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COVID-19 nightmare response and stress: A new Mexico sample based survey

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ABSTRACT

Studies conducted during the COVID-19 Pandemic have reported increased rates of mental illnesses including depression, anxiety, and post-traumatic stress disorder (PTSD) [1]. A common symptom of mental illness is change in Rapid Eye Movement (REM) sleep, the phase of sleep associated with dreaming and nightmares. The COVID-19 pandemic offers a unique opportunity to evaluate the effects of systemic stress on nightmares.

In this study, we investigate whether the COVID-19 pandemic affects nightmare frequency and content using a web-based survey within the state of New Mexico. The survey returned 197 responses showing an increase in the quantity of both bad dreams and nightmares. Furthermore, significant changes in nightmare themes were reported compared to relative rates prior to the pandemic (RR 1.42, $p < 0.01$; RR 5, $p < 0.001$). This novel data supports that increased stress from the COVID-19 pandemic has altered dream and nightmare content and frequency.

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1. Introduction

On March 11th, 2020, New Mexico reported its first confirmed positive COVID-19 case. Twelve days later on March 23rd, New Mexico Governor Michelle Lujan Grisham announced a statewide stay-at-home order requiring closure of all non-essential businesses, schools, and mass gatherings of more than five individuals [2]. Governor Grisham's stay-at-home order resulted in many New Mexicans facing financial uncertainty, health concerns, and social restrictions.

Increased stress had been reported in past pandemics related to containment measures and dissatisfaction with them in past pandemics [3–7]. These include fear and anxiety, especially in previous respiratory viral pandemics including the 2009 H1N1 outbreak and the 2003 SARS pandemic [8–10].

For the COVID-19 pandemic a study during the initial 2019 outbreak found that 53.8% of respondents rated the psychological impact of the outbreak as moderate or severe, including one third of respondents who reported moderate to severe anxiety [11]. A further meta-analysis of 13 studies on mental health during the COVID-19 pandemic found pooled rates of anxiety at 23%,

depression at 22.8%, and insomnia at 34.3% [12], which are all increased from pre-pandemic prevalence of Generalized Anxiety Disorder (GAD) 2.7%, and anxiety disorder 19.1% and Major Depressive Disorder (MDD) at 6.8% [13].

Within the United States, a Center for Disease Control (CDC) report from July 2020 found increased symptoms of anxiety and depressive disorders between April–June 2020 compared to the same period in 2019. The report further indicated that 40.9% of respondents reported at least one adverse mental or behavioral health condition, of which 30.9% was anxiety or depression. Additionally, 10.7% of respondents reported having seriously considered suicide in the 30 days period to completing the survey [14]. These reports all indicate that the COVID-19 pandemic is similarly influencing mental health as during previous pandemics.

Sleep disturbances such as bad dreams and nightmares have been associated with various psychiatric conditions including generalized anxiety disorder, acute stress reactions, and post-traumatic stress disorder, and are seen in the acute phase of these disorders [15]. Sleep disturbances have also been known to persist long after traumatic events and are often refractory to treatment [16]. Dreams are associated with both positive and negative connotations and are colloquially used to predict the future, interpret the past, and evaluate emotional states. Bad dreams are separated from nightmares in the Diagnostic and Statistical Manual of Mental Disorders (DSM-V) as idiopathic events

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that result in being alert and awake after the episode [17]. For this study, we use the Schredl and Göritz definition of bad dreams, defined as distressing episodes, compared to nightmares, which are defined as distressing episodes that awaken the person from sleep [18].

Previous studies on nightmares have shown that between 2 and 3% of people have weekly nightmares. These nightmares involve common themes of failure, helplessness, and physical aggression. Less common are themes of death and illness [15,18–20]. Importantly, previous studies have shown impacts of intense, emotional, experiences like those created during the early days of the pandemic on people’s dream content [21,22]. A variety of studies from around the same time period during which we conducted our study found higher likelihoods of new onset nightmares in Saudi college students with Covid-19 related stressors [23], increasing likelihood of nightmares and nightmare themes related to the changing socio-political and public health environment in people with higher levels of stress in the United States [24], and an increase in the frequency of contagion as a theme in ongoing dream journals [25].

In this study, we take the unique experience of the New Mexico stay-at-home order to study the impacts of psychological distress due to the COVID-19 pandemic of both conscious and unconscious emotional awareness through bad dream and nightmare frequency in relation to health related episode themes.

We make two hypotheses regarding the impacts of the COVID-19 pandemic on nightmares and sleep quality:

- We hypothesize that an increase in stress during the pandemic will increase bad dream and nightmare frequency.
- We hypothesize that the topics of nightmares and bad dreams will change such that themes of death and health related concerns will be increased in comparison to the more common themes of failure, helplessness, and physical aggression.

2. Methods

2.1. Recruitment

Study data were collected and managed using REDCap (Research Electronic Data Capture) electronic data capture tools hosted at University of New Mexico Health Sciences Center [26,27]. REDCap is a secure, web-based software platform designed to support data capture for research studies. The REDCap survey was distributed over social media to online groups such as the “New Mexico Coronavirus Updates” Facebook group, and the Reddit sub-pages “r/Albuquerque”, “r/UNM”, and “r/newmexico”. Anyone with access to the link was able to take the survey. Paper surveys with a QR code were placed in public areas around the University of New Mexico. The survey was available between May 21st through June 6th, 2020.

2.2. Survey Design:

Simple demographic data (sex, age) was collected, along with 5-point likert questions assessing how concerned respondents were about the effects of the COVID-19 pandemic and their overall well-being since March. The survey asked participants to answer yes/no/maybe questions about whether they had possible exposure, have been financially impacted by the pandemic, usually remembered their dreams, and had heard the rumor that people had been having unusual dreams during the pandemic. We utilized a shortened version of the Stanford Acute Stress Reaction Questionnaire (SASRQ), which was originally used to evaluate stress in response to natural disasters [24]. At the time of the study, quarantine measures

due to the COVID-19 pandemic were fairly new and uncertain to last more than a few weeks. We considered this an “acute” stressor, justifying use of the SASRQ. We chose 5 items from the questionnaire to reduce survey length and increase response rate. Four items were chosen from the anxiety subscale: I had difficulty concentrating (concentration), I had difficulty falling or staying asleep (sleep quality), I felt hyper vigilant or on edge (hypervigilant), I felt restless (restless). One item was closed from the dissociation subscale; I felt estranged or distant from others (estrangement). We felt these questions best measured repeated instances of acutely stressful situations that participants may be experiencing as a result of the COVID-19 pandemic. We used the average value of the selected items to estimate the amount of acute stress participants were feeling and called this measure the shortened Stanford Acute Stress Response (sSASR). The quantity of nightmares was assessed with two separate questions: did you have a bad dream in the last week, and did any of those bad dreams wake you up from sleep. These questions were meant to separate bad dreams from nightmare episodes, with the nightmares waking participants from sleep. Other sleep disturbances were not evaluated through this study. The study’s protocol was approved by and conducted with the oversight of the University of New Mexico Health Sciences Center Human Subjects Research Protections Office.

We performed power calculations for correlation analysis and chi square testing. An estimated sample size estimate for any of our correlations between our independent and dependent variables with an alpha of .05, a beta of 0.2 and a r of 0.2 was 196. An estimated sample size for chi square testing for the frequency of nightmares and bad dreams relative to known baselines with alpha of 0.05, a beta of 0.2, and a weight of 0.3 was 88. An estimated sample size for chi squared testing between nightmare for the frequency bad dream themes relative to known baselines with an alpha of 0.05, a beta of 0.2, and a weight of 0.3 was 187.

3. Results

3.1. Participation demographics

197 of the 219 survey responses were complete enough used for. Demographic data found that respondents were majority female (73%) with a median age between 30 and 45. For COVID-19 specific survey questions, respondents did note a significant financial impact from the pandemic (55%) but no significant direct exposure to COVID-19 infected individuals (80%). Additionally, the majority of respondents had not heard of unusual dream phenomena during the pandemic quarantine (63%) (Table 1.)

These demographic variables demonstrate an adequate reflection of the New Mexican population which is majority female (98:100 gender ratio) and has a median age of 38 years old. The financial impact of survey respondents is significant, but not

Table 1
Demographic data of survey population.

Sex	Female	Male	Other
	143	47	5
	Yes	No	Maybe
Financially Impacted	108	89	–
Had COVID-19 Contact	32	157	8
Usually Remember Dreams	133	59	5
Heard of Unusual Dreams	72	120	5
Live in NM	182	3	–
Associated with UNM HSC	17	180	–

Table 1. A total of 197 surveys were used for data analysis.

surprising considering the financial vulnerability of New Mexicans prior to quarantine with 18% of the population falling below the national poverty line [28,29].

3.2. Shortened stanford acute stress reaction questionnaire (sSASRQ)

The sSASRQ is an averaged value of the 5 SASRQ components best related to COVID-19 pandemic related stress. We would accept the sSASRQ as a useful measure of acute stress during the COVID-19 pandemic in New Mexico during the study period if no single component has an outside effect on the aggregate sSASRQ value and no single component had a stronger correlation with either bad dreams or nightmares than the aggregate value. To quantify this, we performed Pearson correlation analysis on each of the five individual SASRQ items to the averaged sSASRQ aggregate value. Each component was found to have a similar and strong positive correlation amongst both the anxiety and dissociation subscale (Table 2).

Taken together this indicates that our modified sSASRQ variables are valid both independently and as an aggregate. We next took the sSASRQ variables and measured Pearson correlation coefficients between bad dreams and nightmares (Table 3).

From these analyses, we find a strong positive correlation between the aggregate sSASRQ to both increased bad dreams ($r\ 0.28, p < 0.001$) and nightmares ($r\ 0.33, p < 0.001$). Each of the individual components of the sSASRQ were also significant for a positive correlation to both bad dream and nightmare episodes.

3.3. Effect of COVID-19 specific and demographic variables

We next determined if the independent variables from the study were correlated to the acute stress measures (sSASRQ). We performed two-tailed heteroscedastic t-tests for the sSASRQ, bad dreams, and nightmares each against: financial impact, COVID-19 contact, and whether or survey respondents had heard of others having bad dreams during. We added gender to determine if the strongly female survey response influenced the high sSASRQ values and incidence of bad dreams or nightmares (Table 4).

The sSASRQ variables were significantly different between men and women in the sample. This accurately reflects previous studies that report higher prevalence of anxiety disorders in women. Notably, the average amount of acute stress of men is also significant in our sample. Similarly, any effect of gender on the sSASRQ value did not have any statistical significance on the number of bad dreams or nightmares. The other categorical variables were not statistically significant except for an increase in reported nightmares by those who had heard of people having bad dreams. This may reflect either individuals who had heard that people were having bad dreams being more likely to remember nightmares or people who were having nightmares being more likely to seek out information about whether or not people were having bad dreams during the study period.

We then examined the impact of our continuous variables on sSASRQ and Bad Dream and Nightmare frequency. Pearson Correlation analysis was performed comparing age, concern about COVID-19, the subject feeling of well-being since the start of the pandemic with bad dream/nightmare frequency and sSASRQ

Table 2
Weighted sSASRQ variables on the effects of stress.

Variable Removed from sSASRQ	Estrangement	Sleep Quality	Concentration	Hypervigilance	Restlessness
r	0.59	0.69	0.73	0.71	0.71

Table 2. Pearson Correlation variables indicate that each of these variables are contributory to stress for participants during the COVID-19 pandemic.

Table 3
Correlation of sSASRQ variable and Observed Dream Outcomes.

	Mean	Standard Deviation	Bad Dreams	Nightmares
sSASRQ	3.17	0.41	0.28 ^C	0.33 ^C
Estranged	3	1.46	0.17 ^A	0.24 ^C
Sleep Quality	3.41	1.49	0.26 ^C	0.28 ^C
Concentration	3.23	1.4	0.24 ^C	0.18 ^A
Hypervigilance	2.89	1.58	0.22 ^B	0.32 ^C
Restlessness	3.34	1.34	0.21 ^B	0.31 ^C

^A $p < 0.05$, ^B $p < 0.01$, ^C $p < 0.001$.

Table 3. Pearson Correlation analysis of sSASRQ items and number of Bad Dreams and Nightmares shows that increased anxiety measures statistically increase the frequency of bad dreams and nightmares.

(Table 5).

We note strong to moderate correlations of well-being with the reported variables and a strong of well-being with sSASRQ about as strong as the sSASRQ components. We consequently assume that sSASRQ and well-being are measuring similar things. There was a moderate increase of sSASRQ with an increase in concern about COVID-19 and a moderate correlation with increased age and increased nightmares. The correlation of increased age with increased nightmare frequency is not part of any identifiable pattern and is unexpected as nightmares tend to decrease with age and it would be expected that increases in nightmares would likely co-occur with increased stress and bad dreams. The correlation with increased concern about COVID-19 with increased sSASRQ likely reflects some relationship between the two variables. People may be stressed because of their concern about the virus, may be more concerned about the virus because they are more prone to anxiety, or are engaging in behaviors that make them either more anxious or concerned about the virus.

3.4. Bad dream and nightmare frequency

We next measured rates of bad dreams and nightmares to determine if there was a rise in baseline non-stressed frequencies. To do this, we calculated the average percent of people likely to experience nightmare episodes in the past week by multiplying the frequencies provided by Schredl and Göritz [18] to our sample (Appendix A). We repeated these calculations for bad dream episodes (Appendix B). We then applied these estimated frequencies of bad dreams and nightmares to our measured sample (Table 6). We performed a chi square analysis between the estimated number and reported number of the population experiencing both bad dreams and nightmares. We found a five times increase in the number of nightmares in the last week and a 1.75 increase in the number of bad dreams relative to calculated averages ($p < 0.001, p < 0.001$).

The data suggested significant increases in the number of both bad dreams and nightmares over baseline. Importantly, the size of these effects may be underestimated as the researchers were cautious and tried to estimate the largest possible portion of people who have had bad dreams and nightmares in any given week in the comparison studies.

Table 4
Significance of COVID-19 specific factors on sSASRQ value, Bad Dream, and Nightmare Frequency.

	sSASRQ			Bad Dream			Nightmare		
	Yes	No	P	Yes	No	P	Yes	No	P
Financially Impacted	3.24	3.11	0.44	0.92	0.90	0.9	0.91	0.75	0.45
COVID-19 Contact	3.11	3.24	0.08	0.82	0.93	0.57	0.93	0.8	0.57
Heard of people having bad dreams	3.34	3.08	0.11	1.00	0.85	0.45	1.86	0.66	<0.001
Remember dreams				1.1	0.5	<0.001	0.98	0.50	0.01
Gender	Female	Male	P	Female	Male	P	Female	Male	P
	3.3	2.74	0.007	0.99	0.7	0.15	0.92	0.57	0.18

Table 4. Heteroscedastic t-Test comparisons of reported categories with sSASRQ, bad dream, and nightmare frequency.

Table 5
Analysis of continuous influencing factors on sSASRQ, Bad Dream, and Nightmare Frequency.

	Mean	Standard Deviation	Dream Phenomenon	Bad Dreams	Nightmares	sSASRQ
Concerned about COVID-19	2.31	1.14	0.12	0.13	0.06	**0.2
Well-being	1.85	0.99	***0.39	***0.32	***0.26	***0.6
Age+	30–45	N/A	0.09	–0.1	**0.21	0.02
Bad Dreams	0.91	1.22	x	1	x	x
Nightmares	0.822	1.48	x	x	1	x

*p < 0.05, **p < 0.01, ***p < 0.001.

Table 5. Pearson Correlation analysis of continuous variables sSASRQ, Bad Dream, Nightmare, and combined bad dream and nightmare frequency.

+This is a median and standard deviation is not available.

Table 6
Estimated versus reported number of bad dreams and nightmares.

	Nightmares		Bad Dreams	
	Estimated	Reported	Estimated	Reported
None	182	122	135	107
At Least one in the Past Week	15	75	62	88

Table 6. Chi-square analysis of estimated versus reported bad dreams ($\chi^2 = 7.74$, $p < 0.01$) and nightmares ($\chi^2 = 51.82$, $p < 0.001$).

3.5. Bad dream and nightmare topics

To determine if the increased bad dreams and nightmares were thematically influenced by COVID-19, we compared the observed number of themes to the anticipated number of themes determined by Schredl and Göritz [18] (Table 7).

There were statistically significant increases in the frequency of dreams involving themes of interpersonal conflict, failure and helplessness, health and death, apprehension, and disaster. Similarly, there was an increase in nightmares related to accidents.

Table 7
Comparison of estimated versus observed bad dream and nightmare themes.

	Bad Dream		Nightmare	
	Estimated	Reported	Estimated	Reported
Physical Aggression	104	35 ^C	12.4	6 ^B
Interpersonal Conflict	44.9	64 ^B	20.2	10 ^C
Failure or Helplessness	34.6	65 ^C	10.3	10
Health Related Concerns and Death	19.5	36 ^C	8.1	14
Apprehension/Worry	18.6	49 ^C	7.6	9
Being Chased	23.7	16	3.3	8
Evil Forces	23.7	14 ^B	2.7	6
Accidents	18.6	12	2.9	10 ^A
Disaster/Calamity	11.8	24 ^C	3.3	6
Insects	14.3	8 ^A	2.6	1
Environmental Abnormality	10	11	2.6	1
Others	14.3	4 ^B	6.1	1 ^C

^Ap < 0.05, ^Bp < 0.01, ^Cp < 0.001.

Table 7. Compared to anticipated amounts of themes in bad dreams and nightmares, the participants experienced significantly higher frequencies of themes related to physical aggression, interpersonal conflict, failure or helplessness, apprehension or worry, evil forces, disaster/calamity, insects, and other themes.

from reports prior to the pandemic, and were more related to health related adverse events.

4. Discussion

The data we collected provides a unique window into a unique period of time where the social impact of the Covid-19 pandemic was uncertain, but beginning to have significant changes in the state of New Mexico. This period of uncertainty and fear of a deadly disease and worry of economic changes, lead to significant changes in people's dreams. While the idea that increased stress leads to increased bad dreams and nightmares and increases in the dream content related to the stressor seems intuitive, our data is the first we are aware of that shows the increase in frequency. Additionally, prior research showing increased stress relating to increased frequency of dream themes was related to a more visually impactful event, the 9/11 attacks [21,22], and the early days of the COVID-19 pandemic did not have such visually iconic images associated with them. Additionally, the prior studies we are aware of did not attempt to measure individuals' reported stress but rather assumed the presence of stress.

Similar studies conducted around the time of our study also find an association between increasing levels of stress with increasing amounts of nightmares and shifts in themes towards contagions or other sociopolitical themes such as authoritarianism or apocalyptic imagery [23–25]. One study asked participants about new onset nightmares and about 40% were new onset [23]. The current study provides a more direct comparison to older existing data than the other studies the authors are aware of and finds changes relative to the historical data. The current data fits in well with similar studies showing increasing nightmare frequency with increasing stress, increasing themes of death/illness/contagion, and demonstrates that these frequencies are significantly different from baseline data from before the beginning of the COVID-19 pandemic.

5. Limitations

Limitations include the distribution of materials, which were limited to literate participants with access to the internet. This could have skewed data to wealthier, more urban areas, with higher rates of internet access, neglecting more rural areas of New Mexico. Our participants were mostly middle age and younger and this could have resulted from the use of online distribution and an online survey tool. Similarly, utilizing New Mexico as a geographic requirement could have included cultural biases of dreams and associations of dreams with conscious interpretations. Additionally, the majority of the participants were women, which may have increased the amount of measured stress and increased the frequency of nightmares. The description used in survey recruitment posts, describing the study as looking at stress and sleep, could have also been more likely to draw people with higher levels of stress and sleep disturbances. Another limitation is our inability to directly compare people who believe COVID-19 is a hoax or who believe they had had COVID-19 prior to the first reported case to those who do not. These ideas were unknown to the authors at the time of study design and thus were not asked. However, people who think COVID-19 is a hoax or who believe they have had it without testing are likely to report a lower level of concern about COVID-19. While our sample size is relatively small, we met our recruitment goal and our study had enough power to detect the correlations we report, the chi squares for frequency of dreams and nightmares relative to baseline, and the relative proportions of

dream themes relative to baseline. We did not meet our target and are underpowered for our analysis of nightmare themes meaning that there may be other differences in theme frequencies that we were unable to detect.

Our study is further limited by not assessing for comorbid and pre-existing medical and psychiatric causes that could have explained some of the symptoms reported by the individuals in our study (i.e., PTSD, Generalized Anxiety Disorder, Depression, Restless Leg Syndrome, Attention Deficit Hyperactivity Disorder (ADHD), etc.) and by not seeking to assess whether these conditions were new. We also did not assess for other measures of sleep and sleep quality as we wished to focus on bad dreams and nightmares. It is possible that other changes in participants' sleep quality influence and are influenced by the bad dreams and nightmares; however, this is beyond the scope of the current study.

Additionally, whereas the three main comparison studies [18–20] were dream journals, our participants self-coded their dreams. This may explain the decrease in the “other” category as dream topics, as participants may have assigned topics differently than the original researchers, and avoided placing things in the “other” category. While this does create the possibility of an individual participant misunderstanding the thematic categories and misapplying them, we thought that the risk of this event skewing the data was less likely than the researchers coding it independently. Additionally, whereas Schredl & Göritz [18] allowed multiple topics per nightmare, we only allowed one topic per nightmare, which may change the overall frequency of topics for nightmares as it forces participants to choose between topics for nightmares with multiple topics.

6. Conclusion

In summary, our research found correlations that indicate that sleep disturbances were changing significantly in their frequency during the early pandemic. The data provides evidence to support the intuitive idea that large-scale stressful incidents are related to changes in dreams and nightmares in response to these stressful incidents, and that the stress causes a shift in general themes towards the theme that best describes the stressor. These data also provide insight into the changing mental health climate of New Mexico during the early stages of the Pandemic and that, at least in this younger cohort, the social disruption from the pandemic had a greater impact on overall wellbeing and stress than fear of COVID-19.

CRediT authorship contribution statement

Tim Campbell: Conceptualization, Methodology, Formal analysis, Writing – original draft, writing review/revision. **Ariel Hurwitz:** Methodology, Formal analysis, Writing – original draft. **Robyn Bartel:** Methodology, writing review/revision. **Rachel Rose:** Methodology, Software. **Jeremy Dean:** Methodology, Investigation, Writing – original draft. **Tom Markle:** Methodology, corresponding author.

Appendix A. Nightmare frequency anticipated from Schredl and Göritz [14]

Nightmare Frequency Calculation			
Frequency, Schredl and Göritz	Frequency, per week	percentage (%) reported	Calculation
weekly	1	2.4	2.4
bi-weekly	0.5	2.3	1.15
monthly	0.25	4.3	1.075
several per year	0.125	10.8	1.35
rarely	0.04	38.1	1.524
never	0	42	0
Sum of calculations as percentage of nightmares anticipated per week =			7.5

B. Bad dream frequency anticipated from Schredl and Göritz [14]

Bad Dream Frequency Calculation			
Frequency, Schredl and Göritz	Frequency, per week	percentage (%) reported	Calculation
weekly	1	15.8	15.8
2-3 per month	0.75	13.9	10.425
monthly	0.25	14.3	3.575
once per year	0.02	10.6	0.212
never	0	23.4	0
Sum of calculations as percentage of bad dreams anticipated per week =			30.0

Calculation of Bad Dream and Nightmare Expected Frequencies. To complete these calculations, we took the reported incidence of bad dream and nightmare themes from Schredl and Göritz [14] and converted them to anticipated numbers for our population. Schredl and Göritz [14] allowed for multiple themes per episode, so these percentages were altered for our study, which only utilized one predominant theme per episode (Appendix C1).

Appendix C1. Estimated Bad Dream and Nightmare Theme Frequency

Theme	% Bad Dream, Schedl and Göritz	Divided by total Bad Dreams	% Nightmare, Schedl and Göritz	Divided by total nightmares
Physical Aggression	0.49	0.31	0.21	0.15
Interpersonal Conflict	0.21	0.13	0.35	0.25
Failure or Helplessness	0.16	0.10	0.18	0.13
Health Related Concerns and Death	0.09	0.06	0.14	0.10
Apprehension/Worry	0.09	0.06	0.13	0.09
Being Chased	0.11	0.07	0.06	0.04
Evil Forces	0.11	0.07	0.05	0.03
Accidents	0.09	0.06	0.05	0.03
Disaster/Calamity	0.06	0.03	0.06	0.04
Insects	0.07	0.04	0.04	0.03
Environmental Abnormality	0.05	0.03	0.04	0.03
Others	0.07	0.04	0.10	0.07
Total	1.58	1.00	1.41	1.00

Data taken from Table 2 from Schredl and Göritz [14].

Due to the stepwise questioning of our study, to calculate the episodes per theme we subtracted the number of nightmares per theme to find the resultant number of bad dreams associated with each theme (Appendix C2).

Appendix C2. Number of Bad Dreams calculated from Reported number of Nightmares per theme

Theme	Total themes	Number of nightmares	Number of bad dreams
Physical Aggression	41	6	35
Interpersonal conflict	74	10	64
Failure or helplessness	75	10	65
Health related concerns and Death	50	14	36
Apprehension/Worry	58	9	49
Being Chased	24	8	16
Evil Forces	20	6	14
Accidents	22	10	12
Disaster/Calamity	30	6	24
Insects	9	1	8
Environmental abnormality	12	1	11
Others	5	1	4
Total	420	82	338

The number of nightmares per theme was given in the study and the total number of either bad dream/nightmare episodes was given per theme. A back calculation was used to formulate the number of bad dreams per theme.

To calculate the anticipated bad dreams and nightmares associated with each theme according to Schredl and Göritz [14], we multiplied the number of incidences of each theme per the total number of reported bad dreams and themes (Appendix C3). It was these numbers used for comparison to the reported data of how the anticipated and reported numbers differed in the data set.

Appendix C3. Estimated Number of Bad Dreams and Nightmares per Theme

Theme	Divided by total Bad Dreams	prevalence by reported number of bad dreams (338)	Divided by total nightmares	prevalence by reported number of nightmares (82)
Physical Aggression	0.31	104	0.15	12
Interpersonal conflict	0.13	45	0.25	20
Failure or helplessness	0.10	35	0.13	10
Health related concerns and Death	0.06	19	0.10	8
Apprehension/Worry	0.06	19	0.09	8
Being Chased	0.07	24	0.04	3
Evil Forces	0.07	24	0.03	3
Accidents	0.06	19	0.03	3
Disaster/Calamity	0.03	12	0.04	3
Insects	0.04	14	0.03	3
Environmental abnormality	0.03	10	0.03	3
Others	0.04	14	0.07	6
Total		338		82

The percentages calculated from Appendix C1 were used to estimate the number of bad dream and nightmares themes that were anticipated for our sample. These numbers were used to compare to our sample data.

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