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Empirical Validation of a Short Version of the Adolescent Sleep Wake Scale using a Sample of Ethnically Diverse Adolescents from an Economically Disadvantage Community

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Abstract

Objective—There is a need for brief, psychometrically sound instruments to assess adolescent sleep, particularly for ethnic-minority and economically disadvantage adolescents. A 10-item short version of the Adolescent Sleep Wake Scale was recently proposed based upon exploratory factor analysis with primarily Caucasian healthy adolescents from middle to high-income families. The aim of the current study was to expand the utility of the short version of the Adolescent Sleep Wake Scale by investigating the empirical and construct validity of the measure on an ethnically diverse sample of adolescents from an economically disadvantaged community.

Material and Methods—Participants included 467 adolescents (40% African American, 35.5% Caucasian, 16.5% Latino, and 7.9% Multi-Ethnic), aged 12 to 18 years (mean = 15.27 years, SD =

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1.96 years), who completed the Adolescent Sleep Wake Scale. A confirmatory factor analysis (CFA) was conducted with Mplus 7 based on the 3-factor solution proposed by Essner et al (2014).

Results—CFA indicated that the three-factor structure was a good fit for the data ($\chi^2(29)=52.053$, $p=.005$, $RMSEA=0.04$, $CFI=0.98$, $TLI=.96$, $SRMR=0.03$), and factor loadings for each item were $>.40$. Cronbach alphas by ethnicity indicated that the scale has acceptable reliability (.70 α .90) for African American, Caucasian, and multi-ethnic adolescents, but not for Latino adolescents.

Conclusion—Our results support the use of the Adolescent Sleep Wake Scale short form for most ethnic-minority and economically disadvantaged adolescents.

Keywords

ethnic-minority; youth; sleep measure; ethnic disparities; inadequate sleep; wakefulness

1. Introduction

Adolescents are at increased risk of insufficient and disrupted sleep, and poor sleep patterns in adolescence are related to drug and alcohol use, mental health problems, academic difficulties, and a higher risk of obesity, type 2 diabetes, and motor vehicle accidents^{1, 2}. Further, research suggests adolescents from low socioeconomic status (SES) environments³, and African American and Latino adolescents⁴ exhibit poorer sleep than their counterparts. The negative effects of poor sleep on cognitive and academic functioning may be greater for low SES³ and ethnic-minority children ; though this has not been examined for adolescents. Notably, adolescents rarely pursue help for sleep-related difficulties and screening for clinically significant sleep problems is neglected in primary care⁶ and schools⁷. Given the time constraints in these settings, there is a significant need for psychometrically sound, brief instruments to assess adolescent sleep. The Adolescent Sleep Wake Scale (ASWS)⁸ is a measure of behavioral sleep patterns that is widely used and “approaching well-established” in general adolescent populations⁹. A recent exploratory factor analysis of the ASWS resulted in a 10-item short version (ASWS-S) with a three factor solution using a sample of primarily Caucasian (75.6%) adolescents from middle to high-income families¹⁰. For the ASWS-S to be useful in research and clinical settings, the structure needs to be validated for ethnically diverse and low SES samples. The current study aims to test the empirical and construct validity of the ASWS-S with an ethnically diverse sample of healthy adolescents from an economically disadvantaged community.

2. Methods

2.1. Participants and Procedure

Four hundred sixty-seven adolescents, aged 12 to 18 years (mean = 15.27 years, SD = 1.96 years), from middle and high schools in a rural, low-income (28.3% below poverty line) district completed the ASWS-S in a quiet room during an academic class, in a quiet room during an academic class, based on teacher volunteer status. Among students enrolled in volunteered classes, two students chose not to participate. The sample was ethnically diverse

(40% African American, 35.5% Caucasian, 16.5% Latino, and 7.9% Multi-Ethnic), and the majority were female (59.2%). The University's Institutional Review Board approved this study. Informed written consent and assent was obtained from parents and adolescents, respectively.

2.2. Measures

ASWS-S—The 10-item measure is based on the ASWS⁸, was developed by Essner and colleagues¹⁰, and consists of three factors: (a) Falling Asleep and Reinitiating Sleep-Revised, (b) Returning to Wakefulness-Revised, and (c) Going to Bed-Revised. Internal consistency for this three factor model was good, with Cronbach's Alpha ranging from .64 to .89 using a healthy sample and from .74 to .84 using a pooled sample of adolescents with chronic pain, sickle cell disease, traumatic brain injury and depressive disorders.

2.3. Data Analysis

Descriptive statistics were calculated using the Statistical Package for the Social Sciences (SPSS), Version 20. A confirmatory factor analysis (CFA) was conducted with Mplus 7 based on the 3-factor solution proposed by Essner et al (2014). The following indices were evaluated for the CFA: root mean square error of approximation (RMSEA < 0.06 for good fit), the Tucker-Lewis Index (TLI > 0.95 for good fit), comparative fit index (CFI > 0.95 for good fit), and the standardized root mean residuals (SRMR < 0.08 for good fit)¹¹. Forty eight of the 467 participants had missing ASWS-S data: 37 (7.9%) were missing one of the ten items, 7 (1.5%) were missing two items, and 4 (0.9%) were missing three items. This missing data was handled by coding it in the database and using full information maximum likelihood estimation in Mplus.

To examine internal consistency of the final model, SPSS was used to calculate Cronbach alpha coefficients for the entire sample and each ethnic subgroup. ANOVAs and t-tests were conducted to examine mean differences in sleep for adolescents of different ethnic groups and in comparison to the healthy Essner et al (2014) sample.

3. Results

The CFA indicated that the three-factor structure was a good fit for the data (χ^2 (29)=52.053, $p=.005$, RMSEA=0.04, CFI=0.98, TLI=.96, SRMR=0.03), and factor loadings for each item were >.40 (Table 1). Examination of the Cronbach alphas by ethnicity indicated that the total 10-item scale has acceptable reliability (.70 α .90) for the African American, Caucasian, and Multi-ethnic subsamples, but not for the Latino subsample (Table 2). Also, the alphas for the "Falling Asleep and Reinitiating Sleep" and "Returning to Wakefulness" subscales indicated acceptable reliability for the African, Caucasian, and Multi-ethnic subsamples, but not the "Going to Bed" subscale, which ranged from .48–.67. Also, we examined the changes in alphas for the "Going to Bed" subscale when items were removed using the total sample and the subsamples based on race, and found that other than for the Latino subsample, removing any of the items reduced the alphas. For the Latino subsample, removing item #3 raised the alpha to .59, which is still low and in the unacceptable range.

One-way ANOVAS were calculated to compare mean differences between the African American, Caucasian, and Multi-ethnic Samples on the Total scale, the Falling Asleep and Reinitiating Sleep subscale, Going to Bed, and the Returning to Wakefulness subscale. Results indicated the samples differed on the Returning to Wakefulness subscale ($F(2)=5.128$, $p < .01$), with African American adolescents ($M=2.81$) reporting more problems returning to wakefulness than Caucasian adolescents ($M=2.38$, $t(349) = 3.26$, $p = .001$). In comparison to Essner et al.'s (2014) healthy adolescent subsample, the current study sample, excluding the Latino subgroup, reported more total sleep problems ($M=3.81$ versus $M=3.61$, $t(389)=.67$, $p < .001$), problems falling asleep and reinitiating sleep, ($M=4.51$ versus $M = 3.88$, $t(389)=2.63$, $p=.009$), and problems returning to wakefulness ($M=2.61$ versus $M=2.44$, $t(387)$, $p < .001$). They also reported less problems going to bed than the Essner et al. (2014) sample ($M=3.41$ versus $M=3.66$, $t(386)=-4.28$, $p < .001$).

4. Discussion

The objective of the current study was to expand the utility of the ASWS-S¹⁰ by investigating the empirical validity of the measure for an ethnically diverse sample of adolescents from an economically disadvantaged community. The three-factor structure was a good fit for the ASWS-S, and adequate reliability was indicated for African American, Caucasian, and multiethnic adolescents, but not for Latino adolescents. Given that the sample was drawn from a school primarily serving a rural farming community, the Latino adolescents in the current sample likely included many first generation Latino-Americans, and English may have been the second language for many. Future research should screen for English language reading proficiency, and try to identify other factors that may influence validity of the measure for Latino adolescents. Our findings also provided support for the construct validity of the measure. The measure indicated that African American adolescents experience more problems waking up compared to Caucasian adolescents. Also, compared to healthy, primarily Caucasian adolescents from middle to high SES environments¹⁰, our sample of diverse adolescents from a primarily low SES environment reported more total sleep problems, problems falling asleep and returning to sleep, and problems waking up. This pattern of results is consistent with literature indicating an increased risk of sleep problems among ethnically diverse, and economically disadvantaged adolescents^{3, 12}. However, these findings are also tempered by the fact that we did not directly assess the SES of the current participants. Thus, future research should include more detailed assessment of SES. Notably, the "Going to Bed" subscale did not appear psychometrically sound and also produced results that were inconsistent with current research indicating ethnically diverse, low income adolescents are at higher risk of sleep problems. Given that 3 of the 5 items for the subscale were from the original 5-item subscale of the full ASWS, these findings were inconsistent with findings that the 5-item subscale had a Chronbach's alpha in the acceptable range for a diverse sample of adolescents from a state in the southeast of United States⁸. However, the average SES for the other sample was middle income, while the current sample came from a primarily low SES community. Thus, our findings may indicate that the "Going to Bed" subscale is not psychometrically sound for adolescents from low SES environments. For example, adolescents from low SES environments may be less likely to have set bedtimes, which would have impacted their responses to the questions posed.

Future research should explore the possible connections between SES and bedtime behaviors.

In conclusion, our results support the use of the ASWS-S for screening sleep problems in low SES, ethnic-minority adolescents, with the exclusion of Latino adolescents. The convenience of the short form may allow for broader use in situations with time constraints or research where multiple health outcomes are being examined. From a clinical standpoint, schools and health care providers may be more receptive to screening for sleep problems with a brief measure that is easy to score. In addition, our results contribute to the literature suggesting that ethnic minority and economically disadvantaged adolescents are at increased risk for sleep problems. This supports the need for screening and interventions targeted to these populations.

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Highlights

- ASWS-S was reliable for African American, Caucasian, and multi-ethnic adolescents
- ASWS-S was not reliable for Latino adolescents
- ASWS-S can be used to screen for sleep problems in most adolescents

Table 1

Factor Loadings Specified in the Final Three-Factor Model

ASWS Item	Falling Asleep & Reinitiating Sleep-Revised	Returning to Wakefulness-Revised	Going to Bed-Revised
1. When it's time to go to bed, I want to stay up and do other things (R)			.57
2. In general, I am ready for bed at bedtime			.42
3. In general, I try to "put off" or delay going to bed (R)			.57
4. When it's time to go to sleep, I have trouble settling down (R)	.68		
5. In general, I <i>need help</i> getting to sleep (for example, I need to listen to music, watch TV, take medication, or have someone else in the bed with me) (R)	.48		
6. After waking up during the night, I have trouble going back to sleep (R)	.53		
7. After waking up during the night, I have trouble getting comfortable (R)	.58		
8. After waking up during the night, I <i>need help</i> to go back to sleep (for example: I need to watch TV, read, or sleep with another person) (R)	.55		
9. In the morning, I wake up and feel ready to get up for the day		.82	
10. In the morning, I wake up feeling rest and alert.		.78	

Note: (R) = item reverse-scored

Table 2

Internal Consistency of ASWS-S Subscales for Entire Sample and Subsamples by Race

ASWS-S Subscale	Number of Items	Cronbach's Alpha	Mean	Standard Deviation
Total Sample (<i>N</i> = 419)				
Falling Asleep and Reinitiating Sleep	5	.75*	4.52	1.12
Returning to Wakefulness	2	.78*	2.61	1.28
Going to Bed	3	.54	3.41	1.13
Total Measure	10	.72*	3.81	0.83
African American Sample (<i>N</i> = 159)				
Falling Asleep and Reinitiating Sleep	5	.74*	4.60	1.10
Returning to Wakefulness	2	.75*	2.81	1.35
Going to Bed	3	.48	3.33	1.13
Total Measure	10	.73*	3.88	0.85
Caucasian Sample (<i>N</i> = 152)				
Falling Asleep and Reinitiating Sleep	5	.78*	4.49	1.14
Returning to Wakefulness	2	.77*	2.38	1.12
Going to Bed	3	.67	3.52	1.16
Total Measure	10	.73*	3.78	0.81
Latino Sample (<i>N</i> = 71)				
Falling Asleep and Reinitiating Sleep	5	.63	4.58	.98
Returning to Wakefulness ^{3.41}	2	.81*	2.62	1.24
Going to Bed	3	.40	3.41	1.07
Total Measure	10	.60	3.84	0.72
Biracial Sample (<i>N</i> = 37)				
Falling Asleep and Reinitiating Sleep	5	.83*	4.19	1.31
Returning to Wakefulness	2	.80*	2.68	1.53
Going to Bed	3	.49	3.33	1.11
Total Measure	10	.80*	3.63	0.99

* Values fall within the acceptable range for Cronbach's alpha ($.70 \leq \alpha \leq .90$).

Note. Due to listwise deletion by SPSS when calculating Cronbach Alpha's, sample sizes varied for each analyses. Sample sizes listed above are the minimum number of observations used to calculate any of the scales for that ethnicity.