

# Dreaming

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# Factor Analysis and Validation of the Disturbing Dreams and Nightmare Severity Index

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*The Disturbing Dream and Nightmare Severity Index (DDNSI) has been used widely in research and clinical practice without psychometric evidence supporting its use. The present study aimed to explore and confirm the factor structure of the DDNSI as well as to test the measure's construct validity and invariance between groups based on sex and race. In all, 2 samples of U.S. undergraduate participants (N = 614 and N = 606) provided data on nightmares (i.e., DDNSI, Nightmare Effects Survey, Nightmare Frequency Questionnaire, Nightmare Distress Questionnaire, and Trauma-Related Nightmare Survey) and related psychopathology (e.g., symptoms of insomnia, depression, posttraumatic stress disorder, and anxiety). Exploratory and confirmatory factor analyses found the 5 original items of the DDNSI to load onto a single latent factor. The DDNSI was found to be a valid measure of nightmare frequency and distress, as it was significantly correlated with the Nightmare Frequency Questionnaire and the Nightmare Distress Questionnaire, and the DDNSI was able to differentiate between nightmares and psychopathology. Multiple group analysis invariance testing found that the latent structure of the DDNSI was comparable between sex (male vs. female) and race (White vs. Black). Though this research comes nearly 2 decades after the initial creation and use of the DDNSI, it provides a foundation for the scientific rigor of previous and future studies on nightmares using the DDNSI.*

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**Keywords:** nightmare assessment, psychometrics, nightmares, Disturbing Dreams and Nightmare Severity Index, disturbing dreams

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Nightmares, or distressing dreams that cause startled awakenings, are clinically relevant in behavioral sleep medicine and the treatment of psychological disorders. Nightmares have been found to be related to symptoms of depression (Nadorff et al., 2011, 2013), anxiety (Nadorff, Porter, et al., 2014; Nielsen et al., 2000), posttraumatic stress disorder (PTSD; Bryant et al., 2010; Mellman et al., 1995; Ohayon et al., 2000), dissociative disorders (Agargun et al., 2003), borderline personality disorder (Claridge et al., 1998; Hartmann et al., 1981), psychosis (Hartmann et al., 1981; Michels et al., 2014), and suicidality (Nadorff, Anestis et al., 2014; Sjöström et al., 2009; Tanskanen et al., 2001). Despite these significant clinical implications, nightmares are often not reported nor assessed (Nadorff et al., 2015). A notable barrier to adoption has been the lack of well-validated nightmare screening measures.

### **Nightmare Assessment Measures**

When deciding to assess nightmares, there are several measures to choose from. These include the Nightmare Distress Questionnaire (NDQ; Belicki, 1985, 1992), Nightmare Effects Survey (NES; Krakow et al., 2000), Nightmare Frequency Questionnaire (NFQ; Krakow, Schrader et al., 2002), Trauma-Related Nightmare Survey (TRNS; Cranston et al., 2017), Nightmare Proneness Scale (Kelly, 2018), Nightmare Experience Scale (Kelly & Mathe, 2019), Cognitive Appraisal of Nightmares (Gieselmann et al., 2020), Nightmare Disorder Index (Dietch et al., 2020), and Disturbing Dreams and Nightmare Severity Index (DDNSI; Krakow, Schrader, et al., 2002). Despite all of these measures assessing nightmares, there are significant differences between them. For instance, some examine just frequency (e.g., NFQ), whereas others focus on the severity or effects of the nightmares (e.g., NDQ and NES). By looking at just part of the nightmare experience, these measures may not properly assess the full extent of a nightmare problem. Another limitation of the literature is that although several nightmare measures exist, many have little, if any, evidence in support of their psychometric soundness, and studies that have attempted to validate these measures, such as the NDQ, do not support the initial structure of the measures (Stieger & Kuhlmann, 2018). Thus, there is little clarity in the literature about which measures perform validly and should be used both in research and clinical practice.

### **The Disturbing Dreams and Nightmare Severity Index**

The DDNSI (Krakow et al., 2001) is a self-report measure consisting of five items that assess the frequency, quantity, severity, and intensity of disturbing dreams and nightmares as well as the frequency of nightmare-related awakenings. Two additional items ask about frequency (i.e., never, yearly, monthly, weekly) and duration (i.e., number of months or years) of disturbing dreams and nightmares but are not included in the total score (see Supplement 1 in the online supplemental materials for full measure). Because it assesses both the frequency and effects of nightmares, it is an ideal measure to assess the full nightmare experience. The DDNSI is an adaptation and expansion of the NFQ (Krakow, Schrader, et al., 2002), and the development of the DDNSI is sometimes miscredited to a study using the NFQ with survivors of sexual assault who had PTSD (Krakow, Schrader, et al.,

2002) or to a study on sleep dynamic therapy with Cerro Grande Fire evacuees (Krakow, Melendrez, et al., 2002). However, the first mention of the DDNSI appears in an abstract by Krakow and colleagues (2001) as the Nightmare Severity Index, which only names the measure. To the best of our knowledge, there is no published report on how the DDNSI was developed or validated prior to its use in research and clinical settings.

The DDNSI has been widely used in research on nightmares, being cited approximately 50 times since its initial development in 2002 (see Supplement 2 in the online supplemental materials). The DDNSI is also often used as a measure that new nightmare measures are correlated with to determine convergent validity (Kelly & Mathe, 2019; Kelly & Yu, 2019). The DDNSI has demonstrated adequate internal consistency in many samples ( $\alpha = .73$  in Hom et al., 2018 to  $\alpha = .93$  in Nadorff et al., 2013), yet other psychometric properties of the DDNSI have yet to be examined directly.

Given the widespread use of the DDNSI in research and practice and lack of complete, sound psychometric evidence supporting the validity of the measure, the purpose of the present study was to explore and confirm the factor structure of the DDNSI and to establish its construct validity against other nightmare measures and measures of other related, yet different constructs. In addition, because there are significant racial and sex differences in normal sleep and sleep disturbances between Whites and Blacks (Petrov & Lichstein, 2016; Ruiter et al., 2011) as well as males and females (Bjorvatn et al., 2010; Mallampalli & Carter, 2014), we examined whether the latent structure of the DDNSI was comparable across these groups.

## Methods: Study 1

### Participants and Procedure

Data were collected in 2016. Participants included 614 undergraduate students from a large, public land-grant university in the southern United States. Participants completed the research for credits required by multiple psychology courses. Participants logged into an online recruitment website (Sona Systems), where they were shown all of the studies for which they met the inclusion criteria. The study was advertised as “A Validation of a New Measure of Bad Dreams and Nightmares” and took approximately 30 min to complete. Participants who were interested read the informed consent document, indicated consent by clicking to take part in the study, and answered questions on the SONA website regarding demographics, insomnia symptoms, trauma, alcohol use, impulsivity, depression symptoms, suicidality, and nightmares. This study was deemed exempt by the Mississippi State University Institutional Review Board (13-008). Participants were on average 20 years of age (range: 18–52;  $SD = 3.36$ ), primarily female (62.6%), single (65.3%), and Caucasian (60.2%). To increase the validity of the responses, we eliminated participants who responded randomly or in a patterned fashion (e.g., all 0s, 01230123) using responses to the Center for Epidemiologic Studies Depression Scale, as this measure has reverse-coded items.

## Measure

The DDNSI (Krakow et al., 2001) is a five-item self-report measure that assesses the frequency, quantity, severity, and intensity of disturbing dreams and nightmares as well as the frequency of nightmare-related awakenings (see Supplement 1 in the online supplemental materials for the full measure and two items that are not included in the total score). The measure is scored by adding item scores, which provides a total score range from 0 to 37. Generally, scores above 10 are thought to be indicative of nightmare disorder, although the basis for this cutoff is unclear. Participants who reported “never” experiencing disturbing dreams and/or nightmares on the first item of the DDNSI were coded to receive scores of 0 on all other DDNSI items, and these participants were included in the data analysis.

## Data Analysis

Missing data were handled with imputation through expectation-maximization, in which the measure was compared with other sleep measures within the data and then these relationships were maximized to obtain parameter estimates (Bennett, 2001). Exploratory factor analysis (EFA) on the DDNSI items was conducted. A maximum-likelihood analysis was conducted using SPSS 27.0 with extraction values set to eigenvalues over 1 (Kaiser, 1960). A criterion level of .40 for factor loadings indicated an adequate fit. Items below a minimum factor loading threshold of .40 were dropped from the measure. Final EFA results consist of items only above this threshold.

## Results: Study 1

Results of the EFA are shown in Table 1. Kaiser–Meyer–Olkin measure of sampling adequacy was .85, over the recommended value of .6, and Bartlett’s test of sphericity was significant,  $\chi^2(21) = 868.53, p < .001$ . Eigenvalues indicated a single solution with factors accounting for 67.38% of the variance. Parallel analysis suggested a model with two factors and one component, and visual review of the scree plot suggested one factor (Figure 1). An unrotated EFA was conducted and found

**Table 1**  
*Factor Loadings*

Item	EFA factor loadings (Study 1)	CFA factor loadings (Study 2)
How often do you have disturbing dreams and/or nightmares?	.743	.871
How many nights in a week do you have disturbing dreams or nightmares?	.715	.848
On average, do your nightmares wake you up?	.682	.251
How would you rate the severity of your disturbing dreams and/or nightmares?	.863	.456
How would you rate the intensity of your disturbing dreams and/or nightmares?	.843	.366

*Note.*  $\chi^2(2) = 7.996, p = .018$ . EFA = exploratory factor analysis; CFA = confirmatory factor analysis.

poor model fit when constrained to two factors ( $\chi^2 = .133, p = .715$ ), and thus a single-factor model was retained. Internal consistency of the final scale was examined using Cronbach's  $\alpha$  (.87 in the current study), and no increases in  $\alpha$  would have been achieved by deleting any other items.

## Methods: Study 2

### Participants and Procedure

Data were collected in 2013. Participants included 606 undergraduate students from the same university as Study 1. The Study 2 procedure was consistent with the procedure used in Study 1, although the specific measures included in the survey differed. Participants completed the following measures in addition to a demographic questionnaire. Participants in Study 2 were on average 20 years of age (range: 18–52;  $SD = 2.28$ ), primarily female (63.7%), single (65.2%), and Caucasian (71.8%).

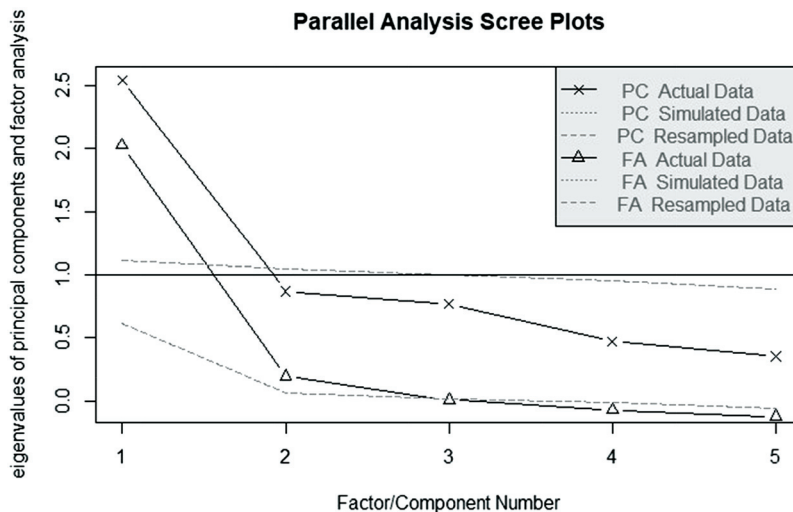
### Measures

#### *Convergent Validity Measures*

**Nightmare Effects Survey.** The NES is an 11-item self-report measure used to assess the adverse impact of nightmares in various life domains (Krakow et al., 2000). Respondents use a 5-point Likert scale to report the degree their nightmares affect each life domain (0 = *not at all* to 4 = *a great deal*). Answers are then summed to provide a total score, and higher scores indicate greater adverse consequences of nightmares on daily functioning. The NES has been found to have good reliability

**Figure 1**

*Scree Plot Depicting the Eigenvalues of the Principal Components and Factor Analysis, Which Show a One-Factor Solution*



( $\alpha = .90$ ; Krakow et al., 2000), and a Spanish version of the NES has been validated (Martínez et al., 2005). The Cronbach's  $\alpha$  in the current study was .92.

**Nightmare Distress Questionnaire.** The NDQ is a 13-item self-report measure that assesses one's distress due to their experiencing nightmares as well as one's interest in receiving nightmare treatment (Belicki, 1985, 1992). Items are rated on a 5-point Likert scale, and responses are summed to provide a total score. Research on the Spanish and German versions of the NDQ has found a three-factor structure to the measure (Böckermann et al., 2014; Martínez et al., 2005). The NDQ has been found to have adequate reliability ( $\alpha = .83$  to  $.88$ ; Belicki, 1992). Although studies examining the Spanish and German versions of the NDQ support the validity of the measure, Stieger and Kuhlmann (2018) found only two of the three NDQ subscales to be valid measures of nightmare distress. The Cronbach's  $\alpha$  in the current study was .90.

**Nightmare Frequency Questionnaire.** The NFQ is a two-item measure assessing the number of nights respondents experienced nightmares and their actual number of nightmares weekly, monthly, or yearly in the previous 3 months (Krakow, Schrader, et al., 2002). Responses were converted to nights and nightmares per week and then summed for a total score. This scoring method is in line with the standard scoring of the first two items of the DDNSI, which approximate the two NFQ items. Because the NFQ served as a basis of the DDNSI, the total score of the NFQ was used to determine the convergent validity of the DDNSI. The individual items of the NFQ have been found to have adequate test-retest reliability (Krakow, Schrader, et al., 2002). The German version of the NFQ has shown adequate validity (Schmid et al., 2017), though the validity of the English version of the measure remains unexplored. The Cronbach's  $\alpha$  in the current study was .88.

**Trauma-Related Nightmare Survey.** The TRNS assesses several characteristics of sleep and chronic nightmares using 16 items with Likert, dichotomous, categorical, and open-ended response methods (Cranston et al., 2017; Davis & Wright, 2007). The TRNS individual item responses are used independently, and no total score is derived from the measure due to the variability of response formats (Cranston et al., 2017). The TRNS items have been found to have adequate reliability and validity (Cranston et al., 2017; Davis & Wright, 2007). For the present study, the Items 6, 8, 9, 10, and 11 as listed in Cranston and colleagues' (2017) article were used to determine the convergent validity of the DDNSI. Item 8 was asked using two different questions (i.e., "Approximately how many nightmares have you experienced in the past month per week?" and "Approximately how many nightmares have you experienced in the past month per month [if less than one per week]?"). To obtain a consistent measure of nightmare frequency, responses to the first item were multiplied by 4 to obtain a monthly nightmare frequency score for individuals who endorsed weekly nightmares. The Cronbach's  $\alpha$  in the current study was .78.

### *Divergent Validity Measures*

**Pittsburgh Revision of the Taylor Manifest Anxiety Scale.** The Pittsburgh revision of the Taylor Manifest Anxiety Scale (TMAS; Bendig, 1956) is a self-report measure composed of 20 statements regarding one's personality as an anxious person. This measure is a revision of the 50-item TMAS (Taylor, 1953). Respondents report whether each statement is true or false of their personality. Item responses are then summed to provide a total score ranging from 0 to 20, with higher scores indicating a

more anxious personality. The Pittsburgh revision of the TMAS has been found to have adequate reliability ( $\alpha = .76$ ; Bendig, 1956). The Cronbach's  $\alpha$  in the current study was .85.

**Specific Loss of Interest and Pleasure Scale.** The Specific Loss of Interest and Pleasure Scale (SLIPS; Winer et al., 2014) is a 23-item self-report measure used to assess recent (i.e., past 2 weeks) changes in anhedonia. The SLIPS uses a 4-point Likert scale ranging from 0 (*no loss of interest or pleasure*) to 3 (*never any interest or pleasure*) regarding 23 specific activities or interactions. To score the SLIPS, responses of 3 are recoded to 0 to account for trait anhedonia. Item scores are then summed to provide a total score ranging from 0 to 46, with higher scores indicating more severe changes in anhedonia in the past 2 weeks. The SLIPS has been found to be reliable and a valid measure of anhedonia (Winer et al., 2014). The Cronbach's  $\alpha$  in the current study was .94.

**Center for Epidemiologic Studies Depression Scale.** The Center for Epidemiological Studies Depression Scale (Radloff, 1977) is a 20-item self-report questionnaire that measures depressive symptoms over the past week. The Center for Epidemiological Studies Depression Scale has been found to have sufficient reliability and validity in the general population (Radloff, 1977). Items are rated on a 4-point scale (0 = *less than 1 day* to 3 = *5–7 days*). Scores are then summed to provide a total score ranging from 0 to 60, with a score of 16 or more being indicative of clinically significant depressive symptoms. The Cronbach's  $\alpha$  in the current study was .89.

**Insomnia Severity Index.** The Insomnia Severity Index (ISI) measures self-reported insomnia severity over the past 2 weeks using seven items (Bastien et al., 2001). The ISI uses a 5-point Likert scale with corresponding scores from 0 to 4. To obtain a total score, item scores are summed for a total score range between 0 and 28. Cutoff scores are as follows: 8 to 14 = subthreshold insomnia, 15 to 21 = moderate insomnia, and 22 or above = severe insomnia. Previous research has found the ISI to have adequate psychometric properties (Bastien et al., 2001; Savard et al., 2005). The Cronbach's  $\alpha$  in the current study was .84.

**Posttraumatic Stress Disorder Checklist–Civilian Version.** The Posttraumatic Stress Disorder Checklist–Civilian Version (PCL-C) measures symptoms of PTSD over the past month (Weathers et al., 1993). The PCL-C includes 17 self-report items, which are rated on a 5-point Likert scale, ranging from 1 (*not at all*) to 5 (*extremely*). A total score is obtained by adding all item responses, for a total score range from 17 to 85. Scores greater than 50 are suggestive of clinically significant posttraumatic stress symptoms. The PCL-C has adequate psychometric properties (Weathers et al., 1993). The Cronbach's  $\alpha$  in the current study was .93.

## Data Analysis

Missing data were handled with expectation-maximization as described in Study 1. Structural equation modeling was conducted using AMOS 27.0 to conduct a confirmatory factor analysis (CFA) with items found in Study 1. Model fit was examined with the standardized root mean square residual (SRMR) in combination with the comparative fit index (CFI); in combination, SRMR values less than or equal to .08 and CFI values greater than or equal to .90 indicate good model fit (Hu & Bentler, 1999). Invariance testing was conducted using multiple group analysis (MGA) according to  $\Delta$ CFI,  $\Delta$ RMSEA, and  $\Delta$ SRMR cutoffs established by Putnick



and Bornstein (2016; i.e.,  $\Delta CFI < .02$ ,  $\Delta RMSEA < .02$ , and  $\Delta SRMR < .03$ ). Metric (i.e., factor loadings are not significantly different across groups, allowing for direct comparisons among path coefficients and correlations), scalar (i.e., intercepts are not significantly different across groups, allowing for direct mean comparisons), and residual invariance (i.e., error terms are not significantly different across groups) were tested. Lastly, convergent and divergent validity were examined using correlations between scales and items as discussed in the Method section earlier.

### Results: Study 2

A CFA was performed loading the five items from the EFA onto the single latent variable indicated in the EFA. The model demonstrated good model fit (CFI = .99, root mean square error of approximation (RMSEA) = .07, SRMR = .01). An MGA between sex (i.e., male vs. female) demonstrated configural, metric, scalar, and residual invariance (see Table 2 for fit indices) and for race (i.e., White vs. Black; see Table 3 for fit indices). Thus, regardless of sex group membership, factor loadings are similar across the comparison, correlations coefficients can be directly compared between groups, means of the constructs represent the same scale and may be directly compared, and error terms were not significantly different between groups.

Items from the CFA were summed with a Cronbach's  $\alpha$  of .78 in the current study. Pearson correlations demonstrating convergent and divergent validity are shown in Table 4. The strength of the correlations was examined using Fisher's R to Z transformations to determine whether the DDNSI correlated more strongly with the nightmare measures than measures of other related constructs. The DDNSI had the strongest correlation with the NDQ ( $r = .68$ ), which was significantly stronger than the correlations with symptoms of manifest anxiety, anhedonia, PTSD, insomnia, and depression,  $p < .01$ . The correlation with the NES ( $r = .54$ ) was significantly stronger than the correlation with manifest anxiety, depressive, insomnia symptoms ( $p < .01$ ) but did not significantly differ from the correlation with PTSD symptoms ( $r = .48$ ,  $p = .17$ ). Further, even when the trauma item was removed, correlations

**Table 2**  
*Invariance Testing for Sex*

Model	$\chi^2$ (df)	CFI	RMSEA [90% CI]	SRMR	Model compared	$\Delta\chi^2$ ( $\Delta df$ )	$\Delta CFI$	$\Delta RMSEA$	$\Delta SRMR$	Decision
Model 1: Configural invariance	9.43 (4)	.99	.047 [.000, .088]	.007						Accept
Model 2: Metric invariance	10.94 (8)	.99	.025 [.000, .057]	.020	Model 1	1.51 (4)	.00	.02	.02	Accept
Model 3: Scalar invariance	26.50 (14)	.99	.039 [.014, .061]	.026	Model 2	15.56 (6)	.00	.00	.00	Accept
Model 4: Residual invariance	47.41 (22)	.99	.044 [.027, .061]	.034	Model 3	20.91 (8)	.00	.01	.08	Accept

*Note.* CFI = comparative fit index; RMSEA = root mean square error of approximation; SRMR = standardized root mean square residual.

**Table 3**  
*Invariance Testing for Race*

Model	$\chi^2$ (df)	CFI	RMSEA (90% CI)	SRMR	Model compared	$\Delta\chi^2$ ( $\Delta$ df)	$\Delta$ CFI	$\Delta$ RMSEA	$\Delta$ SRMR	Decision
Model 1:										
Configural invariance	9.64 (4)	.99	.050 (.005, .091)	.009						Accept
Model 2: Metric invariance										
Model 2: Metric invariance	13.89 (8)	.99	.036 (.000, .067)	.018	Model 1	4.25 (4)	.01	.01	.06	Reject
Model 3: Scalar invariance										
Model 3: Scalar invariance	24.70 (14)	.99	.037 (.009, .060)	.014	Model 2	10.81 (6)	.00	.00	.01	Accept
Model 4: Residual invariance										
Model 4: Residual invariance	47.28 (22)	.98	.045 (.027, .063)	.016	Model 3	22.58 (8)	.00	.01	.01	Accept

*Note.* CFI = comparative fit index; RMSEA = root mean square error of approximation; SRMR = standardized root mean square residual.

between the PCL-C (with no trauma item) and the DDNSI ( $r = .47$ ) were still not significantly different. The correlation with the NFQ ( $r = .68$ ) was significantly stronger than the correlations with manifest anxiety, anhedonia, PTSD, insomnia, and depressive symptoms,  $p < .01$ .

Lastly, correlations with Items 6 ( $r = .36$ ) and 10 ( $r = .31$ ) of the TRNS were not significantly larger than the correlation between the DDNSI and symptoms of manifest anxiety, anhedonia, depression, or insomnia and were significantly weaker than the correlation of the DDNSI with symptoms of PTSD. The DDNSI correlations with the TRNS Items 9 ( $r = .51$ ) and 11 ( $r = .57$ ) were significantly stronger than the

**Table 4**  
*Correlations for Both Convergent and Divergent Validity*

Measure	1	2	3	4	5	6	7	8	9	10	11	12	13	14
Convergent														
1. DDNSI	—													
2. NES	.54	—												
3. NDQ	.68	.71	—											
4. NFQ	.67	.42	.46	—										
5. TRNS 6	.36	.12	.26	.16	—									
6. TRNS 8	.46	.33	.36	.51	.23	—								
7. TRNS 9	.58	.42	.41	.63	.13	.57	—							
8. TRNS 10	.31	.26	.27	.43	.13	.41	.59	—						
9. TRNS 11	.58	.43	.53	.31	.32	.36	.39	.16	—					
Divergent														
10. P-TMAS	.39	.40	.43	.29	.20	.18	.22	.11	.30	—				
11. SLIPS	.31	.41	.33	.27	.11	.20	.30	.21	.23	.62	—			
12. CES-D	.38	.45	.43	.28	.12	.22	.28	.16	.30	.72	.67	—		
13. ISI	.40	.43	.45	.31	.20	.25	.33	.15	.37	.49	.40	.52	—	
14. PCL-C	.48	.56	.57	.37	.30	.33	.30	.21	.46	.69	.65	.69	.58	—

*Note.* All correlations were significant at  $p < .001$ . DDNSI = The Disturbing Dreams and Nightmare Severity Index measure as found in the confirmatory factor analysis of the current study ( $M = 6.67$ ,  $SD = 4.55$ , range: 0–26); NES = Nightmare Effects Survey ( $M = 6.04$ ,  $SD = 7.06$ , range: 0–32); NDQ = Nightmare Distress Questionnaire ( $M = 12.64$ ,  $SD = 8.77$ , range: 0–44); NFQ = Nightmare Frequency Questionnaire ( $M = 1.52$ ,  $SD = 2.09$ , range: 0–14); TRNS = Trauma-Related Nightmare Survey; P-TMAS = Pittsburgh revision of the Taylor Manifest Anxiety Scale ( $M = 7.65$ ,  $SD = 4.82$ , range: 0–19); SLIPS = Specific Loss of Interest and Pleasure Scale ( $M = 4.78$ ,  $SD = 7.28$ , range: 0–40); CES-D = Center for Epidemiological Studies Depression Scale ( $M = 12.75$ ,  $SD = 9.76$ , range: 0–54); ISI = Insomnia Severity Index ( $M = 6.50$ ,  $SD = 4.79$ , range: 0–24); PCL-C = Posttraumatic Stress Disorder Checklist–Civilian Version ( $M = 29.14$ ,  $SD = 11.72$ , range: 0–77).

correlations with symptoms of manifest anxiety, anhedonia, depression, and insomnia ( $p < .01$ ), though not when compared with PTSD symptoms. Finally, the correlation of Item 8 of the TRNS ( $r = .46$ ) was only significantly stronger than the correlation with anhedonia.

## Discussion

### Summary

Through the use of EFA and CFA, the present study found the five original items of the DDNSI to load onto a single latent factor. The DDNSI was found to be valid, as it correlated with several other nightmare measures. Specifically, the DDNSI appears to be a measure of nightmare frequency and distress, as it was significantly correlated with the NFQ and NDQ. The DDNSI does not appear to be a valid assessment of the broader effects of nightmares, however, as it failed to significantly correlate with the NES. In addition, correlations between the DDNSI and TRNS items were mixed, as some correlations were not significantly different, significantly stronger, or significantly weaker than the correlations with the measures of psychopathology. These complex findings may be due to the lack of variability of the individual TRNS items, which can lead to weaker correlations, or the fact that the DDNSI is positioned to ask about broader qualities of nightmares than the TRNS items individually. Had the TRNS items been summed then correlated with the DDNSI, we may have found greater support for the convergent validity of the DDNSI. However, the TRNS is not typically used in this manner. Further, the DDNSI was found to significantly correlate with measures assessing symptoms of anxiety, depression, anhedonia, insomnia, and PTSD. Most of these correlations were weaker than those between the DDNSI and other nightmare measures, which supports that the DDNSI has divergent validity. The significant correlations between the DDNSI and measures assessing symptoms of psychopathology suggest that experiencing nightmares may be transdiagnostic. Finally, MGA invariance testing found that the latent structure of the DDNSI was comparable across sex (male vs. female) and race (White vs. Black).

### Implications

To the best of our knowledge, the present study represents the first published examination of the validity of the DDNSI, though it has been widely used in both research and clinical practice for nearly 2 decades. Therefore, our findings bolster the findings of previous studies that used the DDNSI and support further use of the measure in research studies. Further, our findings support the use of the DDNSI in clinical practice to assess nightmare frequency and distress, though not to differentiate between these two constructs. The use of a single measure to assess both nightmare frequency and distress may reduce the burden on both patients and practitioners, compared with the use of two separate measures (e.g., the NFQ and NDQ). On the other hand, the confounding of nightmare distress and frequency on the DDNSI limits the measure's ability to tease these constructs apart, which has been found to be important for the relation between nightmares and psychopathology (Speed et al., 2018).

## Strengths and Limitations

Similar to all research, the present study has both strengths and limitations. An important strength of the present study is the use of such rigorous tests of divergent validity. Commonly, divergent validity is ascertained using measures that are vastly different from the measure of interest. The present study set a high standard for divergent validity by using measures of psychopathology that often correlate with nightmares.

Limitations of the present study include the use of an undergraduate sample, though this sample reported a high prevalence of nightmares (see Table 4 for average scores), which makes the sample ideal for research on nightmares and bolsters generalization to the clinical population. The present study is also limited by the use of retrospective self-report measures, as these measures may be biased by participants' memory. The use of dream logs would have made the present study stronger, and future research may consider the use of dream logs in similar studies. The use of retrospective self-report measures is a common practice in clinical work, however, so our use of these measures may help to generalize our findings to practice. The present findings are also limited by the lack of psychometric testing of some measures used in the present study. Specifically, the validity of the NFQ, NES, NDQ, Pittsburgh revision of the TMAS is questionable (see Methods: Study 2 section). Certainly, additional psychometric analysis of these measures is warranted, just as the present study has completed for the DDNSI. Although these measures lack firm evidence of their validity, some versions of these measures have demonstrated adequate validity, and our stringent divergent validity testing attenuates the limitation of using these measures. Finally, the present study did not conduct diagnostic assessments of nightmare disorder in participants, and therefore, we were unable to determine a DDNSI cutoff score that is indicative of nightmare disorder. Generally, a score >10 has been used to indicate the existence of nightmare disorder, though future research is necessary to verify this threshold.

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