Sleep the Stress Away? A prospective study of the bidirectional relationship between stress and sleep

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Introduction

- Stress and sleep disturbances are on the rise in first year college students and each can negatively affect academic performance (Gomes, Tavares, & de Azevedo, 2011; Lund, Reider, Whiting, & Prichard, 2010).
- Reports of stress at bedtime have been associated with daytime sleepiness and morning sleepiness was associated with higher stress during the day (Garde et. al., 2012).
- College students are presented with unique stressors that aren't seen in other populations (Darling et al., 2007)
- Individuals high in neuroticism also tend to perceive stressful events as more stressful, and report poorer sleep (leading to more stress) than individuals who are lower in neuroticism (McCrae, 1990; Williams & Moroz, 2009).
- Few prospective studies examining the direction of the relationship exist. The studies that have been conducted show that stress has an effect on sleep, but research on the reverse has not produced a definitive relationship (Tavernier & Willoughby, 2014).
- The present study aims to better understand the direction of the relationship between stress and sleep by using a cross-lagged panel analysis and hierarchical regression analyses on prospective data.

Aims

Aim 1: Describe cross-sectional relationship between sleep & stress.

Aim 2: Describe the prospective relationship between sleep and stress.

Aim3: Examine whether prospective associations would persist when controlling for neuroticism and autocorrelations between the sleep and stress over time.

Participants

- 245 first-year students from Furman University
- 178 women (72.7%) , 65 men (26.5%), 2 not reported (.8%)
- 202 white (82.4%), 8 African American (3.3%), and 33 other (13.5%)

Method

- Online surveys were administered via Qualtrics to students in October and December of their first semester at college.
- Pittsburgh Sleep Quality Index (Buysse et. al., 1989): a 21-item **self-report scale** that measures sleep over the past month (α = .49-.60). Scores were measured on a continuous scale with **higher scores indicating worse sleep**.
- Perceived Stress Scale (Cohen et. al., 1983): a 10-item self-report scale that measures the overall stress of participants in this study since the last assessment (α = .73 - .88).
- BFI –Neuroticism Sub Scale (John, O. P., Donahue, E. M., & Kentle, R. L. (1991): an 8-item subscale from the Big Five Inventory, which measures neuroticism. (α = .81)

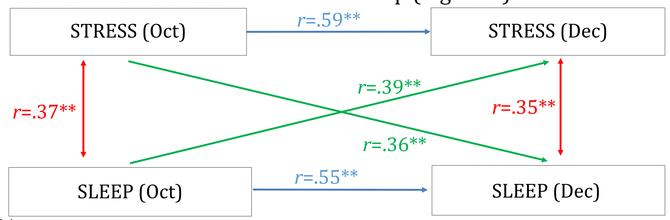
Results

Table 1 *Descriptive Statistics*

Variable	Summer	October *Mean(SD)*	December *Mean(SD)*	Possible Range
Neuroticism	2.96 (.71)			1-5
Sleep (PSQI Total)		5.62 (1.77)	6.58 (2.13)	0-21
Perceived Stress		17.35 (7.18)	16.64 (7.05)	0-40

Aims 1 & 2: Concurrent and Prospective Associations

✓ Pearson's correlations reveal statistically significant cross-sectional and prospective associations between stress and sleep (Figure 1).



** p<.001

Figure 1. Concurrent and prospective correlations between stress and sleep.

Aim 3: Hierarchical Regressions

✓
- Stress levels (r=.59, p<.001) and sleep habits (r=.58, p<.001) tend to stay consistent, over time.
- Two hierarchical regressions were performed controlling for neuroticism and the cross-sectional correlations between stress and sleep.
  - Stress in Oct. is predictive of sleep in Dec. (Table 2).
  - Sleep in Oct. is predictive of stress in Dec. (Table 3).
- When neuroticism and the cross-sectional relationship have been controlled for, the prospective relationships are still significant, suggesting that there is a predictive relationship in both directions.

Table 2 *Hierarchical Regression of Neuroticism and Stress on Sleep*

Model	**Sleep in December**					
	Step 1			Step 2		
	B	*SE B*	*β*	*B*	*SE B*	*β*
Neuroticism	.45	.22	.15*			
Perceived Stress Dec.	.082	.022	.28***			
Perceived Stress Oct.				**.059**	**.025**	**.20****
R^2		.14			.17	
F		18.05			14.21	
ΔR^2		.14			.022	
p		< .001			<.001	

*p<.05 **p<.01 ***p<.001

Aim 3: Continued

Table 3 *Hierarchical Regression of Neuroticism and Sleep on Stress*

Model	**Perceived Stress In December**					
	Step 1			Step 2		
	B	*SE B*	*β*	*B*	*SE B*	*β*
Neuroticism	4.76	.59	.47***			
Sleep in Dec.	.73	.20	.22***			
Sleep in Oct.				**.89**	**.27**	**.22****
R^2		.34			.37	
F		52.84			40.43	
ΔR^2		.34			.033	
p		< .001			<.001	

*p<.05 **p<.01 ***p<.001

Discussion

- The prospective correlations indicate that sleep has a similar effect on stress that stress has on sleep suggesting that there is a bidirectional relationship.
- Sleep in October appears to be a stronger predictor of stress in December than stress in October is of sleep in December. This is not entirely consistent with previous research; previous studies have found that stress is a stronger predictor (Tavernier & Willoughby, 2014). This could be due to the type of stress measure that we used.
- Consistent with previous studies, neuroticism accounts for variance in both sleep and stress (Williams & Moroz, 2009).
- Other factors (substance use, a medical condition, etc.) in an individual's life may factor into the relationship between sleep and stress in addition to neuroticism.
- Limitations: sample size, only subjective markers of sleep and perceived stress, general attrition rates
- Because of the variety of stressors that are a part of overall stress, future research could focus on specific stressors or domains of stress over longer periods of time.
- Further research on sleep and stress could inform interventions for colleges.

References

Åkerstedt, T., Orsini, N., Petersen, H., Axelsson, J., Lekander, M., & Kecklund, G. (2012). Predicting sleep quality from stress and prior sleep – a study of day-to-day covariation across sixweeks. *Sleep Medicine, 13*(6), 674–679. http://doi.org/10.1016/j.sleep.2011.12.013

Buysse, D. J., Reynolds, C. F., Monk, T. H., Berman, S. R., & Kupfer, D. J. (1989). The Pittsburgh Sleep Quality Index: A new instrument for psychiatric practice and research. *Psychiatry Research, 28*(2), 193–213. http://doi.org/10.1016/0165-1781(89)90047-4

Cohen, S., Kamarck, T., & Mermelstein, R. (1983). A global measure of perceived stress. *Journal of Health and Social Behavior, 24*(4), 385–396. http://doi.org/10.2307/2136404

Darling, C. A., McWey, L. M., Howard, S. N., & Olmstead, S. B. (2007). College student stress: The influence of interpersonal relationships on sense of coherence. Stress and Health: Journal of the International Society for the Investigation of Stress, 23(4), 215–229. http://doi.org/10.1002/smi.1139

Garde, A. H., Albertsen, K., Persson, R., Hansen, Å. M., & Rugulies, R. (2011). Bi-directional associations between psychological arousal, cortisol, and sleep. *Behavioral Sleep Medicine, 10*(1), 28–40. http://doi.org/10.1080/15402002.2012.636272

Gomes, A. A., Tavares, J., & de Azevedo, M. H. P. (2011). Sleep and academic performance in undergraduates: A multi-measure, multi-predictor Approach. *Chronobiology International, 28*(9), 786–801. http://doi.org/10.3109/07420528.2011.606518

John, O. P., Donahue, E. M., & Kentle, R. L. (1991). The Big Five Inventory--Versions 4a and 54. Berkeley, CA: University of California, Berkeley, Institute of Personality and Social Research

Lund, H. G., Reider, B. D., Whiting, A. B., & Prichard, J. R. (2010). Sleep patterns and predictors of disturbed sleep in a large population of college Students. *Journal of Adolescent Health, 46*(2), 124–132. http://doi.org/10.1016/j.jadohealth.2009.06.016

McCrae, R. R. (1990). Controlling neuroticism in the measurement of stress. *Stress Medicine, 6*(3), 237–241. http://doi.org/10.1002/smi.2460060309

Williams, P. G., & Moroz, T. L. (2009). Personality vulnerability to stress-related sleep disruption: Pathways to adverse mental and physical health

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