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BRIEF REPORT

Validation of the Fear of Sleep Inventory (FOSI) in an Urban Young Adult African American Sample

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The Fear of Sleep Inventory (FOSI) was developed to identify factors that contribute to sleep disturbances in individuals exposed to trauma. This investigation examined the psychometric properties of the FOSI in a sample of African American young adults residing in urban areas. A 5-factor structure was derived from an exploratory factor analysis and then verified by confirmatory factor analysis. FOSI factors were positively correlated with the severity of PTSD (rs = .30 to .58, all ps < .001) and insomnia symptoms (rs = .36 to .64, all ps < .001). Individuals with probable PTSD or insomnia had higher scores on the total FOSI and each of the factors compared to those without probable PTSD (all ps < .001; effect sizes: r = .32 to .62) or insomnia (all ps < .001; effect sizes: r = .42 to .70). These data expand the evidence that the FOSI identifies factors contributing to sleep disturbances in trauma-exposed individuals.

Sleep complaints are prominent and distressing features of posttraumatic stress disorder (PTSD; Ohayon & Shapiro, 2000). Nightmares and insomnia symptoms are represented in two of the four PTSD symptom clusters defined in the *Diagnostic and Statistical Manual of Mental Disorders* (5th ed.; American Psychiatric Association, 2013). Sleep disturbances can be predictive of the onset and maintenance of PTSD symptoms and treatments focused on nightmares and insomnia can reduce PTSD symptoms and associated impairment (Germain, 2013; Ross, Ball, Sullivan, & Caroff, 1989). Pilot evaluations have shown promise for treatments targeting PTSD-related sleep disturbances, however, many individuals remain symptomatic (Ulmer, Edinger, & Calhoun, 2011). Instruments identifying contributing behaviors could be applied to enhance treatment outcomes.

The Fear of Sleep Inventory (FOSI) is a self-report measure developed to identify factors contributing to trauma-related sleep disturbances (Zayfert, DeViva, Pigeon, & Goodson, 2006). Zayfert and colleagues examined the psychometric properties of the FOSI in a rural, predominantly female (81%) and Caucasian (89%) sample with a 66% trauma exposure rate and reported that the total scale score and two subscales, nightmare avoidance and nighttime vigilance, had adequate reliability and positively correlated with ratings of insomnia and sleep quality. The FOSI's latent variables were characterized using principal components analysis, a data reduction method making no distinction between shared and unique variance among latent variables (Preacher & MacCallum, 2003) and does not test specific hypotheses about the data (Fabrigar, Wegener, MacCallum, & Strahan, 1999). Exploratory factor analysis (EFA) addresses these limitations by accounting for error and the derived model specifies hypotheses that can be evaluated with confirmatory factor analysis (CFA).

We sought to address statistical limitations of the Zayfert and colleagues' unpublished study, while adding diversity to the evaluated samples by characterizing the FOSI's psychometric properties using EFA and CFA and examining associations with PTSD symptoms and insomnia, in a sample of young adult urban-residing African Americans. The relevance of this sample is underscored by frequent exposure to urban violence (Gillespie et al., 2009) and elevated rates for PTSD and compromised sleep found in urban African American populations (Roberts, Gilman, Breslau, Breslau, & Koenen, 2011; Ruiter, Decoster, Jacobs, & Lichstein, 2011).

Method

Participants

Participants (N = 366; 48.4% female; mean age 22.46 years, SD = 4.17 years) were African Americans aged 18–35 years

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recruited from the Washington, DC metropolitan area via flyers and prior participant referrals. Participants completed the FOSI as a part of a larger study designed to investigate the associations between health risk markers, sleep, trauma exposure, and PTSD. Initial screening questions addressed and individuals were excluded for chronic or severe medical and psychiatric illness other than PTSD, morbid obesity, sleep apnea, shift work, and current alcohol or substance abuse or dependence.

Measures

Age, sex, education, and income were reported by participants using a demographic questionnaire.

The FOSI (Zayfert et al., 2006) is a 23-item trauma-related sleep disturbances scale employing a 5-point scale (0 = *not at all* to 4 = *every night*) to rate events occurring within the last month. The FOSI total score and subscales have adequate reliability (Cronbach's $\alpha = .80$ to .95), temporal stability (1-week $r = .89$) and positive correlations with sleep quality ($r = .40$) and insomnia severity ($r = .40$). Four additional questions query traumatic events (TEs) in the sleep context.

Exposure to TEs was assessed using the Life Events Checklist (Gray, Litz, Hsu, & Lombardo, 2004), a 17-item checklist of TEs, and participants indicated their worst stressor to serve as the specific TE of reference on the PCL-S.

The PTSD checklist-specific (PCL-S; Weathers, Litz, Herman, Huska, & Keane, 1993) is a 17-item PTSD severity inventory with items rated on a 5-point scale (1 = *not at all* to 5 = *extremely*) indicating distress associated with symptoms of in the past month and a cutoff score of 44 (Blanchard, Jones-Alexander, Buckley, & Forneris, 1996) indicates probable PTSD. In the present study, the PCL-S had a Cronbach's α of .94.

The Insomnia Severity Index (ISI; Bastien, Vallieres, & Morin, 2001) is a 7-item insomnia severity inventory with items rated on a 5-point scale (0 = *not at all* to 4 = *very much*) and a cutoff score of 10 indicating clinically significant insomnia (Morin, Belleville, Belanger, & Ivers, 2011). In the present study, the ISI had a Cronbach's α of .86.

Procedures

The study was approved by the Howard University Institutional Review Board. Potential participants were given a description of the study and interviewed to determine eligibility. Eligible individuals were invited to the Howard University Clinical Research Unit to meet with a researcher who obtained written informed consent. During the session, participants completed the aforementioned self-report instruments.

Data Analysis

The entire sample was randomized into thirds to achieve a 10-participant/item ratio suggested for EFA (DeVellis, 2003) with the remaining third used for CFA. No differences between subsamples with regard to ISI, PCL-S scores, or demographic characteristics were observed (Table 1). A principal axis factoring analysis with promax rotation was utilized (IBM SPSS Statistics Version 19) because some correlation among factors was expected. A combination of methods for determining the number of factors to retain was employed (Fabrigar et al., 1999) including parallel analysis, Velicer's Minimum Average Partial Test, scree plot, and interpretability of factors. Consistency across several indices was used to evaluate EFA-derived the model (Brown, 2006) using CFA (LISREL version 8.8). Composite reliability (ρc) of each latent variable calculated with estimates > .60 indicating adequate construct reliability (Diamantopoulos & Siguaw, 2000). Correlations between the FOSI, ISI, and PCL-S were computed and mean FOSI scores were compared between individuals with probable PTSD (i.e., PCL-S score > 44) or insomnia (i.e. ISI > 10) to those without probable PTSD or insomnia using analysis of covariance with education and dependents as covariates.

Results

A majority of participants (88.3%; Table 1) reported a TE and interpersonal violence was most common (46.8%; includes nonsexual violent crime and sexual trauma, 34.2% and 12.6%, respectively). Seventy-nine participants (21.6%) reported probable PTSD (mean PCL-S = 57.46, *SD* = 8.14) and 115 (31.4%) reported insomnia (mean ISI = 14.94, *SD* = 3.51).

The EFA yielded a 5-factor solution accounting for 55.0% of the total variance was obtained with factors were conceptualized as Fear of Sleep, Fear of the Loss of Vigilance, Fear of Re-experiencing Trauma, Vigilant Behavior, and Fear of the Dark (Table 2). The internal consistency for the total scale and factors was moderate to high (Cronbach $\alpha = .74$–.92; Table 2).

The fit indices from the CFA for the 5-factor model (Table 2) indicated a satisfactory and more parsimonious fit relative to Zayfert's 2-factor or a 1-factor model with adequate construct reliability estimates (ρc range = .62–.73).

Correlation coefficients between FOSI factors, PCL-S, and ISI were similar across participants utilized for the EFA and CFA; therefore, data were combined. The FOSI Total scale and subscales were positively correlated with the ISI (*r*s = .36 to .64, all *p*s < .001) and PCL-S with sleep items removed (*r*s = .30 to .58, all *p*s < .001). Individuals with probable PTSD and insomnia had higher FOSI scores for the total FOSI score and all of the factors when compared to those without probable PTSD (all *p*s < .001; effect sizes: $r = .32$ to .62) or insomnia (all *p*s < .001; effect sizes: $r = .42$ to .70).

Twenty-three percent of participants reported a history of maintaining vigilance in bed, and 19.7% of participants reported experiencing a trauma while sleeping or in bed, and FOSI scores were significantly higher for these participants (all *p*s < .001). Females reported more Vigilant Behaviors (females: $M = 4.23$,

Table 1
Study Demographic and Psychiatric Characteristics

	Total sample $N = 366$		Exploratory factor analysis $n = 244$		Confirmatory factor analysis $n = 122$		
Variable	*n* or *M*	% or *SD*	*n* or *M*	% or *SD*	*n* or *M*	% or *SD*	Test statistic
Sex,% female	177	48.40	119	48.80	58	47.50	$\chi^2 = 0.05$
Education,% completed college	96	26.20	66	27.80	30	24.60	$\chi^2 = 0.4$
Household income							$\chi^2 = 1.4$
< $30,000	104	28.80	69	29.20	35	29.20	
$30,000–$49,999	68	18.80	42	17.80	25	20.80	
$50,000–$74,999	78	21.60	55	23.30	22	18.30	
$75,000–$99,999	34	9.40	21	8.90	11	9.20	
> $100,000	77	21.30	49	20.80	27	22.50	
Married	12	3.30	9	3.80	3	2.50	$\chi^2 = 0.4$
Dependents	47	13.10	33	13.90	14	11.50	$\chi^2 = 0.4$
Index TE							$\chi^2 = 0.8$
Interpersonal violence	171	46.70	111	45.50	60	49.20	
Noninterpersonal event	152	41.50	102	41.80	50	41.00	
No TE	43	11.70	31	12.70	12	9.80	$\chi^2 = 0.4$
Age	22.46	4.17	22.54	4.21	22.28	4.08	$t = -0.6$
PCL	35.45	15.23	35.24	15.03	33.11	14.25	$t = -1.3$
ISI	8.24	5.66	8.41	5.72	7.91	5.56	$t = -0.8$

Note. TE = potentially traumatic event; PCL-S = PTSD Checklist; ISI = Insomnia Severity Index.

SD = 4.72, males: *M* = 3.02, *SD* = 4.26; $t(364) = 2.6$, $p = .011$, $r = .14$) and greater Fear of the Dark (females: *M* = 2.13, *SD* = 2.85, males: *M* = 1.16, *SD* = 2.28; $t(364) = 4.0$, $p < .001$, $r = .21$).

Discussion

The series of analyses described herein comprise the first published validation study of the FOSI and address limitations of the initial efforts to characterize the FOSI. The 5-factor structure demonstrated adequate reliability suggesting the items making up each scale have a strong relationship to each other and therefore reflect a common construct. CFA indicated that the 5-factor structure is a valid model to describe fear of sleep in this sample of urban-residing African American adults with a high rate of trauma exposure. All of the FOSI factors were positively associated with probable PTSD and insomnia symptom severity. The occurrence of trauma in the context of sleep or maintaining vigilance when in bed was also associated with higher FOSI scale ratings. Additionally, sex differences emerged with women reporting higher ratings for Vigilant Behaviors and Fear of the Dark relative to men. Methodological differences including the use of EFA and featuring highly trauma-exposed participants living in urban neighborhoods with greater representation of men likely contributed to the difference between the 2-factor and 5-factor models for the FOSI. The identification of five reliable and valid factors has implications for identifying treatment targets.

Limitations of this study include its cross-sectional design and reliance on self-report instruments rather than structured interviews and polysomnography to screen for obstructive sleep apnea. Although the present study sample is appropriate for examining psychometric of the FOSI, it is important to evaluate the psychometric properties of the FOSI in other ethnic/racial groups and environmental contexts in future studies.

Given that clinically significant sleep disturbances often persist following trauma-focused PTSD treatment (Belleville, Guay, & Marchand, 2011), it appears warranted for psychological interventions to be informed by the assessment of sleep-related fears. Our findings suggest that attempts to avoid or control fears associated with sleep contribute to PTSD-related sleep disturbances and reinforce sleep incompatible behaviors that maintain cognitive and physiological arousal. The development of the FOSI fills an important gap in the resources currently available to reliably assess and individualize interventions targeting distress associated with sleep disturbances following trauma exposure.

Table 2
Summary of Exploratory and Confirmatory Factor Analysis

FOSI item	Factor loading
Factor 1: Fear of sleep ($\alpha = .86$; $\rho c = .73$)	
I felt that it was dangerous to fall asleep.	.90
I was afraid to close my eyes.	.86
I woke up in the night and I was terrified of returning to sleep.	.63
I was fearful of the loss of control that I experience during sleep.	.40
I slept on a couch or somewhere other than my bed to feel safe.	.35
I awoke in the middle of the night from a nightmare and avoided returning to sleep because I might go back into the nightmare.	.33
Factor 2: Fear of loss of vigilance ($\alpha = .85$; $\rho c = .68$)	
I tried to stay as alert as I could while lying in bed.	.76
I tried to stay alert to any strange noises while going to sleep.	.72
I kept a weapon near my bed at night.	.69
I was fearful of letting my guard down while sleeping.	.33
Little noises around the house wake me up.	.32
Factor 3: Fear of re-experiencing trauma ($\alpha = .83$; $\rho c = .63$)	
When lying in bed I thought about a traumatic experience.	.79
I had dreams about a past traumatic experience.	.78
I avoided going to sleep because I thought I would have bad dreams.	.60
I stayed up late to avoid sleeping.	.44
Factor 4: Vigilant behaviors ($\alpha = .74$; $\rho c = .62$)	
I slept with the windows closed regardless of the weather to feel safer.	.63
I repeatedly checked the locks on the doors and windows at bedtime.	.63
I use a lot of blankets (regardless of weather) to feel safe at night.	.52
I was aware of being especially vulnerable when I'm asleep.	.44
I slept with something or someone in bed with me to help me feel safe.	.42
Factor 5: Fear of the dark ($\alpha = .76$; $\rho c = .68$)	
I slept with the light on to feel safer.	.81
Being in the dark scares me.	.78
I slept with the television on to feel safe.	.59

Confirmatory factor analysis model comparison	1-Factor	2-Factor	5-Factor
Comparative fit index	.89	**.96**	**.96**
Nonnormed fit index	.87	**.95**	**.95**
Root mean square error of approximation (RMSEA)	.09	0.11	**.06**
90% confidence interval for RMSEA	[.07, .10]	[.10, .13]	**[.04, .07]**
Standardized root mean square residual	**.06**	.12	**.05**
Akaike information criterion	2220.29	4364.68	**2132.61**

Note. Values in bold indicate satisfactory fit. Comparative fit and nonnormed fit index values ≥ .95 indicate satisfactory fit. Root mean square error of approximation with values < .05 indicating a good fit and values between .05 and .08 indicate reasonable fit. Lower limits below .05 and upper limits below .10 for the 90% confidence interval for RMSEA indicate satisfactory fit. Standardized root mean square residual with values < .08 are considered reasonable. The minimum Akaike information criterion value indicates parsimony when comparing multiple models (Brown, 2006).

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