

## Development and psychometric evaluation of the Children's Sleep-Wake Scale ☆☆☆



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### ABSTRACT

**Objective:** To describe the development and psychometric evaluation of the Children's Sleep-Wake Scale (CSWS), a caregiver-report measure of behavioral sleep quality in 2- to 8-year-old children.

**Design:** Five studies using independent samples were completed to generate, refine, and finalize the item pool, as well as to confirm the factor structure and to assess the reliability and validity of the CSWS.

**Setting:** Field.

**Measures:** CSWS, sleep diary, and actigraphy.

**Results:** Confirmatory factor analysis supported the theoretically proposed 5-factor structure (Going to Bed, Falling Asleep, Maintaining Sleep, Reinitiating Sleep, Returning to Wakefulness). The final questionnaire included 25 items, with items rated on a 6-point scale (Never, Once in Awhile, Sometimes, Quite Often, Frequently-if not Always, and Always); higher scores indicate better sleep quality. We found excellent internal consistency reliability for subscales and the total scale ( $\alpha = .81$ – $\alpha = .91$ ), strong test-retest reliability ( $r = 0.67$ – $r = 0.84$ ; all  $P$  values  $< .001$ ), moderate-to-strong correlations between CSWS subscale scores and corresponding parental diary ratings ( $r = 0.58$ – $r = 0.72$ ; all  $P$  values  $< .001$ ), and weak-to-moderate correlations between CSWS subscales and actigraphic measures ( $r = 0.38$ – $r = 0.61$ ; all  $P$  values  $< .001$ ). CSWS subscale scores discriminated 4 extreme groups, thus supporting the construct validity of the scale.

**Conclusion:** These collective findings indicate that the CSWS has adequate reliability and validity for research instruments and suggest that it is a convenient tool for assessing behavioral sleep quality in preschool-aged and school-aged children.

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### Introduction

This article describes the development and psychometric evaluation of the Children's Sleep-Wake Scale (CSWS), a caregiver-report measure of behavioral sleep quality in 2- to 8-year-old children. The CSWS differs from existing questionnaires designed to screen for pediatric sleep disorders or to assess childhood sleep disturbances<sup>1,2</sup>: (a) it is a research instrument; (b) it provides data on the full range of sleep quality, from very good to very poor; and (c) it quantitatively assesses 5 distinct behavioral dimensions of sleep quality, including

Going to Bed, Falling Asleep, Maintaining Sleep, Reinitiating Sleep, and Returning to Wakefulness.

A comprehensive understanding of sleep health necessitates complementary behavioral and physiological approaches.<sup>3</sup> Polysomnography is the gold standard for quantifying multiple aspects of sleep physiology, and actigraphy provides ambulatory estimation of continuous sleep states via motor activity.<sup>4</sup> Both, however, are costly and time/labor intensive, and do not capture all behavioral aspects of children's sleep health, such as bedtime resistance or difficulties awakening in the morning. Given the high prevalence of childhood behavioral sleep problems<sup>5–8</sup> and the need to better understand their etiology, consequences, and treatment course, questionnaires with established reliability and validity are needed.

Development of the CSWS was based on a theoretical framework (Fig. 1) that was informed by published models of infant sleep regulation and disturbance<sup>9,10</sup> and empirical data. This framework proposes that children's behavioral sleep quality (middle oval) occurs within the broad context (outer oval) of 2 extrinsic domains (ie, culture and physical environment) and 2 intrinsic child domains (ie,

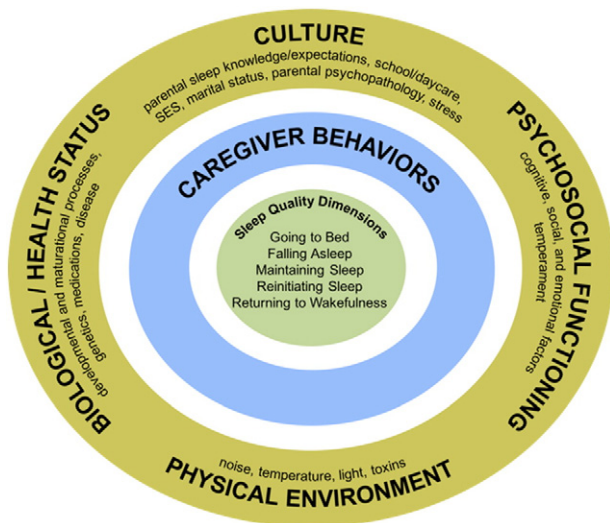
**Abbreviations:** CSWS, Children's Sleep-Wake Scale.

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☆☆ Conflicts of Interest: None.

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**Fig. 1.** Transactional model for the study of children's sleep and the development of the Children's Sleep-Wake Scale (CSWS).

psychosocial functioning and biological/health status). Caregiver behaviors (middle oval), including sleep hygiene practices and behavioral change strategies, can mediate or moderate relationships between sleep quality and contextual domain variables. Similar to other transactional models,<sup>11</sup> this framework assumes interactions between domains and differences in relationships between domain variables and sleep. Domain variables can also have a direct impact upon sleep quality and vice versa. Individual combinations of the domain variables influence each behavioral dimension of sleep quality. Difficulties with one or more of these behavioral dimensions can directly impact caregivers' behaviors and, thus, children's psychosocial functioning, development, and health status.

This project utilized conventional and rigorous procedures for scale development and psychometric evaluation.<sup>12,13</sup> Five studies with independent samples were completed. After establishing content validity of generated items, we evaluated internal consistency and refined and/or deleted items (studies 1 and 2). Study 3 examined the factor structure of the CSWS with confirmatory factor analysis (CFA), evaluated subscale-to-subscale correlations, and then reassessed internal consistency. Study 4 examined the 1-month temporal stability (test-retest reliability) of the CSWS. Finally, study 5 evaluated the construct validity of the CSWS via extreme-groups discrimination.

### General analysis

Data were analyzed with SPSS version 11.0 (SPSS Inc, Chicago, IL) or version 20.0 (IBM Corp, Armonk, NY). Summary measures include range, %, or  $M \pm SD$ . Univariate distributions of variables were evaluated for normality, and correlations were computed following inspection of scatterplots to confirm linearity and to identify potential outliers. For all analyses, the significance level was  $\alpha = .05$ .

### Preliminary CSWS development: item generation and content validity

Sleep medicine and child psychology experts generated a pool of 79 items written below a sixth grade reading level (1-month reference period; 3-point response set: Rarely, Sometimes, Usually). As a first step, primary caregivers ( $n = 30$ ) of 2- to 5-year-olds attending a community daycare/preschool provided qualitative feedback on the clarity of directions and items, suitability of the scaling method, and approximate time to complete administration.

Following scale revisions, 9 pediatric sleep experts participated in a quantitative assessment of the scale's content validity.<sup>13</sup> Reviewers evaluated (a) the clarity and conciseness of the administration directions and items, (b) the content relevance of each item for the 5 proposed sleep quality domains, and (c) the comprehensiveness of the entire scale as a measure of children's behavioral sleep quality. Items were rated using a four-point scale (1 = not relevant, 2 = unable to assess relevance without item revision, 3 = relevant, but needs minor revision, 4 = very relevant and succinct). The index of content validity (CVI; range 0-1) for each item was the proportion of experts who gave the item a rating of at least 3 or 4, and the CVI for the entire instrument was the proportion of total items judged to be content valid. Based upon the approach of Lynn,<sup>13</sup> items with  $CVI < 0.78$  were eliminated from the item pool ( $\alpha = .05$ ). Expert review resulted in a total of 77 items with total CVI of 0.93 for the entire instrument.

### Study 1: Item refinement

Participants were recruited via flyers, personal contact at community events, daycares, and schools (contact information obtained on-site for subsequent follow-up by researchers), and/or snowball sampling<sup>14</sup> from a tri-county area of southern Mississippi, as guided by the 1990 Census of Population and Housing.<sup>15</sup> The CSWS and a general demographics and health questionnaire were completed by the primary caregiver for only one child per family using a controlled selection method.<sup>16</sup> As approved by the University of Southern Mississippi institutional review board, researchers obtained verbal informed consent from caregivers to participate via telephone. There were no exclusionary criteria.

Researchers contacted 174 caregivers of 2- to 5-year-old children ( $3.4 \pm 1.1$  years; Supplemental Data, Table S1) and completed administration of the 77-item CSWS preliminary version with 161 (93% response rate). Subscale items were identified for exclusion if they had corrected item-total correlation coefficients less than  $r = 0.30$ <sup>17</sup> or a high inter-item correlation ( $r = 0.70$ ) with a more internally consistent item (to avoid redundancy). Inspection of item means and standard deviations served as a secondary criterion for elimination. Items with a high, moderate, and low chance of being endorsed were all desired to facilitate differentiating among varying levels of sleep quality in children. The least discriminating items were deleted if their removal improved the subscale's internal consistency. This analysis resulted in elimination of 35 items and the addition of 8 items (ie, combined highly redundant original items), resulting in a 50-item scale.

Corrected item-total correlations ranged from  $r = 0.03$  to  $r = 0.80$ , and 13 items were considered for elimination due to low values ( $r < 0.30$ ). Subscale inter-item correlations varied widely ( $r = 0.00$  to  $r = 0.83$ ); 20 items with high inter-item correlations ( $r > 0.70$ ) were examined for redundancy. Of these items, 2 with item-total correlations lower than the respective redundant item were marked for deletion. The remaining 18 items were retained for the following analysis.

### Study 2: Item analysis

We used the same recruitment strategy and approach for obtaining informed consent as described above for study 1. In a new sample of 543 primary caregivers of 2- to 8-year-old children ( $4.9 \pm 2.0$  years; Supplemental Data, Table S1) contacted by telephone, 485 responded to the 50-item scale (response rate = 89%). Item analysis and selection followed the same procedure as in study 1, resulting in a total of 39 items. Cronbach  $\alpha$  (internal consistency) for the 5 subscales was as follows: Going to Bed (10 items;  $\alpha = .83$ ), Falling Asleep (9 items;  $\alpha = 0.72$ ), Maintaining Sleep (7 items;  $\alpha = .73$ ), Reinitiating Sleep (8 items;  $\alpha = .74$ ), and Returning to Wakefulness (5 items;  $\alpha = .85$ ). Internal consistency reliability for the total scale was  $\alpha = .89$ .

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