

Sleep and School Problems Among Children and Adolescents in State Custody

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Abstract: Population-level research into the association between sleep problems and school problems among high-risk youth is limited. This study uses cross-sectional administrative and standardized assessment information for youth entering Tennessee state custody in fiscal year 2009 ($n = 4280$) to examine whether sleep problems are independently associated with school problems. Sleep problems were identified in 9.8% of the sample. There was no association between sleep and school problems for youth adjudicated delinquent. Among youth adjudicated dependent—neglect/unruly, multivariate logistic regression analysis indicates that youth at risk for sleep problems are 1.78 (95% confidence interval = 1.24–2.55) and youth with actionable sleep problems are 3.30 (95% confidence interval = 1.78–6.14) times more likely than youth without sleep problems to have school problems. Results suggest that the school performance of youth entering state custody adjudicated dependent—neglect/unruly may benefit from systematic screening and intervention for sleep problems.

Key Words: Sleep problems, school problems, children and adolescents, state custody.

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Sleep problems are common among children and adolescents, with estimated occurrence rates of 15% to 40% (Owens, 2007; Petit et al., 2007). Sleep problems of many youth can be treated successfully (Owens and Witmans, 2004; Reid et al., 2009). In spite of this, they are often underrecognized and therefore undertreated in community practice (Owens, 2001; Rosen et al., 2001). Poor sleep has been linked to problems with attention, concentration, impulsivity, daytime sleepiness, mood regulation, and cognitive functioning (Beebe and Gozal, 2002; Chuah and Chee, 2008; Fallone et al., 2001; Fredriksen et al., 2004; Ipsiroglu et al., 2002; Lim and Dinges, 2008; Meijer et al., 2000; Quach et al., 2009; Roberts et al., 2008; Smedje et al., 2001). This suggests that sleep problems may be a key determinant of school problems for many youths. Because many sleep problems are treatable, sleep problems may be a reversible risk factor for poor school performance and a variety of behavioral and mental health problems, including major depression and substance abuse (Roane and Taylor, 2008).

The relationship between sleep problems and school difficulties in children and adolescents has received only limited investigation (Carskadon et al., 1998; Gozal, 1998; Gozal and Pope, 2001; Quine, 2001). Indirect evidence of such a relationship was provided by Fallone et al., who showed that sleep restriction for 3 weeks resulted in significantly higher rates of attention and academic problems compared with nonrestricted sleep (2005). In a longitudi-

nal study of middle school-aged youth, individuals with shorter sleep duration were shown to be at greater risk of poor academic performance (Fredriksen et al., 2004). More recently, nonrespiratory sleep problems were associated with poor academic performance in a sample of 80 children who attended both mainstream schools and schools with specialized services for behaviorally challenged youth (Blundin and Chervin, 2008). Sleep problems were more prevalent among children who attended specialist schools compared with those who attended mainstream schools.

The availability of automated health outcomes databases presents an opportunity to study the effects of sleep problems on a variety of outcomes at the population level, including various school problems; however, such an approach presents many challenges. First, because sleep problems are often not reported, diagnosed, or treated (Owens, 2001; Smedje et al., 1999), many individuals with clinically significant sleep problems may not be identified in the data. Second, because some school problems and sleep difficulties occur in subtle forms that do not conform to specific diagnoses, their occurrence may not be captured adequately using traditional diagnosis coding systems. Third, because psychiatric symptoms such as internalizing and externalizing behaviors, and caregiver problems are themselves associated with both sleep and school problems (Lehmkuhl et al., 2008), they represent potentially important confounders that may be difficult to assess directly. This may make it difficult to assess the independent effect of sleep problems on school problems for a given population because of the absence of a concomitant, reliable, and valid source of individual patient-level data.

In 2006, the Tennessee Department of Children's Services (TDCS) implemented a standardized process to assess the needs and strengths of all youth and families entering state custody, including youth entering through the child welfare system (e.g., adjudicated dependent—neglect/unruly) and the juvenile justice system (e.g., adjudicated delinquent). Using administrative and standardized assessment information for all children and adolescents entering state custody through an automated database maintained by TDCS, this study tests the hypothesis that sleep problems are independently associated with school problems after statistical adjustment for important and potentially confounding covariates.

METHODS

Design

This cross-sectional study was conducted using deidentified TDCS administrative and assessment information for all youth between the ages of 5 to 19 years who entered Tennessee state custody between July 1, 2008 and June 30, 2009. Data elements include youth adjudication status, youth demographic characteristics, and information from the intake assessment of youth and family needs and strengths. For youth who entered state custody more than once during the study time period, only the first assessment during the study time period was included. The research project was approved by the Vanderbilt University Institutional Review Board and the TDCS Research Review Committee.

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Measures

Youth adjudication status and youth demographic variables (e.g., age, gender, and race) were derived from the administrative data files. Categorical variables were dummy coded.

Ratings of child and family needs and strengths were conducted by TDCS at state custody intake using the Child and Adolescent Needs and Strengths (CANS) (Lyons, 1998; Lyons, 1999). CANS ratings are completed by TDCS case managers, all of whom are trained, certified, and annually recertified for 70% reliability. Ongoing consultation and supervision in the reliable use of the measure is provided to TDCS case managers by consultants from the state's network of Centers of Excellence for Children in State Custody. Consultants are embedded within regional TDCS offices, provided objective, third-party review of all ratings, and case by case assistance as needed.

Previous research demonstrates this measure to have adequate inter-rater and internal consistency reliability (Anderson et al., 2003; Epstein et al., 2009; Leon et al., 2000; Leon et al., 1999; Lyons et al., 2002; Lyons et al., 2004), and concurrent, discriminate, and predictive validity (Epstein et al., 2009; Leon et al., 1999; Lyons et al., 2001; Lyons et al., 1997; Lyons et al., 2000a,b; Lyons et al., 2004; Park et al., 2009). The CANS is presently used by child-serving systems in many states as a decision support tool and as a tool for quality and outcomes monitoring (Lyons, 2004; Lyons, 2009; Lyons and Weiner, 2009).

The TDCS version of the CANS contains 65 items, each rated on a 4-point scale that ranges from 0 to 3. A rating of "0" indicates no evidence of a need for services and a rating of "3" indicates a need for immediate and/or intensive action. Ratings of "2" or "3" are considered "actionable" (Lyons, 2009). For this study, CANS information was used to define the outcome variable, primary predictor variable, and 3 important covariates. To define the outcome variable, school problems, 3 CANS items—school attendance, school behavior, and school achievement—were used (Cronbach alpha = 0.76). Youth were defined as not having school problems if their level of need was rated "not actionable" on all 3 school items and as having school problems if their level of need was rated actionable on at least one of the school items.

The sleep item was used to define the primary predictor variable. Ratings on this item were classified to create a 3-level categorical variable. Youth with a rating of 0 were defined as not having a sleep problem, youth with a rating of "1" were defined as at-risk for developing a sleep problem, and youth with a rating of 2 or 3 were defined as having an actionable sleep problem. An example of the rating criteria for the sleep item is presented in Table 1.

Of the remaining CANS items, 30 were submitted to a principal components analysis with varimax rotation. The 30 items

were chosen for their relevance to school problems on the basis of the literature review presented earlier. A 3-factor solution emerged that accounted for 40% of the variance in CANS scores. On the basis of the factor loadings, the factors were called caregiver problems (7 items; scores range from 0 to 21), externalizing symptoms (9 items; scores range from 0 to 27), and internalizing symptoms (6 items; scores range from 0 to 18). All 3 scales were similar to other published analyses that submit CANS information to factor analytic techniques (Leon et al., 2000), had adequate internal consistency reliability (Cronbach alpha was 0.78 for caregiver problems, 0.89 for externalizing symptoms, and 0.74 for internalizing symptoms), and low to moderate correlations between the scales. Each scale was defined as a 3-level categorical variable by categorizing scale scores into tertiles.

Analysis

The purpose of this study is to investigate whether having sleep problems is associated with an increased likelihood of having school problems among a group of youth in Tennessee state custody. Because youth may be adjudicated dependent—neglect/unruly or delinquent and because these may represent 2 distinct groups with respect to sleep and school problems, the first stage of our analysis tested whether these 2 groups of youth should be analyzed separately. To test this, we conducted 2 *chi square* analyses: one to determine whether there was a statistically significant association between our primary predictor variable (sleep problems) and adjudication status; the other to determine whether there was a statistically significant association between our outcome variable (school problems) and adjudication status. In the second stage of our analysis, we conducted analyses stratified by adjudication status to determine whether sleep problems are independently associated with school problems among these 2 groups of youth in Tennessee state custody.

All analyses were performed using SPSS version 17.0 (SPSS Inc., 2006). Skewness was within normal limits for age. Bivariate associations between sleep problems and other dichotomous variables were tested with *chi square* analysis, and bivariate associations between sleep problems and continuous variables were tested using one-way analysis of variance, with Bonferroni correction for multiple comparisons applied to the multiple pairwise comparisons when necessary. All variables were included in the multivariate logistic regression analysis predicting school problems, including potentially important interactions between sleep problems and internalizing symptoms, externalizing symptoms, and caregiver needs. Multicollinearity diagnostics were within normal limits.

RESULTS

Description

Information on 4280 children and adolescents in TDCS custody was included in the analysis. Of these, 1735 (40.5%) were female and 2545 (59.5%) were male. The mean \pm SD age was 13.9 \pm 3.8 years. A majority of children (2698, or 63.0%) were white, nonlatino. An additional 1316 (or 30.7%) were African American, and the remaining 100 (or 2.3%) children for whom race data were available, were from another racial or ethnic minority. A large minority of children (1376, or 32.1%) were adjudicated delinquent. Overall, 49.6% of youth were identified as having school problems, 14.5% were identified as being at risk for sleep problems, and 9.8% were identified as having sleep problems.

Comparison of youth adjudicated dependent—neglect/unruly and delinquent shows that there are statistically significant differences between the 2 groups for sleep problems and school problems. In comparison to youth adjudicated dependent—neglect/unruly, youth adjudicated delinquent ($\chi^2(2) = 21.4, p < 0.001$) were more

TABLE 1. Rating Criteria for the Child and Adolescent Needs and Strengths Sleep Item

Rating	Description
Absent (0)	Youth gets a full night's sleep each night.
Mild (1)	Youth has some problems sleeping. Generally, youth gets a full night's sleep but at least once a week problems arise. This may include occasionally awakening or bed wetting or having nightmares.
Moderate (2)	Youth is having problems with sleep. Sleep is often disrupted and youth seldom obtains a full night of sleep.
Severe (3)	Youth is generally sleep deprived. Sleeping is difficult for the youth and s/he is not able to get a full night's sleep.

likely to be rated as at risk for sleep problems (16.5% vs. 13.9%) and to have actionable sleep problems (12.0% vs. 8.4%). Similarly, in comparison to youth adjudicated dependent—neglect/unruly, youth adjudicated delinquent ($\chi^2(2) = 274.1, p < 0.001$) were more likely to be rated as having school problems (72.4% vs. 43.9%).

Analysis for Youth Adjudicated Delinquent

Bivariate analysis demonstrates that among youth adjudicated delinquent, there is a nonstatistically significant trend toward youth with sleep problems being more likely to have school problems, specifically, 71.5% of youth with no sleep problems, 71.8% of youth at risk for sleep problems, and 79.2% of youth with sleep problems had school problems ($\chi^2(2) = 3.9, p = 0.15$).

Analysis for Youth Adjudicated Dependent—Neglect/Unruly

Table 2 shows the bivariate association between sleep problems and the other study variables for youth adjudicated dependent—neglect/unruly. Results show that among youth adjudicated dependent—neglect/unruly, 38.4% of youth with no sleep problems, 57.8% of youth at risk for sleep problems, and 71.9% of youth with sleep problems also had school problems ($\chi^2(2) = 113.8, p < 0.001$). Statistically significant differences in likelihood of sleep problems were also demonstrated for race ($\chi^2(2) = 30.27, p < 0.001$), externalizing symptoms ($\chi^2(2) = 250.04, p < 0.001$), and internalizing symptoms ($\chi^2(2) = 370.04, p < 0.001$).

Table 3 reports the results of a multivariate logistic regression analysis predicting the probability of having school problems for youth adjudicated dependent—neglect/unruly. In comparison to youth with no sleep problems, youth at risk for sleep problems were 1.78 (95% confidence interval = 1.24–2.55) and youth with actionable sleep problems were 3.30 (95% confidence interval = 1.78–6.14) times more likely to have school problems after statistical adjustment for important and potentially confounding variables. Youth with externalizing behavior problems, increasing age in

TABLE 2. Bivariate Associations Between Sleep Problems and Other Study Variables for Youth Adjudicated Dependent—Neglect/Unruly

Variable	Sleep Problems			p
	None (n = 1896)	At-risk (n = 344)	Actionable (n = 199)	
School problems, %	38.4	57.8	71.9	<0.001
Externalizing, %				<0.001
Low	54.7	31.5	17.3	—
Medium	33.0	34.5	40.0	—
High	12.3	34.0	42.7	—
Internalizing, %				<0.001
Low	41.0	12.9	7.7	—
Medium	35.0	30.1	17.7	—
High	24.0	57.0	74.5	—
Caregiver, %				ns
Low	20.9	19.4	24.8	—
Medium	28.9	29.9	27.2	—
High	50.2	50.7	48.1	—
Female, %	52.4	48.8	48.6	ns
Race, %				<0.001
African American	28.0	17.4	15.6	—
White, nonlatino	69.1	79.7	82.1	—
Other	2.9	2.9	2.4	—

TABLE 3. Multivariate Logistic Regression Predicting School Problems for Youth Adjudicated Dependent—Neglect/Unruly

Predictors	aOR (95% CI)
Sleep problems (none)	1.00
At risk	1.78 (1.24–2.55)
Actionable	3.30 (1.78–6.14)
Externalizing (low)	1.00
Medium	2.54 (1.71–3.80)
High	8.84 (5.35–14.62)
Internalizing (low)	1.00
Medium	1.07 (0.57–1.99)
High	0.77 (0.43–1.38)
Caregiver (low)	1.00
Medium	1.38 (0.89–2.15)
High	1.50 (1.00–2.24)
Male (female)	1.16 (1.95–1.43)
Age in years	1.13 (1.10–1.17)
Race (white, nonlatino)	1.00
African American	1.43 (1.13–1.80)
Other	1.01 (0.54–1.89)
Sleep x externalizing (none x low)	1.00
At risk x medium	1.16 (0.56–2.37)
At risk x high	1.24 (0.52–2.94)
Actionable x medium	0.61 (0.23–1.63)
Actionable x high	1.56 (0.44–5.57)
Sleep x internalizing (none x low)	1.00
At risk x medium	0.41 (0.16–1.01)
At risk x high	0.28 (0.11–0.72)
Actionable x medium	2.63 (0.51–13.65)
Actionable x high	0.86 (0.20–3.77)
Sleep x caregiver (none x low)	1.00
At risk x medium	1.30 (0.58–2.90)
At risk x high	1.37 (0.65–2.87)
Actionable x medium	1.00 (0.33–3.01)
Actionable x high	0.73 (0.27–1.97)

aOR indicates adjusted odds ratio; CI indicates confidence interval; x indicates an interaction term in the regression model.

years, and African American race (in comparison to white, nonlatino youth) also had statistically significantly higher adjusted odds of having school problems. There was a nonstatistically significant trend toward youth with caregiver problems having increased likelihood of school problems. The interactions between sleep problems and externalizing behavior problems and sleep problems and caregiver problems were not statistically significant. Analysis of the interaction between sleep problems and internalizing behavior problems, however, suggests a nonstatistically significant trend toward reduced likelihood of school problems with increasing internalizing behavior problems both for youth at risk for and with actionable sleep problems.

DISCUSSION

This cross-sectional secondary analysis of administrative information on children and adolescents in TDCS state custody documents several key findings. Both sleep and school problems appear to be common occurrences in this population. Overall, 49.6% of youth had school problems, 14.5% of youth were at risk for sleep problems, and 9.8% had sleep problems requiring intervention.

Among youth adjudicated dependent—neglect/unruly, sleep problems are associated with school problems, independent of a variety of other factors that are also known to influence school performance and functioning. This result is further supported by evidence of a dose-response relationship between sleep problems and school problems among this group of youth.

The overall prevalence of sleep problems reported in this study is similar to those reported by others for a variety of moderate-to-severe sleep problems or sleep disorders (Hiscock et al., 2007; Johnson et al., 2006; Quach et al., 2009; Sadeh et al., 2000). Of course, prevalence estimates vary considerably depending on the definition of sleep problems. For example, the prevalence of persisting insomnia in pediatric populations has been estimated as approximately 6%; however, when the definition of insomnia is expanded to include infrequent problems with sleep initiation or sleep-disrupting behavior, prevalence estimates increase to over 40% (Ivanenko and Gururaj, 2009). Based on this, our definition of sleep problems may be considered rather conservative, reflecting primarily cases of child and adolescent insomnia in which the minimum threshold for sleep problems is having sleep that is “often disrupted” and results in “seldom obtain(ing) a full night of sleep.” This threshold represents, in our view, a degree of persistence and severity that most clinicians would regard as clinically significant.

Previous cross-sectional studies of the relationship between sleep problems and school difficulties used poor academic performance as a dependent variable (Blundin and Chervin, 2008; Fallone et al., 2005; Fredriksen et al., 2004). Our definition of school problems was intentionally broad, and included as cases of youth with difficulties with one or more of school attendance, school behavior, and school achievement. This broad definition of school difficulties is consistent with that of a recent longitudinal report that showed a significant relationship between sleep problems and poorer performance on standardized tests of language, learning, and behavior during school transition in a cohort of elementary school-aged children (Quach et al., 2009). The study by Quach et al. (2009) employed a prospective design in which sleep problems were classified in cohort members on the basis of parent interview, with separate test batteries (or portions of them) used to assess key outcome measures. In spite of marked differences in population and methodology between our study and that of Quach et al. (2009), both studies reached the same general conclusions.

Consistent with the observations of previous investigators, we were also able to show an independent association between sleep problems and school problems across a variety of age groups (Carskadon et al., 1998; Fallone et al., 2005; Fredriksen et al., 2004; Gozal et al., 2001; Quach et al., 2009). Many of these previous studies focused on general pediatric populations. We were able to extend prior findings from other cross-sectional studies to a specific at-risk population, e.g., youth entering state custody adjudicated dependent—neglect/unruly. The assessment of sleep and school problems in other studies of youth at high risk has received only preliminary investigation, and has focused largely on comparisons of prevalence rates of sleep problems between youths attending mainstream versus special education schools. For instance, one recently published small, cross-sectional study comparing the prevalence of sleep problems across 2 groups of school-aged youth showed higher rates of sleep problems (assessed using the 26-item Sleep Disturbance Scale for Children (Bruni et al., 1996)) among 15 youth who attended schools with specialized units for behaviorally challenged students compared with 15 matched control children who attended mainstream schools (Blundin and Chervin, 2008). In the same report, poor sleep (defined as daytime sleepiness, parasomnias, behavioral sleep problems, and a composite of 2 or more of these) was associated with poor academic performance using a larger

combined sample consisting of 80 individuals (Blundin and Chervin, 2008). Similar results were obtained by Quine (2001), who reported a higher prevalence of sleep problems, identified by parental questionnaire, among youth who attended special education schools compared with those who attended mainstream schools.

This study results also suggest a nonstatistically significant trend toward an increasing likelihood of school problems with increasing caregiver problems. This finding is generally consistent with existing literature suggesting that social risk factors are associated with negative educational outcomes (Jutte et al., 2010). Unexpectedly, our results also suggest a nonstatistically significant trend toward internalizing behavior problems being associated with a reduced likelihood of school problems for youth at risk for and with actionable sleep problems. The expected positive correlation between internalizing problems and sleep problems was found (Stein et al., 2001), but existing literature suggests that depression, for example, is associated with school performance problems (Frojd et al., 2008). Although we can only speculate, we hypothesize that information bias resulting from our use of a broad definition of school problems that includes attendance, behavior, and achievement may be responsible for this finding. Additional investigation of a potentially important interaction between sleep problems and internalizing behavior problems may also be warranted.

Automated databases have as one of their primary strengths the ability to efficiently characterize very large groups of individuals according to exposures or disease states/entities of interest (Selby, 1997; Strom and Carson, 1990). However, because they are designed for administrative rather than clinical purposes, important clinical information about potential confounding factors may be insufficient, absent the ability to extract the needed information from medical records (Hemmelgarn et al., 1994). In that sense, one noteworthy advantage of our approach using automated CANS information was the ability to perform analyses of the relationship between sleep and school problems that were adjusted for clinically important confounders that would have been otherwise logistically unfeasible to extract. Prior to system-wide use of the CANS, TDCS administrative data consisted of eligibility, demographic, nonclinical administrative information related to child welfare placements or interaction(s) with the juvenile justice system, and limited healthcare encounter data. Although important demographic variables (such as age, gender, and race/ethnicity) were ascertained from administrative files, we were also able to derive estimates of psychiatric symptoms such as internalizing and externalizing behaviors, and caregiver problems. The ability to access reliable and valid individual patient-level data on a population level represents, in our view, the most important methodological feature of this study.

Nevertheless, our results must be interpreted with several limitations in mind. Our results apply only to children and adolescents who entered state custody in Tennessee, and we report differences between youth adjudicated dependent—neglect/unruly and youth adjudicated delinquent. We were unable to compare rates of sleep problems in a matched group of non-TDCS youth. Second, we were also unable to ascertain what, if any, specific sleep disorders or sleep-disrupting behaviors were diagnosed. Although the CANS is a validated tool designed to identify mental health and other service needs, it is not designed to provide a specific sleep disorder diagnosis. Thus, the extent of our ability to classify sleep problems was to identify those who are having sleep problems in need of further clinical evaluation. In a related matter, we used crude estimates of caregiver problems, internalizing symptoms, and externalizing symptoms as covariates rather than specific psychiatric diagnoses, which presents less of a limitation and more of a departure from traditional approaches to covariate definition. We felt that broad categories of need, as defined in our study, were potentially more

clinically meaningful. Third, because CANS item ratings represent the TDCS case manager assessment of need based on available case information at the time youth enter state custody, and because sleep problems may be subtle, it is possible that the proportion of children and adolescents with sleep problems may have been underestimated. Finally, we defined school problems broadly based on a composite variable consisting of 3 school-related CANS items. Although our composite variable had high internal consistency reliability and face validity, our definition does not allow us to assess the comparative effect of sleep problems separately on school attendance, school behavior, and school achievement.

Despite methodological differences across studies, presently there is considerable agreement in the literature, further supported by our results, that sleep problems are common among youth, including populations of high-risk youth. Results of our population-based study, consistent with others, show that sleep problems are independently associated with school problems among youth who enter state custody through the child welfare system. Systematic use of rating scales in high-risk populations not only promotes services planning but may also generate enhanced-data sets that can be used to test empirical questions and identify subpopulations of at-risk youth who may be at even greater risk. Based on our results, it appears that youth entering state custody represent a population at risk for sleep problems that may be targeted for systematic screening and intervention, particularly in view of the treatable nature of many sleep-related problems that affect youth.

CONCLUSIONS

Sleep problems occurred frequently among children and adolescents in Tennessee state custody and were associated with school problems independently of other risk factors for youth who enter state custody through the child welfare system. Because most sleep problems in youth are treatable, they may be considered potentially modifiable risk factors. Systematic programs to address sleep problems in high-risk populations, such as youth entering state custody, need to be developed and studied.

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