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Six Month Persistence of Sleep problems in children with autism, developmental delay and typical development

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Abstract

Objective—This study examined sleep problems and their short-term stability in pre-school children with autism and two matched comparison groups: children with developmental delay without autism and typically developing children. Sleep problems were defined subjectively by parent report, by the Children's Sleep Habits Questionnaire (CSHQ), and objectively by quantitative research diagnostic criteria (RDC) derived from actigraphic recordings.

Methods—Children were studied on three occasions, each separated by a 3-month interval. At each assessment, children were recorded actigraphically for one week and parents completed sleep-wake diaries and the CSHQ. Descriptive statistics and odds ratios were used to assess the occurrence and stability of sleep problems within children and across groups, and to explore how actigraph and CSHQ-defined sleep problems impact parental sleep problem reports.

Results—Parent reports of sleep problems were more prevalent than RDC and CSHQ defined sleep problems, especially for children with neurodevelopmental disorders. For all groups, objectively measured sleep problems were rarely persistent over the 6-month period. The children in both neurodevelopmental groups, however, had more sleep problems on one or two occasions, using actigraph and the CSHQ than typically developing children

Conclusions—Objective and subjective measures of sleep problems in preschool-aged children produce different results. In a community sample, the rate of actigraph- and CSHQ-defined sleep

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problems in children with autism did not differ from rates for typically developing children, although the parent report of a generic sleep problem was significantly greater.

Keywords

autism; developmental delay; sleep problems; sleep preschool

Introduction

There is general agreement that sufficient, quality sleep is important for healthy development.¹ Many reports associate child sleep problems and fragmented sleep with disruptive daytime behavior and increased family stress.^{2, 3} Previous research studies report elevated rates of sleep problems in children with neurodevelopmental disorders when compared to typically developing children.⁴⁻⁹ Reports range from 40% to 80% for children with Autism Spectrum Disorders (ASD) and approximately 30% for typically developing children. Depending upon the mental age, chronological age and diagnosis, reports also indicate a range of sleep problems with prevalence estimates from 13% to 86% for children with developmental delays.^{2, 10, 11} However, studies vary widely in their prevalence estimates even within ASD. Parents of children with regressive autism report more sleep problems (94%) than parents of children with non-regressive autism (54%).¹² However, without developmentally matched comparison groups, it is difficult to directly compare prevalence estimates between children with developmental disabilities and typically developing children.

The preschool period is particularly important to consider as it encompasses the age when children's burgeoning autonomy may lead to conflict as their desire to explore and play exceeds their need for sleep. Additionally, sleep hygiene routines develop which may contribute to later school success. The most common sleep difficulties reported for toddlers and preschoolers in Western cultures are problems of going to bed, falling asleep and frequent night awakenings. Collectively these problems are referred to as behavioral insomnias of childhood.¹³⁻¹⁷ Prevalence estimates for behavioral insomnias range from 10% to 35% in typically developing pre-school age children,¹⁸⁻²¹ and are considerably higher in children with neurodevelopmental disorders.²² What constitutes a "problem" in children's sleep as reported by parents, however, varies widely across cultures and is dependent upon parental knowledge, expectations and the child's developmental stage.^{23, 24}

Although parent reports support the persistence of sleep problems, relatively few studies have addressed sleep problems longitudinally, particularly in children with developmental disabilities.²⁵ In one study, 41% of typically developing 3-year-olds reportedly had night waking and bedtime resistance problems since 8 months of age.²⁶ In another, 84% of 3-year-olds continued to have problems 3 years later.²⁷ Still another longitudinal study noted large increases in sleep problems by 5 years in children first studied as toddlers.²⁸ However, less stability has also been reported. Low rates of persistence (12%) and recurrence (19%) of sleep problems were evident in a longitudinal sample from 10 months to 3 years.¹⁸

The current study examines the presence and persistence of sleep problems over a 6-month period in 3 groups of pre-school age children: children with autistic disorder (AUT),

children with developmental delay without autism (DD) and typically developing children (TYP). Children were studied at 3 time points during the 6 months. A report of diagnostic group differences in sleep-wake variables and sleep disorders at Time 1 has been published in this *Journal*.²⁹ This report specifically focuses on the occurrence rates of sleep problems and their stability (or persistence) within children and across diagnostic groups as defined by actigraph, a structured questionnaire and parent report.

Methods

Sample

The families were originally recruited to learn more about sleep and waking behaviors, not to a study about sleep problems.²⁹ TYP children were excluded if they had a sibling with autism or other neurodevelopmental disorder. Exclusion criteria for all children included the presence of a chronic medical illness or current or prior treatment for a sleep disorder. The UC Davis Institutional Review Board approved the protocol and all parents signed informed consents. No adverse events were reported.

Of the 194 children (AUT = 68, DD = 57, TYP = 69) recorded at Time 1, 179 children were studied at Time 2 and 173 children completed all 3 recording sessions, accounting for a 10.8% non-completion rate. There were no significant differences in gender, ethnicity or diagnosis between those who completed the study and those that did not. Six children (9%) in the AUT group, 7 children (12%) in the DD group and 8 (12%) in the TYP group failed to complete the study. The ages of children at initial enrollment ranged from 24 to 66 months ($M = 44.4$ months, $SD = 11.1$).

Procedures

Intake Evaluation—The initial diagnostic evaluation consisted of the Autism Diagnostic Observation Scale (ADOS),³⁰ the Mullen Scales of Early Learning (MSEL),³¹ and the Vineland Adaptive Behavior Scales (VABS).³² The Autism Diagnostic Interview-Revised (ADI-R)³³ was also completed with mothers of children in the AUT group. Only children who met diagnostic cutoff criteria for autism on the ADOS and on all domains of the ADI-R were included in the AUT group. Those that did not meet criteria for AUT but were developmentally delayed were included in the DD group. Thus, children in the DD group scored below the autism cutoff score on the ADOS and below 70 on the MSEL Early Learning Composite (ELC) score. Typically developing children were not given the ADOS but completed the MSEL and had ELC scores above 75.

Recording Period—After recruitment and enrollment, children were studied on 3 occasions, each separated by 3 months. Time 1 occurred shortly after the evaluation visit, Time 2 occurred 3 months later, and Time 3 occurred 3 months after Time 2, or 6 months after enrollment.

Sleep Recording—Each child's sleep was measured with actigraphy, a parent sleep-wake diary, and the structured, parent-completed Children's Sleep Habits Questionnaire (CSHQ).³⁴ The actigraph, a Mini Mitter® Actiwatch (AW64; Mini Mitter, OR) weighed

approximately two ounces and was embedded in a foam pad secured by a Velcro strap on the non-dominant ankle. The actigraph was worn for seven consecutive days and nights on each occasion. Data were downloaded to the computer and scored using the manufacturer's algorithm set at medium sensitivity (Mini Mitter®, Inc.). The output was further “smoothed” with a validated procedure,³⁵ so that consecutive awake epochs, after sleep onset, lasted two or more minutes. Single minute waking epochs were re-coded as sleep. Parents completed a daily sleep diary each morning for the previous 24 hours to cross-validate the actigraph sleep start and sleep end times.³⁶

Sleep Problems—The presence of a sleep problem was measured in three ways. First, at the beginning of each recording week, the parent was asked whether or not, in their opinion, their child currently had a sleep problem. Their subjective response was coded YES/NO. Second, during the week of actigraphy, parents completed the CSHQ for the past month. This structured questionnaire provides eight subscales and one total score.³⁴ For this study, based on a pilot study of pre-school children, a CSHQ Total score of 60 was considered a sleep problem.³⁷ Third, actigraph and diary variables were used to determine intensity and duration thresholds for classifying a sleep onset or night waking behavioral insomnia. These thresholds have been reported previously as research diagnostic criteria (RDC) in an attempt to better standardize the diagnosis of behavioral insomnias in toddlers and pre-school age children.^{14, 29, 38} Thus, this study examined four distinct sleep problems at each 3-month interval: 1) a parent reported generic problem; 2) a parent reported problem scored from the CSHQ; 3) an actigraph defined RDC sleep onset insomnia; and 4) an actigraph defined RDC night waking insomnia.

Data Analysis

Since observations on the same child are typically more similar than observations from different children, statistical analyses accounted for the correlated structure of the data. The objectives of these analyses were to describe the dependence of each binary sleep problem on explanatory variables, and to characterize the intra-child associations due to children's repeated assessments over time. Alternating logistic regressions (ALR) were used to model sleep problems.³⁹ This approach simultaneously regresses the response on explanatory variables as well as models the intra-child association in terms of pair-wise odds ratios (POR). Separate models were fitted for each type of sleep problem. The log odds ratio for the probability of having a sleep problem was modeled as a linear combination of diagnosis, chronologic age, time in months since the initial recording, and their interactions. All analyses controlled for ethnicity, mother's age, marital status, and education. Terms that did not contribute significantly to the reference model were removed. The intra-child association was estimated by POR which is interpreted like ordinary odds ratios, with a value of 1 indicating no association of sleep problems within child. ALR models were implemented in SAS v9.1.

Results

Results are presented as follows: overall sample characteristics, percent of sample with sleep problems by diagnosis, comparison of sleep problem rates by diagnostic group and over

time, effects of CSHQ and actigraph sleep problems on parent reports of a sleep problem, sleep problem persistence for individuals and by diagnostic group.

The Sample

The AUT and DD groups were well matched on the Mullen Early Learning Composite Scores (Means for AUT = 60, DD = 57, TYP = 101) and the Vineland Adaptive Behavior Composite (Means for AUT = 62, DD = 62, TYP = 98). As expected, both neurodevelopmentally disordered groups scored significantly lower than the TYP group on these developmental and adaptive measures but did not differ significantly among themselves. Family composition and SES variables, such as parents' age, employment status and household size did not differ across the three diagnostic groups. The only exception was significantly fewer college graduate mothers and married couples in the DD group. Mothers of the AUT and TYP groups were not significantly different on any of the comparisons.

Sleep Problems

The RDC thresholds for the 2 subtypes of behavioral insomnia were applied to the pertinent actigraph variables at each of the three weeks of recording. Children who met criteria on 5 of 7 recording nights were classified as having one or both of the behavioral insomnia subtypes.²⁹ Table 1 describes the percent of children, stratified by diagnostic group, that met criteria for sleep onset or night waking subtypes of behavioral insomnia at each recording period, as well as the percent of parents who reported a generic sleep problem and/or who endorsed a sleep problem on the CSHQ (Total score = 60) during the week of recording. The overall prevalence of RDC behavioral insomnia and CSHQ sleep problems was low. The CSHQ sleep problem percentages more closely approximated RDC percentages than the generic parent report. The frequencies of having either behavioral insomnia subtype or CSHQ sleep problem decreased over the 6-month period.

Comparisons Between Sleep Problem Rates by Diagnostic Group and Over Time

As reported in Table 2 parent reports of children in the AUT group had 2 times higher odds of reporting a generic problem than parents of children in the TYP group (OR = 1.9, 95% CI: 1.2 – 3.2, $p < 0.05$). There was no significant change over time for parent report of a generic sleep problem. Mothers with lower education and older mothers were more likely to report generic problems (OR = 1.8, 95% CI: 1.1 – 2.9, $p < 0.05$ and OR = 1.2, 95% CI: 1.0 – 1.4, $p < 0.05$). Parents of children in the DD group had 3 times the odds of reporting a sleep problem by CSHQ (OR = 3.3, 95% CI: 1.1 – 10.0, $p < 0.05$) as parents of children in the TYP group. There was no significant change over time for sleep problems derived from the CSHQ total score. Children in both the AUT and DD group were less likely to have an RDC sleep onset insomnia than children in the TYP group (OR = 0.3, 95% CI: 0.2 – 0.8, $p < 0.05$ and OR = 0.3, 95% CI: 0.1 – 0.8, $p < 0.05$, respectively). For all children, the odds of an RDC sleep onset insomnia decreased by about 40% for each three-month period after baseline (OR = 0.6, 95% CI: 0.4 – 0.9, $p < 0.01$). Children whose mothers were less educated and children whose mothers were older were more likely to have an RDC sleep onset insomnia (OR = 3.1, 95% CI: 1.6 – 6.2, $p < 0.01$ and OR = 1.4, 95% CI: 1.1 – 1.8, $p < 0.01$). Children in the DD group were 60% more likely to have an RDC night waking

insomnia than children in the AUT group (OR = 0.4, 95% CI: 0.2 – 0.8, $p < 0.05$). There was a trend for fewer children in the AUT group to have an RDC night waking insomnia than children in the TYP group (OR = 0.5, 95% CI: 0.2 – 1.1, $p < 0.1$). For all children, the odds of having a night waking insomnia decreased by about 30% (OR = 0.7, 95% CI: 0.6 – 0.9, $p < 0.05$) for each three-month time period.

To reiterate, the proportions of children in each of the three diagnostic groups who met thresholds for RDC behavioral insomnias, except for the night waking subtype in the DD group, lessened over time. Yet the generic parent reports remained consistently high, especially for the children in the AUT and DD groups.

To explore whether the presence of a sleep problem by RDC or CSHQ thresholds might affect parent reporting of a problem, an additional alternating logistic regression model was fitted. Parents with CSHQ Total scores ≥ 60 were more likely (OR = 2.6, 95% CI: 1.2 – 5.5, $p < 0.05$) to report a generic sleep problem than parents whose CSHQ Total scores were < 60 . There was no effect of having an RDC sleep onset insomnia on parent reporting of a generic sleep problem. However, parents of children with an RDC night waking insomnia were more likely (OR = 1.9, 95% CI: 1.1 – 3.2, $p < 0.05$) to report a generic sleep problem than parents of children without one.

Sleep Problem Persistence Within Children

As portrayed in Table 3, the estimated pair-wise odds ratios relating two observations from the same child for each of the four sleep problems resulted in strong associations (all p values < 0.01), indicating that some children have a significantly greater propensity for sleep problems than others. To further examine the stability of these problems, each child was categorized as having *no problem* if on all three recording sessions the child did not meet criteria for a problem; as having an *intermittent problem* if on only 1 or 2 of the recording periods, the child met criteria; and as having a *persistent problem* if the child met criteria at all three recording periods. Table 4 presents the frequencies and proportions of children in each category by sleep problem type, stratified by diagnostic group. It is important to note that 61% to 86% of children had no sleep problem at any time point as classified by RDC or CSHQ thresholds. In contrast, only one third of parents of children in both of the neurodevelopmentally disordered groups and one half of parents of children in the TYP group reported no generic sleep problem.

More children were reported as having a problem intermittently than persistently; that is, parents reported a sleep problem on one or two, but not at all 3, recording periods. Nevertheless, when parents reported a persistent problem, children in the AUT (16%) and DD (19%) groups were represented more prominently than children in the TYP (5%) group. A larger proportion of all children (81%-91%) did not meet the CSHQ cutoff score on any occasion, and only 2% of children in the AUT and TYP groups met criteria on all 3 occasions whereas 10% of children in the DD group met criteria. Children who met criteria for an intermittent sleep problem were slightly more prevalent in the AUT group (14%) compared with the DD (10%) and TYP (7%) groups. Finally, children in the AUT group were least likely to meet RDC thresholds for either a sleep onset or night waking insomnia and also least likely to have a persistent RDC problem. Children in the TYP group

demonstrated the greatest proportion of intermittent RDC sleep onset problems (29%). Children in the DD group demonstrated the greatest proportion of intermittent night waking problems (35%).

Sleep Problem Persistence Between Groups

Proportional odds models for ordinal data were fit to explore between group differences in sleep problem persistence, after adjusting for demographics. The resulting odds ratios of having a more persistent sleep problem versus a less persistent problem over the six-month period by diagnostic group are shown in Table 5.

Parents of AUT children had more than two times the odds of reporting more persistent generic sleep problems (OR = 2.3, 95% CI: 1.1 – 4.6, $p < 0.05$) than parents of TYP children. Similarly, parents of AUT children were marginally more likely to report a more persistent generic sleep problem (OR = 1.1, 95% CI: 0.5 – 2.3, $p < 0.1$) than parents of DD children. There were no significant group differences in persistence of CSHQ sleep problems, but Caucasian mothers and mothers less educated or older were more likely to have children with more persistent CSHQ sleep problems (OR = 3.3, 95% CI: 1.1 – 10.3, $p < 0.05$, OR = 4.8, 95% CI: 1.7 – 13.6, $p < 0.01$, and OR = 1.6, 95% CI: 1.1 – 2.5, $p < 0.05$). AUT and DD children had lower odds of having a more persistent sleep onset insomnia (OR = 0.4, 95% CI: 0.1 – 0.9, $p < 0.05$ and OR = 0.3, 95% CI: 0.1 – 0.8, $p < 0.05$), and AUT children had lower odds of having a more persistent night waking insomnia (OR = 0.3, 95% CI: 0.1 – 0.7, $p < 0.01$) than TYP children; yet, parents of AUT children had more than two times higher odds of reporting more persistent generic sleep problems than the parents of TYP children. Similarly, when comparing AUT children with DD children, AUT children were less likely to have a more persistent night waking subtype of behavioral insomnia (OR = 0.3, 95% CI: 0.1 – 0.7, $p < 0.01$) yet their parents were marginally more likely to report a persistent generic sleep problem. Mothers with lower education and older mothers were more likely to have children with more persistent sleep onset insomnias (OR = 3.2, 95% CI: 1.3 – 7.5, $p < 0.01$ and OR = 1.5, 95% CI: 1.0 – 2.0, $p < 0.05$).

Discussion

It is generally acknowledged that children with autism and other neurodevelopmental disorders have significantly more sleep problems than typically developing children.⁴⁰ However, for the most part, studies in the literature have relied on parent reports of a sleep problem rather than objective measures of sleep. Also, the definitions of sleep problems have varied across studies. Few studies have attempted to quantify the intensity and duration of symptoms using objective recording methods. The RDC thresholds used in this study propose quantitative cut points for classifying a behavioral insomnia.^{14, 38}

In addition, some studies have not used diagnostic instruments to confirm neurodevelopmental diagnoses, while others have not used age- and developmentally-matched control groups. Without using a comparison group of developmentally delayed children without autism, it is difficult to determine whether the sleep problem is related to autism or to the developmental delay. In this study, three well-matched diagnostic groups

studied on 3 occasions over 6 months addressed the specificity of diagnostic contributions and the short-term persistence of sleep problems.

Finally, although the extant literature suggests significant persistence of sleep problems from parent reports,²⁵⁻²⁷ relatively few studies have examined persistence objectively. In one sample of typically developing children, there was little persistence of sleep problems as defined by actigraph RDC thresholds at 1 year of age to the preschool period using RDC thresholds on a telephone interview.⁴¹ Defining sleep problems using both objective and subjective methods provides an opportunity to explore concordances and discrepancies between methods.

The results of this study confirm some of the findings from previous reports and add new observations of potential clinical relevance. Parents of children in the TYP group reported that 14% to 33% had a sleep problem over the course of the three recording periods; parents of children in the AUT and DD groups reported that 35% to 48% had a sleep problem. These rates are similar to other parent report studies. Parents of children in the AUT and DD groups also were more likely than parents of children in the TYP group to report persistent sleep problems over the 6-month study.

As might be expected, concordance among methods over the six-month period was poor. Children in the AUT group were less likely to have an RDC sleep onset or night waking problem than children in the DD and TYP groups; a result that is discrepant from prior studies in which parents reported more nighttime awakening and fragmented sleep in children with autism. The lack of congruence between different methods of defining sleep problems may be related to the lack of a consensus regarding age appropriate criteria for defining a sleep problem. Independent of diagnostic group differences, both RDC insomnias decreased over the 6-month period. This might have been due to maturation or, possibly, related to the study's primary focus on sleep.

Parents who report a generic sleep problem are expressing a genuine concern. Generic parent reports, particularly for children in the neurodevelopmental group, may reflect sleep problems not captured by the RDC or the CSHQ (e.g., daytime sleep). Still another explanation for the discrepancies in measures may be the significantly greater stress experienced by parents of children with a neurodevelopmental disorder. This heightened general stress level may impact their experience of their child going to bed, falling asleep and waking during the night. Further research is needed to identify what elements of a child's sleep pattern are concerning for parents.

There are limitations to this study. The children who participated in this study represented a community sample rather than a clinical sleep disordered sample. There might have been greater concordance among measures had the sample consisted of children referred to a sleep clinic. Additionally, actigraph data related to night waking duration and frequency that formed the basis for the RDC night waking insomnia thresholds should be interpreted with caution. Previous validity studies report adequate estimates of sleep by actigraph but highlight discrepancies in night waking counts and duration.^{35, 42, 43}

It also is likely that the RDC thresholds need further refinement. The intensity and duration criteria for each subtype of behavioral insomnia have been derived from previous research and clinical experience; however, they need to be standardized in much larger groups of both community and clinical samples of varying ages and diagnoses. Finally, to differentiate between sleep problems and sleep disorders, it is generally agreed that sleep disorders in children should be associated with some evidence of daytime impairment either in the child or in the parents.¹⁴ The current study did not examine these relationships.

The results of this study suggest that parental concerns about sleep problems may not always be supported by more objective methods of studying sleep, particularly in families raising children with neurodevelopmental disorders. Nevertheless, parent concerns require attention. Clinicians should take a careful sleep history, and, at minimum, have the parent maintain a sleep diary/log for 1-2 weeks and complete a structured instrument such as the CSHQ³⁴ or BEARS (B = bedtime problems, E = excessive daytime sleepiness, A = awakenings during the night, R = regularity and duration of sleep, S = Snoring).⁴⁴

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Table 1

Prevalence of Sleep Problems at Each Time Point (% of Diagnostic Group)

	AUT			DD			TYP		
	<u>T-1</u>	<u>T-2</u>	<u>T-3</u>	<u>T-1</u>	<u>T-2</u>	<u>T-3</u>	<u>T-1</u>	<u>T-2</u>	<u>T-3</u>
N =	68	64	62	57	52	50	69	63	61
Parent generic report	42	47	40	48	35	42	14	33	2
CSHQ total score > 60	8	7	2	17	13	4	10	7	2
RDC behavioral insomnia									
Sleep-onset subtype	11	3	3	13	6	6	21	14	7
Night-waking subtype	10	7	5	26	18	20	23	18	10

Note: AUT = autism; CSHQ = Children's Sleep Habits Questionnaire; DD = developmental disorder (not autism); RDC = Research Diagnostic Criteria, T-1 = recording time 1, T-2 = recording time 1 + 3 months, T-3 = recording time 1 + 6 months; TYP = typical development.

Table 2

Effect of Diagnosis and Recording Period (Time) on the Likelihood of Having a Sleep Problem.

	Parent Report	CSHQ Total Score 60	Sleep Onset Subtype	Night Waking Subtype
Diagnosis				
AUT vs TYP	1.9 (1.2, 3.2) *	1.5 (0.5, 4.6)	0.3 (0.2, 0.8) *	0.5 (0.2, 1.1) ***
DD vs TYP	1.5 (0.9, 2.7)	3.3 (1.1, 10.0) *	0.3 (0.1, 0.8) *	1.4 (0.7, 2.8)
AUT vs DD	1.2 (0.7, 2.1)	0.5 (0.2, 1.2)	1.1 (0.4, 2.9)	0.4 (0.2, 0.8) *
Time	NS	NS	0.6 (0.4, 0.9) **	0.7 (0.6, 0.9) *

Note: Odds ratios (95% confidence interval). AUT = autism; CSHQ = Children's Sleep Habits Questionnaire; DD = developmental disorder (not autism); TYP = typical development.

*
 $p < 0.05$

**
 $p < 0.01$

 $p < 0.1$

Table 3

Estimated Pairwise Odds Ratios (95% Confidence Interval) for Four Types of Sleep Problem.

Pairwise Odds Ratio	
Parent report	2.6 (1.7-4.1) **
Children's Sleep Habits Questionnaire	33.5 (12.0-93.1) **
Sleep-onset subtype	4.3 (1.4-12.9) **
Night-waking subtype	6.6 (3.4-12.9) **

**
 $p < 0.01$

Table 4

Stability of Problem Sleep and Non-problem Sleep for 6 months (Frequency and Percent)

	AUT N(%)	DD N(%)	TYP N(%)	OVERALL N(%)
Parent report				
No problem	16 (29)	26 (34)	26 (46)	58 (37)
Intermittent problem	31 (55)	22 (47)	27 (48)	80 (50)
Persistent problem	9 (16)	9 (19)	3 (5)	21 (13)
CSHQ total score 60				
No problem	50 (85)	34 (81)	53 (91)	137 (86)
Intermittent problem	8 (14)	4 (10)	4 (7)	16 (10)
Persistent problem	1 (2)	4 (10)	1 (2)	6 (4)
RDC sleep onset subtype behavioral insomnia				
No problem	50 (83)	36 (82)	40 (69)	126 (78)
Intermittent problem	10 (17)	7 (16%)	17 (29)	34 (21)
Persistent problem	0 (0)	1 (2)	1 (2)	2 (1)
RDC night waking subtype behavioral insomnia				
No problem	53 (85)	30 (61)	39 (64)	122 (71)
Intermittent problem	8 (13)	17 (35)	20 (33)	45 (26)
Persistent problem	1 (2)	2 (4)	2 (3)	5 (3)

Note. AUT = autism; CSHQ = Children's Sleep Habits Questionnaire; DD = developmental disorder (not autism); RDC = research diagnostic criteria; TYP = typical development.

Table 5

Odds ratios (95% Confidence Interval) of Having a More Persistent Sleep Problem Versus a Less Persistent One

	Parent Report	CSHQ Total Score 60	RDC Sleep Onset Subtype	RDC Night Waking Subtype
Diagnosis				
AUT vs TYP	2.3 (1.1, 4.6)*	1.7 (0.5, 5.9)	0.4 (0.1, 0.9)*	0.3 (0.1, 0.7)**
DD vs TYP	2.1 (1.0, 4.4)	2.2 (0.6, 8.3)	0.3 (0.1, 0.8)*	1.1 (0.5, 2.4)
AUT vs DD	1.1 (0.5, 2.3) ^a	0.8 (0.2, 2.5)	1.2 (0.4, 3.7)	0.3 (0.1, 0.7)**

*
 $p < 0.05$

**
 $p < 0.01$

^a
 $p < 0.1$.