

# Sleep Problems in Children With Autism and Other Developmental Disabilities: A Brief Report

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**Maria Valicenti-McDermott, MD, MS<sup>1</sup>, Katharine Lawson, PhD<sup>1</sup>,  
Kathryn Hottinger, BA<sup>1</sup>, Rosa Seijo, MD<sup>1</sup>, Merryl Schechtman, MD<sup>1</sup>,  
Lisa Shulman, MD<sup>1</sup>, and Shlomo Shinnar, MD, PhD<sup>1,2</sup>**

## Abstract

Sleep problems in children with autism and the association with child behavioral problems was studied in an ethnically diverse population, in a cross-sectional study with structured interview. Sample included 50 families of children with autism and 50 families of children with other developmental disabilities, matched by age/gender. Interview included Child Sleep Habits Questionnaire and Aberrant Behavior Checklist. In this ethnically diverse sample, at least 78% of families of children with autism reported significant sleep problems compared to 34% of families of children with other developmental disabilities. Specifically, children with autism reported more frequent bedtime resistance, sleep anxiety, and night wakings than children with other developmental disabilities. Across groups, sleep problems were related to child behavioral difficulties, including irritability and hyperactivity, although this association did not reach significance for the group with autism. Specifics in terms of the nature of sleep disorders will help our understanding and design of effective treatment options.

## Keywords

sleep problems, autism spectrum disorder, developmental disabilities, children, irritability

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Autism spectrum disorders are characterized by developmental deficits in socialization and communication and the presence of restricted, repetitive behaviors or circumscribed interests.<sup>1,2</sup> Besides the core features, children with autism spectrum disorder frequently present comorbid behavioral difficulties that interfere with their functioning. Sleep problems are common in autism spectrum disorders, with 40% to 80% of individuals experiencing sleep disturbances that are disruptive to the children or their families.<sup>3-7</sup> The causes of the higher rate of sleep disturbance in children with autism spectrum disorders are still under investigation but they have been found to be associated with biological, psychological, and environmental factors.<sup>8-10</sup>

There are many reports in the literature of sleep difficulties associated with autism spectrum disorders. However, there is little research investigating the unique features that distinguish sleep problems in children with autism spectrum disorders from children with other developmental disabilities. Sleep problems are particularly common among individuals with intellectual disabilities<sup>11,12</sup> and in children with cerebral palsy.<sup>13</sup> Initiating and maintaining sleep, sleep-wake transition, and sleep breathing disorders were the most frequently identified problems in children with intellectual disabilities, while disorders of initiation and maintenance of sleep were frequent

in children with cerebral palsy. Sleep problems can have a significant impact on the individual's health and daytime functioning.<sup>14,15</sup> Parents are also likely to experience increased levels of stress and sleep deprivation.<sup>15</sup> Sleep problems often go untreated, as they are seen as an unavoidable aspect of the developmental disabilities,<sup>16</sup> and not as a key mental health issue by professionals.<sup>17</sup> Identification of specific sleep difficulties may help design more targeted intervention.

Because most studies in the literature are based on samples consisting predominantly of white, middle-class parents, little is known about sleep disorders in autism spectrum disorders among racial and ethnic minority groups. Given the

<sup>1</sup> RFK Children's Evaluation and Rehabilitation Center, Montefiore Medical Center, Albert Einstein College of Medicine, Bronx, NY, USA

<sup>2</sup> Saul R. Korey Department of Neurology Montefiore Medical Center, Albert Einstein College of Medicine, Bronx, NY, USA

## Corresponding Author:

Maria Valicenti-McDermott, MD, MS, RFK Children's Evaluation and Rehabilitation Center, Montefiore Medical Center, Albert Einstein College of Medicine, 1410 Pelham Parkway South, Bronx, NY 10461, USA.

Email: rvalicenti@hotmail.com

nondiscriminatory nature of autism, which is reported to occur in all racial, ethnic, and socioeconomic groups, more information on subpopulations within the autism spectrum disorder community is needed to better understand the ramifications of the diagnosis and to optimize individualized approaches to therapeutic intervention. The effect of socioeconomic and ethnicity in sleep disorders in children with typical development is an area of active research but findings have not been consistent or conclusive. Information about sleep problems in families of children with autism spectrum disorder in ethnic minority groups is particularly sparse.

We previously studied families of diverse ethnic backgrounds, with a majority of Hispanic and African American families,<sup>18</sup> and observed that families of children with autism spectrum disorder reported more sleep problems than families of children with other developmental disabilities. To expand knowledge of sleep difficulties and to distinguish specific sleep problems to each group, this study examines specific sleep disorders in a group of children with autism spectrum disorder and a group of children with other developmental disabilities, primarily in Hispanic and African American inner city families. Our hypothesis was that sleep problems will be more prevalent in children with autism than children with other developmental disabilities, but the sleep pattern will be different between groups. Moreover, we examined the association of sleep problems with irritability and hyperactivity in each group.

## Methods

### Population and Recruitment

This study was conducted as part of a larger project that examined the use of complementary and alternative medicine in children with autism spectrum disorder.<sup>18</sup> Children eligible for the study included those aged 2-18 years with autism spectrum disorder followed by the developmental pediatrics program of the Albert Einstein College of Medicine, the Children's Evaluation and Rehabilitation Center of the Kennedy Center. Subjects were recruited between February 2007 and February 2010. The comparison group consisted of children with other developmental disabilities who were recruited from the same site, matched for age and gender to the group with autism spectrum disorder. The comparison group with other developmental disabilities were matched to subjects with autism spectrum disorder by age ( $\pm 6$  months) because of the wide age range of the group with autism spectrum disorder. They were also matched by gender because of the predominance of males in the group with autism spectrum disorder.

Informed consent and, when appropriate, assent were obtained in all cases. Both English- and Spanish-speaking families were included.

The study design and procedures were approved by the institutional review board of the Albert Einstein College of Medicine.

### Inclusion and Exclusion Criteria

**Cases.** Eligible cases were children with autism spectrum disorder between 2 and 18 years of age who were followed at this center. The diagnosis of autism spectrum disorder was made by a multidisciplinary team and was confirmed by medical record review and interview by the research team. Diagnostic criteria were those of autistic disorder of the *Diagnostic and Statistical Manual of Mental Disorders*,

*Fourth Edition* (DSM-IV-TR) criteria.<sup>19</sup> Inclusion also required a score of 30 or more on the Childhood Autism Rating Scale.<sup>20</sup> Excluded were children with known genetic syndromes such as trisomy 21, tuberous sclerosis, Rett disorder, and other known static or progressive neurologic conditions.

**Comparison group with developmental disabilities.** Participants were 50 children matched with the group with autism spectrum disorder for age and gender, with other major developmental disabilities, including intellectual disability, cerebral palsy, and global developmental delay. The diagnoses were made by a multidisciplinary team, using the appropriate diagnostic algorithm. Exclusions were the same as for the group with autism spectrum disorder. The children with developmental disabilities were required to have a total Childhood Autism Rating Scale score of 20 or less to avoid including children with some autistic features. Children with total Childhood Autism Rating Scale scores of 21 to 29 were not eligible to be either in the autism spectrum disorder group or the group with other developmental disabilities. As in the group of children with autism spectrum disorder, children with known genetic syndromes were excluded.

### Procedures

The structured interview was conducted in either English or Spanish in nonconsecutive patients. A developmental history was obtained from the parent and from review of the medical record. Descriptive data such as demographics, other developmental diagnoses, time since diagnosis, use of medication, and other possible confounders, such as level of maternal education, were collected from interviews of the parent and child. Level of functioning was determined from a review of the available medical and educational records. Ethnicity was determined based on maternal self-report.

Sleep disturbances were examined using the abbreviated version of the parent-report Children's Sleep Habits Questionnaire<sup>21</sup> which includes 33 items rated on a 3-point scale. The Children's Sleep Habits Questionnaire includes items relating to a number of key sleep domains that encompass the major presenting clinical sleep complaints: bedtime behavior and sleep onset; sleep duration; anxiety around sleep; behavior occurring during sleep and night wakings; sleep-disordered breathing; parasomnias; and morning waking/daytime sleepiness. A higher score reflects more disturbed sleep behavior. In one study, a cutoff total score of 41 generated by analysis of the receiver operating characteristic curve yielded a sensitivity of 0.80 and a specificity of 0.72.<sup>21</sup> Sleep problems were defined as a total overall score  $>41$ . Total overall score and scores in each subscale were examined, as well as sleep duration (in hours) and the number of patients with sleep onset delays and sleep-disordered breathing in each group. The Children's Sleep Habits Questionnaire has been used as a screening for sleep abnormalities in preschool and school-age children and it has been used in previous research work in children with autism spectrum disorder.<sup>22,23</sup>

To assess behavioral problems and their associations with sleep disorders, the Aberrant Behavior Checklist<sup>24</sup> was used. The Aberrant Behavior Checklist is a 58-item symptom checklist for assessing problem behaviors of children and adults with low cognitive functioning and yields subscales of (1) irritability, agitation; (2) lethargy, social withdrawal; (3) stereotypic behavior; (4) hyperactivity, noncompliance; and (5) inappropriate speech. This instrument characterizes behavioral problems in both groups and has been widely used in the developmental disabilities literature. Given that the most frequent

behavioral problems related to sleep problems are irritability and hyperactivity, we focused the analysis in both symptoms.<sup>25,26</sup>

## Analysis

The primary analysis compared the children in the autism spectrum disorder group and the group with other developmental disabilities using paired analysis, because the groups were matched. Categorical data were analyzed using the McNemar test, and continuous variables were analyzed with paired *t* tests. Analysis within each group included  $\chi^2$  and independent *t* test or nonparametrics. Univariate and multivariate logistic regression analyses were used to assess the relation of sleep disturbances to the child's developmental diagnosis and behavioral symptoms, with adjustment for demographics and use of medication to treat behavioral problems. The results were expressed in odds ratios with a confidence interval of 95%.

As sleep disorders have been described in children with attention-deficit hyperactivity disorder (ADHD)<sup>27</sup> and in those with epilepsy,<sup>28</sup> we also analyzed the frequency and type of sleep problems, excluding children with such comorbid disorders, or receiving medication for behavior<sup>29</sup> in both groups. Statistical significance was defined as *P* of less than .05, with 2-tailed tests used throughout. All analyses were performed using SPSS software (SPSS, Inc, Chicago, IL).

## Results

### Population Characteristics

The demographic characteristics and relevant symptoms of the children in both groups are summarized in Table 1. As expected in a sample of children with autism spectrum disorder, the majority were boys. The primary diagnoses for children in the group with developmental disabilities were cerebral palsy (*n* = 28, 56%) and intellectual disability/global developmental delays (*n* = 22, 44%). Of the 50 children with autism spectrum disorder, 25 presented with low cognitive functioning, defined as nonverbal IQ less than 70.

The racial/ethnic distribution is similar to the distribution described previously in the Bronx<sup>30</sup> where this study was done. Although the children were matched for age and gender, there were some differences in other demographic characteristics of the groups, especially in maternal characteristics. In particular, the level of maternal education was higher for the group with autism spectrum disorder than for the group with developmental disabilities. In addition, the group with autism spectrum disorder had more mothers who were born in the United States compared to the group with developmental disabilities, and children with autism spectrum disorder were more likely to be taking medication to address behavioral difficulties than children with other developmental disabilities (36% vs 12%, *P* = .01).

Parents of children with autism spectrum disorder have more concerns about their child's sleep and, as reported previously,<sup>18</sup> they reported more sleep problems than did parents of children with other developmental disabilities, 78% versus 34% (Table 2). Children with autism had higher scores in the Total Sleep Disturbance Score and in the specific subscales for bedtime resistance, sleep anxiety, and night waking. The group of children with autism also reported more behavioral

problems, defined as 2 or more items >85th percentile in the Aberrant Behavior Checklist,<sup>24</sup> 82% versus 24% (*P* < .001), and they were reported to be more irritable (53% vs 20%, *P* = .001) and hyperactive (51% vs 20%, *P* = .001) (Table 1).

When we examined the association of sleep disorders to demographics in the groups combined, children with sleep disorders tended to be younger ( $8 \pm 3$  years vs  $10 \pm 4$  years, *P* = .007). This age difference was significant in the group of children with autism ( $8 \pm 3$  years vs  $11 \pm 4$  years, *P* = .03) but not in the group of children with other developmental disabilities ( $8 \pm 3$  years vs  $9 \pm 4$  years, *P* = .1).

For the groups combined, children with sleep problems also had more behavioral difficulties (71% vs 30%, *P* < .001). They were more irritable (51% vs 18%, *P* = .001) and hyperactive (36% vs 13%, *P* = .01), and there was a significant correlation between the Total Sleep Disturbance Score and irritability (*r* = .36, *P* < .001) and hyperactivity (*r* = .36, *P* < .001) (Table 3). Specifically, irritability correlated with sleep onset delays, sleep anxiety, night waking, parasomnias, and daytime sleepiness. Hyperactivity correlated with bedtime resistance, sleep-onset delays, sleep anxiety, night waking, and parasomnias (Table 3).

When we analyzed each group separately, the results were different for the 2 groups. Although parents of children with autism reported more behavioral problems in general, these problems were not significantly higher for those who also had sleep problems (82% vs 74%, *P* = .3), and there was no significant correlation between sleep problems and irritability or hyperactivity in this group. In the group of the children with other developmental disabilities, those who reported more sleep problems also reported more behavioral difficulties (41% vs 15%, *P* = .04), and there was a significant correlation between Total Sleep Disturbance Score with irritability (*r* = .37, *P* = .008) and hyperactivity (*r* = .42, *P* = .002). In this group, irritability was correlated with sleep onset delays (*r* = .33, *P* = .01), sleep anxiety (*r* = .28, *P* = .04), parasomnias (*r* = .29, *P* = .04), and daytime sleepiness (*r* = .36, *P* = .009). Hyperactivity was correlated with bedtime resistance (*r* = .34, *P* = .01), sleep onset delays (*r* = .36, *P* = .01), sleep anxiety (*r* = .38, *P* = .006), night wakings (*r* = .33, *P* = .01), and parasomnias (*r* = .37, *P* = .007).

Sleep problems were still higher in children with autism than children with other developmental disabilities after excluding children with attention-deficit hyperactivity disorders (31 of 40 [77%] vs 17 of 47 [36%], *P* < .001), and children with epilepsy (38 of 47 [80%] vs 14 of 40 [35%], *P* < .001). Children with autism had higher scores in the Total Sleep Disturbance Score and in the specific subscales for bedtime resistance, sleep anxiety, and night waking, than children with other developmental disabilities, similar to results obtained without excluding such comorbid disorders. When we excluded children who were receiving medication for behavior in both groups, results were similar, with more sleep problems in the group of children with autism (26 of 32 [81%] vs 15 of 44 [34%], *P* < .001) and higher scores Total Sleep Disturbance Score and in the specific subscales for bedtime resistance, sleep

**Table 1.** Demographics and Clinical Characteristics for Study Children.

Demographic/clinical characteristics	Autism spectrum disorder (n = 50)	Developmental disabilities (n = 50)	P <sup>a</sup>
<b>Child's characteristics</b>			
Current age, y, mean ± SD	8.8 ± 3	9.2 ± 3	.5 <sup>b</sup>
Age at diagnosis, y, mean ± SD	3.8 ± 2	1.6 ± 2	<.001 <sup>b</sup>
Time since diagnosis, y, mean ± SD	4 ± 3	7.4 ± 4	<.001 <sup>b</sup>
Gender, male/female	47/3	47/3	1
Other developmental problems in the child, <sup>c</sup> n (%)	27 (54)	32 (64)	.4
Attention-deficit hyperactivity disorder (ADHD)	10 (20)	3 (6)	.09
Sleep problems, <sup>d</sup> n (%)	39 (78)	17 (34)	<.001
Seizure disorder, n (%)	2 (4)	10 (20)	.09
Behavioral problems, <sup>e</sup> n (%)	41 (82)	12 (24)	<.001
Irritability score (ABC)	61 ± 7	54 ± 7	<.001
Hyperactivity score (ABC)	60 ± 6	54 ± 7	<.001
No. of children on medication, n (%)	26 (52)	27 (54)	1
Medication for behavior, n (%) <sup>f</sup>	18 (36)	6 (12)	.01
Antiepileptic medication, n (%) <sup>g</sup>	2 (4)	10 (20)	.09
<b>Maternal characteristics</b>			
Race/ethnic groups, n (%)			1 <sup>h</sup>
White	11 (22)	1 (2)	
Hispanic	21 (42)	30 (60)	
African American	12 (24)	19 (38)	
Other	6 (12)	0	
Mother born in the US, n (%)	32 (64)	18 (36)	.009
Bilingual household (Spanish-English), n (%)	16 (32)	23 (46)	.1
Current maternal age, y, mean ± SD	38 ± 7	38 ± 9	.8 <sup>b</sup>
Maternal age at birth, y, mean ± SD	29 ± 8	29 ± 6	.9 <sup>b</sup>
Maternal education, n (%)			.002 <sup>h</sup>
<High school	8 (16)	17 (34)	
High school	11 (22)	18 (36)	
Some college	18 (36)	8 (16)	
College ≥4-y/advance degree	13 (26)	5 (10)	

Abbreviations: ABC, Aberrant Behavior Checklist; SD, standard deviation.

<sup>a</sup>McNemar test.

<sup>b</sup>Paired *t* test.

<sup>c</sup>Children with other developmental disability: global developmental delay, intellectual disabilities, and cerebral palsy.

<sup>d</sup>Sleep Problems were defined as scores above 41 in the Total Sleep Disturbance Score from the Children's Sleep Habits Questionnaire.

<sup>e</sup>Behavioral problems were defined as 2 or more items at >85th percentile in the Aberrant Behavior Checklist.

<sup>f</sup>Medication for behavior included *stimulant medication*: methylphenidate (n = 4), amphetamine/dextroamphetamine mixed salts (n = 4), dexamethylphenidate hydrochlorate (n = 2); *atomoxetine* (n = 1); and *atypical antipsychotics*: risperidone (n = 7), clonidine (n = 3), guanfacine (n = 2), and quetiapine fumarate (n = 2). Patients may be taking more than 1 medication.

<sup>g</sup>Antiepileptic medications included oxcarbazepine (n = 3), levetiracetam (n = 3), phenobarbital (n = 3), carbamazepine (n = 2), lamotrigine (n = 2), valproic acid (n = 2), and zonisamide (n = 1). Patients may be taking more than 1 medication.

<sup>h</sup>Wilcoxon rank-sum test.

anxiety, and night waking, than children with other developmental disabilities.

Multivariate logistic regression analysis was performed (Table 4) to assess the association of sleep problems with developmental diagnosis (autism spectrum disorder vs other developmental disabilities), irritability, hyperactivity, and use of medication for behavioral problems, adjusting for potential confounders (selected on the basis of significant differences between the groups), including ethnic group, level of maternal education, and age of the child. Because the number of Caucasians was low, we compared Latino families versus others. Given the significant difference in age between those with sleep problems and those without sleep problems, age was

included in the model. In the univariate analysis done in the 100 children, sleep problems were associated with autism spectrum disorder, irritability, hyperactivity, and age of the child. The association between sleep problems and autism spectrum disorder persisted when child comorbid symptoms, including irritability and hyperactivity, and use of medication for behavioral problems, were analyzed simultaneously in the multivariate analyses.

## Discussion

The results of this study indicate that in an ethnically diverse population, at least 78% of families of children with autism

**Table 2.** Sleep Problems by Group, Based on the Child Sleep Habits Questionnaire.

Sleep problems (mean $\pm$ SD)	Autism spectrum disorder (n = 50)	Developmental disabilities (n = 50)	<i>p</i> <sup>a</sup>
Parental concern about sleep, n (%)	24 (48)	12 (24)	.007 <sup>b</sup>
Sleep problems, <sup>c</sup> n (%)	39 (78)	17 (34)	<.001 <sup>b</sup>
Sleep duration, h	9.5 $\pm$ 1	9.2 $\pm$ 1	.3
Bedtime resistance <sup>d</sup>	9.8 $\pm$ 2	8 $\pm$ 2	.004
Sleep onset delays, n (%)	28 (56)	32 (64)	.5 <sup>b</sup>
Sleep anxiety <sup>d</sup>	6.5 $\pm$ 2	5.2 $\pm$ 1.6	.001
Night wakings <sup>d</sup>	3.9 $\pm$ 1	3.3 $\pm$ 0.9	.003
Sleep disordered breathing <sup>d</sup>	4 $\pm$ 1.3	3.6 $\pm$ 1.1	.05
Sleep disordered breathing, n (%)	25 (50)	21 (42)	.5 <sup>b</sup>
Parasomnias <sup>d</sup>	9 $\pm$ 1.7	8.6 $\pm$ 2.2	.3
Daytime sleepiness <sup>d</sup>	12.8 $\pm$ 3.9	12.7 $\pm$ 4.3	.5
Total sleep disturbance score	49 $\pm$ 7	44 $\pm$ 9	.01

Abbreviation: SD, standard deviation.

<sup>a</sup>Paired *t* test.

<sup>b</sup>McNemar paired test.

<sup>c</sup>Sleep problems were defined as scores above 41 in the Total Sleep Disturbance Score from the Children's Sleep Habits Questionnaire.

<sup>d</sup>Score on each subscale from the Child Sleep Habits Questionnaire.

**Table 3.** Correlations Between Sleep Problems (CHSQ) and Irritability and Hyperactivity Combining Both Groups.

Correlations—overall	Irritability <sup>a</sup> ( <i>r</i> )	<i>p</i> <sup>b</sup>	Hyperactivity <sup>a</sup> ( <i>r</i> )	<i>p</i> <sup>b</sup>
Sleep problems <sup>c</sup>	0.34	.001	0.46	<.001
Sleep duration	−0.5	.6	.01	.8
Bedtime resistance	.19	.5	.34	.001
Sleep onset delays	.27	.001	.21	.03
Sleep anxiety	.24	.01	.21	.03
Night wakings	.27	.005	.24	.01
Sleep disorder breathing	.15	.11	.02	.8
Parasomnias	.29	.003	.35	<.001
Daytime sleepiness	.36	.009	.11	.24
Total Sleep Disturbance Score	.37	<.001	.36	<.001

Abbreviation: CHSQ, Child Sleep Habits Questionnaire.

<sup>b</sup>Pearson correlations.

<sup>a</sup>Total score from the Aberrant Behavior Checklist.

<sup>c</sup>Sleep problems were defined as scores above 41 in the Total Sleep Disturbance Score from the Children's Sleep Habits Questionnaire.

**Table 4.** Multivariate Analysis—Logistic Regression.<sup>a</sup>

Independent variables	Unadjusted OR	95% CI	Adjusted OR	95% CI
Autism	<b>6.8</b>	<b>2.8-16</b>	<b>4.3</b>	<b>1.3-13</b>
Age	0.8	0.7-0.9	0.8	0.7-1
Medication for behavior	1.4	0.5-3.6	1.1	0.3-4.3
Irritability total score (ABC)	1.1	1.04-1.1	1.03	0.9-1.1
Hyperactivity total score (ABC)	1.1	1.05-1.1	1.04	0.9-1.1
Maternal education	1.5	1-2.2	1.4	0.8-2.2
Latino vs rest	1	0.4-2.2	2.5	0.8-7.2

Abbreviations: ABC, Aberrant Behavior Checklist; CHSQ: Child Sleep Habits Questionnaire; CI, confidence interval; OR, odds ratio.

<sup>a</sup>Dependent Variable: Sleep problems (scores above 41 in the Total Sleep Disturbance Score from Children's Sleep Habits Questionnaire)

spectrum disorder reported significant sleep problems compared to 34% of families of children with other developmental disabilities. Across groups, sleep problems were related to child behavioral difficulties, including irritability and

hyperactivity, although this association did not reach significance for the group with autism spectrum disorder.

The rates of sleep problems observed for the groups of families of children with autism spectrum disorder and with other

developmental disabilities are similar to the rates described in a number of other studies of sleep disorders in autism<sup>6,12</sup> and in cerebral palsy.<sup>13</sup> These general results are extended by our findings that the nature of the sleep difficulties is different between the groups. Specifically, children with autism reported more frequent bedtime resistance, sleep anxiety, and night wakings than children with other developmental disabilities but not in sleep onset delays, sleep duration, parasomnias, sleep disorder breathing, and daytime sleepiness. When assessing patients with sleep disorders, whether by history or by parental questionnaires, treatment management must take into account what aspects of sleep are affected. For example, the elevated sleep anxiety and bedtime resistance subscale scores indicate a need to focus on decreasing anxiety before bed and developing a nighttime routine with behavioral reinforcements for completing the routine. A good bedtime routine may facilitate a pattern of calming down, relaxing, and getting ready to sleep. However, if a child does not respond to behavioral management, then medications may need to be considered. For example, melatonin is a pineal hormone that regulates the circadian rhythm. Melatonin has been reported to be effective in reducing time to sleep, but reports of its efficacy in reducing nighttime awakenings and other aspects of sleep disturbances in children with Autism have been variable.<sup>31</sup> Specifics in terms of the nature of sleep disorders will help our understanding and our design of effective treatment options for patients.

As reported previously in the literature, sleep problems were associated with child behavioral issues for the groups combined, but, surprisingly, for the group with autism spectrum disorder, parents who reported more sleep problems did not report higher irritability or hyperactivity. The lack of association with sleep difficulties is surprising and probably related to a ceiling effect because sleep problems were so prevalent in the group of children with autism spectrum disorder, reported by 78% of the current sample, and a larger sample may be needed to obtain more differentiated results. Sleep problems were significantly associated with behavioral issues for children with other developmental disabilities, and results are similar to other reports in the literature.<sup>25</sup>

The association between sleep problems and autism seems to be independent of other comorbid disorders that are also related to sleep problems, such as attention-deficit hyperactivity disorder<sup>28</sup> and epilepsy.<sup>29</sup> Sleep problems were still higher in children with autism than children with other developmental disabilities after excluding children with these comorbidities. We also excluded from the analysis children who were receiving medication for behavior<sup>30</sup> in both groups, and results were similar, with more sleep problems in the group of children with autism.

Age of child has been reported to be associated with sleep disorders for children with typical development, with parents reporting more sleep difficulties when their child is younger.<sup>32</sup> We observed similar findings for the groups combined and in the group of children with autism but not for the group of children with other developmental disabilities.

There are limitations to this study including that sleep disorders are based on parental report using questionnaire, with no other biological marker. On the other hand, the Children's Sleep Habits Questionnaire individual items, as well as the subscale and total scores, were able to consistently differentiate the community group from the sleep-disordered group, demonstrating validity.<sup>21</sup> Another limitation of the study is the relatively small size of our samples, which may have interfered with our analysis in each group. However, the results do indicate that children with autism in an ethnically diverse population have more sleep problems than children with other developmental disabilities and may present a unique pattern, to be considered in the use of medication.

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### Author Contributions

All the authors contributed to the conception, design, interpretation of data and critical review, revisions, and approval of the final manuscript. MVD conducted the analysis and prepared the initial draft.

### Declaration of Conflicting Interests

The author(s) declared no potential conflicts of interest with respect to the research, authorship, and/or publication of this article.

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### Ethical Approval

The study was approved by the Committee of Clinical Investigation of Albert Einstein College of Medicine (IRB approval no. 2007-371).

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