to. Some daily activities may be easier to deal with than others, and people differ in the way they handle consequences of nightmares. It might then be a good idea to concentrate on a more homogenous population that go through more of the same daily activities, like the student sample studied in Chen and colleagues’ (2014) development of the Structure-Validated Nightmare Experience Questionnaire. And seen as though there are a total of 44 reported cases of nightmare experiences, a case must be made that the actual variance in the general population is most likely not represented here.

#### *5.6 Statistical significance vs. practical significance, confounds and solutions in NEQ “Physical effect”*

The practical significance of the group differences tells a different story than the statistical significance. While it might be improbable that random effects produce the same or more extreme results than what we’ve got, the group differences in nightmare induced loss of appetite range from a mean of 2.5 in low mood, to 1.41 and 1.47 in neutral and good mood groups. A mean score of 2.5 represent a point between “moderately unlike me” and “somewhat like and unlike me”. For the latter, somewhere between “very unlike me” and “moderately unlike me”. In practical terms, this could mean that participants who rated themselves low in mood before bedtime the previous day were slightly more likely to report having their appetite somewhat more affected by the nightmare, although this relationship is a weak one as reflected in the low effect size. It could also mean that our design is especially susceptible to response biases and other confounding variables. For example, mood and loss of appetite are often interconnected, which might help explain why this effect turned out

significant and the others did not (Macht, 2008). Looking at the individual change and stability in mood scores day by day might have given us vital information in determining the actual effect nightmares have on our appetite, thus how much of mood itself might be confounding or inflating the effect. If we see stable levels of low mood in a participants' reports over a prolonged period, we might assume that their appetite is generally lower and might therefore be confounding – although this would require having an additional item measuring both baseline appetite (normal appetite for this person) and changes. If we see that moods reported before bedtime follow the trend of nightmare-induced loss of appetite, we'd have stronger evidence to suggest there is a relationship between the two. Unfortunately, due to some circumstantial constraints we were not able to assess individual trajectories of change and stability in mood. When we're measuring what effect mood have in both prevalence of nightmares and nightmare-induced loss of appetite in a quantitative study, we want to be able to get a general idea about how mood might influence this outcome in a population. With a total of 44 cases of nightmares, and ultimately low power. It's difficult to make any such generalizations (Rossi, 1990). Tracking back to the small, and imprecise, positive correlations between mood and bad dream/nightmare frequencies when considering these remarks, we have no grounds to confirm or deny that self-reports of low mood is associated with a higher prevalence of nightmares and increased chances of any negative nightmare outcomes we measured. On the account of NEQ “negative emotion” and self-reported mood prior to bedtime, we'll also have to submit to non-conclusive results based in many of the same reasons discussed up to this point. However, there are some differences worth noting in what might have caused the insignificant result that bear some important implications for future research.

### *5.7 NEQ “Negative Emotion” and cues for optimizing design*

The effects of reporting lower or higher mood had no significance in determining how much negative emotion one was prone to experience in the nightmare. This is of course dependent on how we measure mood in this survey, as discussed earlier. Looking at the mean scores on the subscales of this item (in table 3a), we observe markedly higher individual group scores and total scores than that of “physical effect”. These indicators of negative emotion give us a lead on what kind of predictors that might be better suited when looking for continual relationships between what goes on in our daily lives and what goes on when we sleep. Our data on negative emotional valence in nightmares is present but what might have caused it in these cases is still unknown. What we do have, however, is an indication that the nightmare

frightened the dreamer (Woods & Bootzin, 1990) and that fear was indeed present (Dunn & Barret, 1998; Zandra, Pilon & Donderi, 2006). This might prompt us to look for other mediators than just self-reported mood before bedtime. But again, we do not have sufficient evidence to suggest self-reported mood before bedtime have no predictive value for either of the NEQ subscales. The effect sizes, which are practically non-existent here, could as mentioned earlier be too small to detect with a low powered study, provided we adjust the way we measure mood, or use other predictors or mediators. Nightmares are after all characterized by a relatively high emotional activation, making it paramount to include some measures that capture the emotional footprint that which we typically see in nightmares when we take on a hypothesis of continuity. Understanding the causes of such emotional activation, be it stressing work-environments combined with individual dispositions (i.e., trait neuroticism) that differentiate our susceptibility to environmental influences, we might gain a fuller understanding of what influence our nightmare experiences (Garcia et al, 2021; Zandra & Donderi, 2000; Peasant & Zandra, 2006; Belsky & Pluess, 2009). Down the line this knowledge might be of use to clinicians and professionals working with patients who are more or less afflicted by nightmares. It can be argued that including such measures alongside a refined item measuring mood might help us see how variance in mood and emotions covary as a function of environmental influence and differential susceptibility, thus allowing us to gain more precise knowledge on the potential predictive properties of mood in nightmares as well as bad dreams.

#### *5.8 Sensitive questions and social desirability bias*

Sensitive questions may tamper with the validity of the results of this study. The phenomenon under study might be seen by some as being sensitive because it might reveal some intricate details about one's general well-being. The relationship between socially desirable reporting and sensitive topics in psychological research is well documented (Tongarangeu & Yan, 2007) What exact details nightmares, bad dreams and mood might reveal about a participants' life, and its' personal and interpersonal significance, must be seen on a case-by-case basis. As for this study, some of the participants recruited were close friends and family – which in turn might cause some to alter their answers in a more socially desirable way in anticipation of the familiar researcher's scrutiny of their answers. For example, some may alter the way in which they answered the “mood” item, as so to hide repeated negative signs of affect to look better in a given social space. For example, inferences can be made about who someone is based on age, gender, and marital status (it was collected but not used here,

although relevant) – and if this is knowledge a participant considers, it might skew the results. This is not to say that the participant’s anonymity was not upheld to scientific contemporary standards by the design and procedures of this study, but rather that the method of sampling in this context might come with some considerable inherent weaknesses. On the other hand, as shown in some cases, online surveys conveying sensitive questions seem to fare much better than in-person interviews with respect to the rate at which people answer questions truthfully, which is a strength with our design (Wish, Hoffman, & Nemes, 1997; Hochstim, 1967; Corkrey og Parkison, 2002). Considering these findings, the participants relationship to the researcher coupled with a sensitive research topic can be considered a threat to the validity of our results. Not recruiting close friends and family may then have benefited the project.

## 6. Strengths, weaknesses, and implications

While the literature on links between psychological disorders (i.e emotional and affective disorders) and nightmares and bad dreams show clear relationships, the literature on how mood relates to these dreams is quite scarce. One of the clear strengths of this study is namely this, that it addresses a relationship rarely seen in the literature. Even though we were not able to arrive at any conclusions regarding the hypotheses, I think we’re able to highlights some important factors that other researchers might need to be on the lookout for when researching these relationships in the future. For example, an important assumption about the difference between affect, emotion and mood was made. This distinction is arguably important to keep in mind when considering how we should design our study; what situational factors might be of importance in producing our moods and emotions; how these moods and emotions covary, enabling us to see clearer the mediating effects they produce in our dreams; clarify the item measuring mood; and indications that one should aim to have a larger sample size when researching these topics.

We have been through several limitations and weaknesses with the design of this study that contribute to the non-conclusive results. It is likely we’re susceptible to mid-way response bias because the item measuring mood were administered with a time lag, and it had the option of reporting “neutral”. Operationalizing the item this way may not only enhance bias tendencies, but also render it less optimal in detecting finer details in mood related to its’ type and intensity – ultimately losing some of its predictive power in NEQ sub-scales. There

might also be reason to believe recruitment of family members and close friends when researching a sensitive topic might induce socially desirable reporting from some participants. In addition, relatively few participants reported having had nightmares, making our study low powered and susceptible to type two errors. Also, as we lack control over what might influence our variables, limitations arise in determining what caused low the low alpha coefficient in NEQ “Physical Effect” – making the results difficult to interpret. Limitations not directly associated with the design were that we had less time than usual (due to a one-month delay in NSD approval of the project) to organize the data, to consider different analytical methods when processing results, and finally to write the discussion.

There are also possibilities that mood might not be an optimal measure in predicting the negative emotional content or physical effects/impairments of nightmares, and that we need other situational measures like stressful work or tragic life-events, emotional measures that better resemble the emotional intensity of nightmares, or measures of affective styles like trait neuroticism, to find more clear-cut and meaningful continual relationships between waking and sleeping states. This serves as both a limitation but also an important implication of our results.

## 7. Conclusion

Based on the analysis of the data gathered, we have no evidence to either confirm or deny any of the three hypotheses set for this project. The results were difficult to interpret as some features of our design was not an optimal fit for the hypotheses. Having less time than usual to work with data, analysis and discussion did not contribute positively to this notion. Although, it is my belief that the project has proved itself useful in contributing positively to creating new and useful hypotheses to be deployed in future research, suggesting some possible means of integrating this empirical work with the relevant literature.

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