

Development of a Structure-Validated Nightmare Experience Questionnaire in Chinese University Students

Wanzhen Chen^{1,2}, You Xu¹, Ming Zhu¹, Yixin Tang¹, Shenyu Huang¹, Hongjing Mao³, Jian Liu³ and Wei Wang^{1,2,3}

¹Department of Clinical Psychology and Psychiatry/School of Public Health, Zhejiang University College of Medicine, Hangzhou, China

²Department of Psychology and Behavioral Sciences, Zhejiang University College of Sciences, Hangzhou, China

³Department of Clinical Psychology, Affiliated Psychiatric Hospital, Zhejiang University College of Medicine, Hangzhou, China

*Corresponding author: Wei Wang, Department of Clinical Psychology and Psychiatry/School of Public Health, Zhejiang University College of Medicine, Yuhangtang Road 866, Hangzhou, Zhejiang 310058, China, Tel: +86-571-88208188; E-mail: wangmufan@msn.com

Received Date: July 16, 2014, Accepted Date: September 23, 2014, Published Date: September 30, 2014

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Abstract

Background: Nightmare experience is associated with a broad spectrum of psychopathology, however, there lacks a structure-validated questionnaire to measure the effects of nightmare contents on the physical, psychological and behavioral aspects.

Methods: Based on the clinical manifestation and previous documentation, we have designed a matrix of 95 items to measure the nightmare contents, plus one item to measure the nightmare frequency, and trialed them in 160 male and 161 female Chinese university students who have had a life-long nightmare experience.

Results: After both exploratory and confirmatory factor analyses, we have found four factors regarding the nightmare experience, namely Physical Effect, Negative Emotion, Meaning Interpretation and Horrible Stimulation. The fit of 20-item model (five top-loading items each factor) has proven to be the best structure. Together with an item measuring frequency, the model, called Nightmare Experience Questionnaire (NEQ), was retained for further analyses. The nightmare frequency was positively correlated with all the four NEQ factors, and women scored significantly higher on NEQ Negative Emotion and Meaning Interpretation factors than men did.

Conclusion: The NEQ might help to understand some psychiatric disorders, especially those with the awaking emotional deregulation in women.

Keywords: Confirmatory factor analysis; Nightmare experience; Principal component analysis; Structure-validated

Introduction

Nightmares are repeated occurrences of extended, extremely dysphoric, and well-remembered dreams usually involving efforts to avoid threats to survival, security, or physical integrity, and usually being accompanied by fear or panic which results in immediate awakening [1]. An individual generally has a nightmare during the rapid eye movement sleep, and quickly becomes oriented and alert on waking from the dream; however, the nightmare might leave the individual negative emotions and cause obvious distress, emotional deregulation, or impairment in social, occupational, or other functioning [2,3]. The life-long nightmare experience happens in almost every healthy individual [4,5], especially in adolescents and young adults, or in women [6,7].

In clinics, the frequent nightmares are prevalent in 16.7% patients with schizophrenia [8], 17.5% depression [8,9], 25% substance or alcohol abuse [10,11], 49% borderline personality disorder [12,13], 57% dissociative disorder [14,15], and 90% post-traumatic stress

disorder (PTSD) [16]. Moreover, the frequent nightmares happen in anxiety and bipolar disorders [17,18]. They are even considered as a hallmark of PTSD [3,9], since they are connected with a broad range of traumatic events, such as combat exposure, traffic accident, crime victimization, rape, and natural disaster [20-23]. There is a robust association between the nightmare frequency and the severity of the clinical symptom of the psychiatric disorders mentioned-above [3]. In addition, the frequent nightmares in early adolescence predict the onset of anxiety symptoms five years later [18], and increase the suicidal tendency in patients with major depression, borderline personality disorder, and dissociative disorder [24,25].

Scholars have developed several inventories to measure the frequency and different aspects of nightmare. For instance, there are one questionnaire measuring the nightmare effects of distress: the 13-item Nightmare Distress Questionnaire (with an internal alpha of between 0.83 and 0.88) [26]; one questionnaire measuring its effects on emotion: the 4-item Nightmare Emotions Scale (with an internal alpha of 0.62) [27]; one questionnaire on daily behaviors: the 43-item Nightmare Behavior Questionnaire [28]; and two questionnaires on daily activities: the 11-item Nightmare Effects Survey [29] and the 13-item Nightmare History and Impact Questionnaire [30]. Although the Nightmare Distress Questionnaire has proven to be a three-factor structured one (i.e., preoccupation-fear, interference, and premonition), and the Nightmare Effects Survey a two-factor one (specific effects, and general effects) [31], most of these questionnaires were not structurally-validated with a structure-modeling equation

method. Moreover, up to present, there is no single study using an overall self-report questionnaire for nightmare regarding the dream contents and their effects on the cognitive, physical, and behavioral aspects of the individual.

The aim of the present study was to develop a structure-validated measurement of nightmare experience which might cover different nightmare topics, the experienced emotion, the cognition and behavior afterwards, and the physical/ psychological effects. Inspired by previous studies [26,28,29,32,33] and the definition of the nightmare in DSM-5 [1], we have built a matrix of statements regarding the nightmare experience. We have hypothesized that: (1) the nightmare experience contents are clearly divided into: the nightmare topic, the emotion during dreaming and subsequent waking states, the cognition, behavior and physical/ psychological functions during waking state afterwards; (2) the nightmare frequency is correlated with these content measures; (3) women display pronounced emotional and behavioral effects which relating to the nightmares.

Methods

Participants

Totally 354 participants were invited to participate in the current study. Participants who never had a nightmare experience (n=23) or had not responded to the 95-item matrix measuring nightmares (see below) (n=10) were excluded. The remaining participants were 160 men (mean age: 20.13 years \pm 1.12 S.D.; range: 18-25 years) and 161 women (mean age: 19.97 \pm 1.29; range: 18-29). There was no significant age difference between the two gender groups (the Student $t=1.12$, $p=0.26$, 95% Confidence Interval (CI): -0.12 ~ 0.42). They were all undergraduates of Han ethnicity, and majored in Arts, Education, Foreign Languages, Engineering, Math, Mechanics, and Modern Medicine. All participants were free from any somatic or psychiatric illnesses (including sleep-wake disorder and PTSD), had not experienced recent life-events, and had not received horror video, picture or sound stimulation at least 72 hours prior to participating in the study. The study protocol was approved by a local Ethics Committee and all participants had given their written informed consent. Moreover, the participants were paid or earned course credits for their participation.

Measures

Participants were asked to complete a matrix of 95 items measuring the nightmare experience in a quiet room. They were asked to use a five-point Likert rating scale: 1-very unlike me, 2-moderately unlike me, 3-somewhat like and unlike me, 4-moderately like me, and 5-very like me. The main parts of the items were: 1) negative emotion experience in nightmare, 2) aggressivity or grievous bodily harm in nightmare, 3) events in nightmare, 4) dream recall clarity of nightmare, 5) behavior and cognition after nightmare, 6) psychological and physiological effects after nightmare (including the immediate emotion of waking from nightmare). An additional item measuring the nightmare frequency was also adopted from a previous study [32], and participants were asked to rate it by an eight-point Likert rating scale, i.e., 1-never, 2-less than once a year, 3-once a year, 4-two-to-four times a year, 5-once a month, 6-two-to-three times a month, 7-once a week, and 8-several times a week.

Statistical analyses

Answers to the 95 items were subjected to the principal component analysis using the Predictive Analytics Software Statistics, Release Version 18.0.0 (SPSS Inc., 2009, Chicago, IL) [34]. The factor loadings were rotated orthogonally using the varimax normalized methods. Items which were loaded less heavily (below 0.45) on a target factor, or cross-loaded heavily (above 0.30) on more than one factors were removed from subsequent analyses one-by-one.

The fit of the remaining data (i.e., components extracted as latent factors) thereafter were evaluated by the confirmatory factor analysis for the structural equation modeling using the Analysis of Moment Structures (AMOS), version 17.0 (Arbuckle, AMOS Development Corp. 2008, Crawfordville, FL) [35]. Indices used to assess the overall fit model were the χ^2/df , the goodness of fit index [36], the adjusted goodness of fit index, the comparative fit index [37], the Tucker-Lewis Index [38], and the root mean square error of approximation [39].

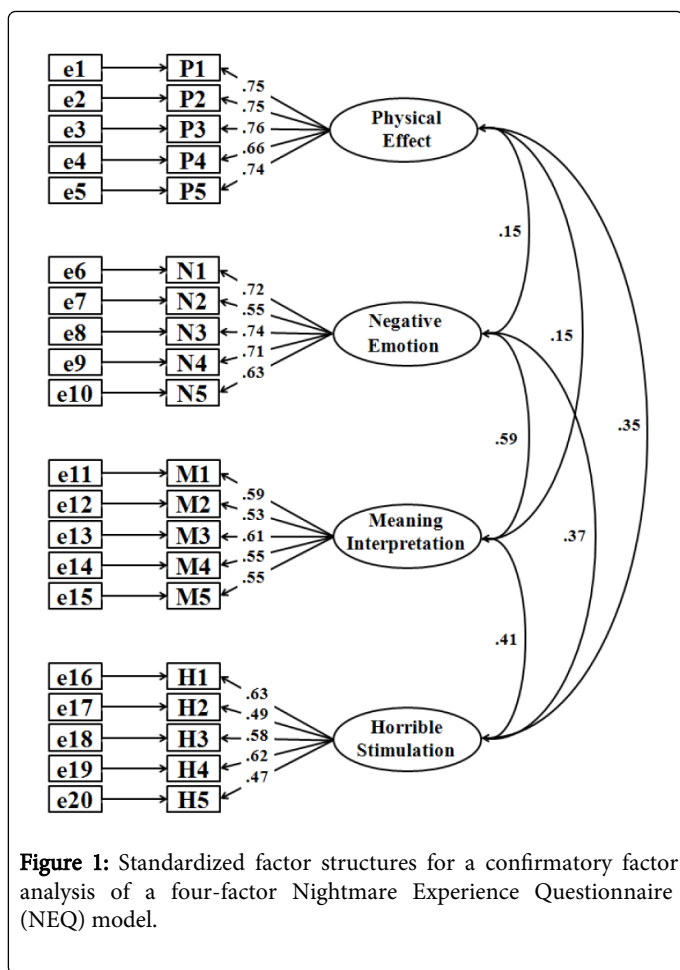
Once factors and the related items were identified, their scores were calculated in each gender group. The internal reliabilities (the Cronbach alphas) for each factor were also calculated in all participants by another computer program - Reliability and Item Analysis. The gender difference of individual factor scores was evaluated by two-way ANOVA (i.e., gender \times factor score) plus the independent Student t test, and the gender difference of the nightmare frequency was analyzed by the Mann-Whitney U test. Moreover, the Pearson correlation test was used to search for possible relationships between the frequency and the four factors, and for those within the factors. A p value less than 0.05 was considered to be significant.

Results

Answers to the 95 items measuring the nightmare experience were entered into a principal component analysis first. Results of the pre-analysis check were acceptable (KMO=0.897; the Bartlett test of sphericity=15588.39; $p=0.000$). Twenty-five eigen values greater than 1.0 were identified, and the scree plot indicated a level-off from the sixth factor on. The eigen values of the first four factors were 14.16, 8.36, 5.64 and 5.54 respectively, which accounted for 35.58% of the total variance. After the varimax normalized rotation, there were less than three items loaded appropriately on each of the fifth and the sixth factor. Therefore, a four-factor solution was chosen for the confirmatory factor analysis, with 40 out of 95 items (19,8,7,6 items respectively for the four factors) which loaded higher than 0.45 on the target factor and not cross-loaded heavily on other factors.

Six AMOS fit-models of four-factors with different items were constructed (Table1) and the 20-item model (five items with top loadings on each target factor) was the best among them. The standardized factor correlations for the 20-item model structure were also acceptable (Figure 1). Based on these 20 items, and an item measuring the nightmare frequency, we have developed a Nightmare Experience Questionnaire (NEQ, Table 2), and consequently named its four factors as below.

Factor 1 was called "Physical Effect", which reflects a deficit of the physical health, appetite, and other daily activities after nightmares; the higher score the higher level of physical impairment. Factor 2 was called "Negative Emotion", which describes frightened, scared, helpless emotions during nightmares; the higher score the more negative emotion experienced.



Factor 3 was called “Meaning Interpretation”, which describes an effort to interpret the nightmare or to value the information it might convey; the higher score the more rumination evoked. Factor 4 was called “Horrible Stimulation”, which describes scenes of terrifying activity or adventure, violence, or terrorist incidents; the higher score the more horror or excitation experienced.

Two-way ANOVA detected a significant difference in the four NEQ factor scores between two gender groups ($F [1,319]=4.94, p=0.027$, mean squared effect=133.58). The post-hoc Student t test showed that the scores of NEQ Negative Emotion and Meaning Interpretation were significantly higher ($p<0.05$) in women than those in men. The internal alphas of the four factors were satisfactory, and the inter-correlations between the four factors were significant but remained in a low or medium level (Table 3).

For the nightmare frequency, nine participants failed to provide an answer. In the rest 312 participants who had a life-long nightmare experience, about 61 people (19%) reported a frequency of less than once a year, 30 (9.3%) once a year, 138 (43%) of two-to-four times a year, 37 (11.5%) once a month, 36 (11.2%) two-to-three times a month, 5 (1.6%) once a week, and 5 (1.6%) several times a week. The Mann-Whitney U test failed to detect a gender difference ($U=12063.00, p=0.89$) regarding the nightmare frequency. There were however, significant positive correlations between nightmare frequency and NEQ Physical Effect ($n=312, r=0.21$), Negative Emotion (0.26), Meaning Interpretation (0.27) and Horrible Stimulation (0.26) factors.

Total item number	Item numbers each factor	χ^2/df	Goodness of fit index	Adjusted goodness of fit index	Comparative fit index	Tucker-Lewis index	Root mean square error of approximation
40	19, 8, 7, 6	2.16	0.79	0.76	0.80	0.79	0.060
31	10, 8, 7, 6	2.03	0.85	0.83	0.86	0.85	0.057
29	8, 8, 7, 6	2.12	0.85	0.83	0.87	0.84	0.059
24	6, 6, 6, 6	2.07	0.89	0.86	0.88	0.87	0.058
23	6, 6, 6, 5	2.19	0.88	0.86	0.88	0.86	0.061
20	5, 5, 5, 5	2.00	0.91	0.89	0.91	0.89	0.056

Table 1: Four-factor fitting models of the Nightmare Experience Questionnaire in 321 participants.

Discussion

Using both exploratory and confirmatory factor analyses on the 95 items regarding nightmare, we have developed a structure-validated, 20-item Nightmare Experience Questionnaire (NEQ) in Chinese university students. The four factors namely Physical Effect, Negative Emotion, Meaning Interpretation, and Horrible Stimulation, had satisfactory internal reliabilities and low-to-medium inter-correlations, which supported our first hypothesis. The 3.2% prevalence of high frequency-nightmare (more than once a week) in

our participants was similar to the 2-6% prevalence reported earlier [40]. The significant correlations between nightmare frequency and four NEQ factor scores, and the women preponderance in NEQ Negative Emotion and Meaning Interpretation factors supported other two of our hypotheses. Previous documentation tells that the nightmare frequency is related to how individuals view their dreams in general [3]; our results have demonstrated further that it was related to four distinctive aspects of nightmare experience in detail.

The first factor, Physical Effect, was a replication of the nightmare distress [26], of the physiological effects [29,30] and of the behavioral effects [28] reported previously. Indeed, the chronic nightmare sufferers often attributed their daytime impairment to the increased

fatigue from the related poor night-sleep [41]. The positive correlation between the nightmare frequency and the Physical Effect score found in our study was also in line with a previous report [42].

Items	Factor 1	2	3	4
I feel getting weak physically because of having nightmares.	0.71	-0.03	0.01	0.10
My appetite has changed because of having nightmares.	0.70	-0.06	-.05	0.15
I find that I cannot deal with activities the day after having nightmares.	0.69	-0.05	-.04	0.21
I always suffer from insomnia due to having nightmares.	0.68	0.07	0.04	0.15
I always consider that my life is deeply influenced by nightmares.	0.64	-0.07	0.06	0.08
I felt frightened in my nightmares.	0.05	0.67	0.16	-.01
I was scared in my nightmares.	0.05	0.63	0.19	0.10
I often feel helpless in my nightmares.	0.07	0.63	0.23	0.09
I can hardly get out of the dilemma in my nightmares.	-0.02	0.60	0.14	0.27
I can do nothing to help facing the occurrence in my nightmares.	0.06	0.54	0.14	0.13
I try to interpret the contents of nightmare.	0.19	0.12	0.61	0.13
Nightmares make no sense to me.	-0.18	0.00	-0.55	0.20
Nightmares contain some important information which I am very cautious about.	0.18	0.23	0.55	0.02
I can always see the details clearly in my nightmares.	-0.05	0.26	0.53	0.18
The scene or person involved in my nightmares was familiar to me.	-0.07	0.19	0.49	0.13
I dreamed about participating in a terrifying activity or adventure.	0.10	0.10	0.18	0.60
I feel excited in my nightmares.	0.22	-0.07	0.01	0.54
My nightmares always go along with violence.	0.15	0.26	-0.04	0.53
I often dream about the terrorist incidents that threaten lives of others.	0.15	.23	0.18	0.49
In my nightmares, I dreamed about doing something I never do in my daily routines.	0.05	0.05	0.05	0.47

Table 2: Factor loadings of the selected 20 items after the principal component analysis and confirmatory factor analysis in 321 participants. Note: Loadings ≥ 0.45 are in bold for clarify.

	Factor Score			Alpha (n = 321)	Inter-correlation (n = 321)		
	Men (n = 160)	Women (n = 161)	95% CI		Physical Effect	Negative emotion	Meaning interpretation
Physical effect	7.16 \pm 3.37	6.71 \pm 2.53	-0.20 ~ 1.11	0.85			
Negative emotion	16.26 \pm 4.47	17.89 \pm 4.14#	-2.58 ~ -0.69	0.80	0.13*		
Meaning interpretation	13.21 \pm 3.97	15.04 \pm 4.02#	-2.72 ~ -0.96	0.65	0.14*	0.42*	
Horrible stimulation	12.94 \pm 4.24	12.50 \pm 4.07	-0.47 ~ 1.35	0.69	0.28*	0.28*	0.24*

Table 3: Factor scores (mean \pm S.D.), internal reliabilities, and their inter-correlations of the Nightmare Experience Questionnaire. Note: # $p < 0.05$ vs. Men; *Significant correlation at $p < 0.05$; CI: Confidence Interval.

The second factor, Negative Emotion, was consistent with the nightmare-related emotion reported previously [27]. As nightmares are vivid and high-emotionally dysphoric dreams that awaken the individual from sleep [3,6], where fear, terror, or anxiety are predominant emotions [2], a factor like this one in our study might be

important to evaluate the nightmare severity as suggested [27]. The positive correlation between the nightmare frequency and this factor score was also in line with previous results [43]. Indeed, it has shown that the heightened reactivity to nightmare at night increases the individual's risk for the elevated distress at waking and the subsequent

psychopathology in life [44], which in turn induces more frequent nightmares [40]. Moreover, we have found that women scored significantly higher on this factor than men did which was in accordance with the finding that women experienced explicitly more emotions in their dreams [45,46]. Furthermore, there are gender-related differences in the cerebral processing of emotions which might be linked to the better episodic memory of emotion in women [47]. This factor supports that nightmare is related to a personality trait of an intense reaction to emotional distress [26,42,48]. The heightened emotional distress at waking as an underlying pathological base might in turn be aggravated by the nightmare reported in the emotion-related disorders such as borderline personality disorder or substance abuse disorder [10-13].

The third factor, Meaning Interpretation, corresponded to a domain of "search of explanations for the nightmare" reported by Köthe & Pietrowsky [28]. The nightmare frequency positively correlated with this factor was also in line with a previous report [28]. Women in our study also scored higher on this factor than men did, which was consistent with previous studies that women rated their nightmares as more vivid and meaningful [4,26,48]. Interestingly, women who frequently experienced nightmares often have higher levels of open-mindedness, sensitivity, vulnerability, creativity, and artistic ability [28,49]. Moreover, other literature supports its correlation with frequency and its women preponderance. For instance, women have more nightmares [7], score higher on neuroticism trait than men do [50], and people with a prominent neuroticism tend to seek the meanings of nightmare [28].

The fourth factor, Horrible Stimulation, corresponded to a differing or idiopathic content, and to a repetitive or recurrent content of the nightmare, which were often focused on a specific terrific or excited event as reported previously [44]. Most scenes appeared in nightmares resembled the terrifying activity or adventure described by patients suffering from PTSD or other disorders with traumatic experiences [51]. The scenes being similar to the flashbacks of trauma, often disrupted the sleep quality considerably, in return might re-exaggerate the symptoms in these patients [52,53], which supports the positive correlation found between the nightmare frequency and this factor score in our participants.

However, one might also bear in mind several limitations of the current study design. Firstly, our participants were college students, who were in a time period of significant life change and adjustment to situations of novel and stressful, which might increase the nightmare frequency [54]. Although we could not guarantee that all our college students were non-stressful, it is absolutely necessary to apply NEQ to other age groups. Secondly, there have been significant differences between the posttraumatic and non-traumatic nightmares [3], although we have excluded PTSD patients from our study, we failed to note whether our participants had any covert early traumatic experiences. A future study designed according to different life-experiences is also warranted.

Nevertheless, we have developed a structure-validated, 20-item NEQ with four distinct factors, and found their positive correlations with the nightmare frequency, which might help to characterize a nightmare in our daily lives and in clinics. For instance, the Physical Effect and Negative Emotion, which relate more to the distress of a nightmare, the Meaning Interpretation, which relates more to its realistic or optimistic reasoning, and the Horrible Stimulation, which connects to its traumatic flashbacks, might specifically help to measure the different aspects of a nightmare experience in normal children and

adolescents, and in patients with cardiovascular or neuropsychiatric disorders. Moreover, women showed higher scores of Negative Emotion and Meaning Interpretation in the current study, which from a limited angle, might help to understand the emotional deregulation and the related coping styles at waking in female patients with borderline personality disorder or substance abuse disorder.

Acknowledgements

The study was supported by the grants from the Natural Science Foundation of China. Dr. W.Wang: 91132715.

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