Research in Autism Spectrum Disorders 8 (2014) 193–199

Contents lists available at ScienceDirect

Research in Autism Spectrum Disorders

Journal homepage: http://ees.elsevier.com/RASD/default.asp

The relationship between autism symptom severity and sleep problems: Should bidirectionality be considered?

Hilary L. Adams *, Johnny L. Matson, Paige E. Cervantes, Rachel L. Goldin

Louisiana State University, USA

ARTICLE INFO

Article history:
Received 14 November 2013
Accepted 23 November 2013

Keywords:
Autism
Sleep problems
Symptom severity

ABSTRACT

Prior research assessing the relationship between autism spectrum disorder (ASD) symptom severity and sleep problems has considered the association in a unidirectional manner; researchers have primarily focused on how sleep difficulties affect ASD symptom presentation. Specifically, extant research literature on this topic indicates that sleep problems exacerbate ASD symptom severity. The present study provides an investigation of this topic in a bidirectional manner. Primary results corroborated the compounding effect of sleep problems on ASD symptom severity. Furthermore, the results of a multinomial linear regression provided preliminary evidence that increased ASD symptom severity may predict an increased likelihood of the presence of sleep problems. As such, the authors conclude that the relationship between ASD symptom severity and sleep problems should be considered bidirectionally in future research. Implications for a relationship in each direction are discussed.

1. Introduction

Currently, rates of autism spectrum disorder (ASD) have been increasing rapidly and are approximately one in 88 children in the United States (Center for Disease Control and Prevention, 2012; Matson & Kozlowski, 2011). Although individuals with ASD differ widely in terms of symptom severity and functional ability, overarching symptoms include qualitative impairments in communication and socialization, as well as the presence of restricted interests and/or repetitive behaviors (Brereton, Tonge, & Einfeld, 2006; Fodstad, Matson, Hess, & Neal, 2009; Matson, 2007; Matson, Dempsey, & Fodstad, 2009a; Matson & Wilkins, 2008b, 2009; Matson, Wilkins, & González, 2008; Tidmarsh & Volkmar, 2003). Furthermore, ASD is frequently accompanied by comorbid disorders and associated problems, one of which is sleep difficulties (LoVullo & Matson, 2009; Matson et al., 2009a; Matson, Dempsey, LoVullo, & Wilkins, 2008; Matson & Rivet, 2008; Matson, Rivet, Fodstad, Dempsey, & Boisjoli, 2009; Smith and Matson, 2010a,b,c). Some researchers suggest that about two-thirds of individuals with ASD have experienced a sleep problem during childhood (Richdale, 2001), whereas others offer estimates between 40% and 80% (Cortesi, Giannotti, Ivanenko, & Johnson, 2010). Regardless, overall, children with ASD appear to suffer from sleep problems more frequently than children with typical development (Liu, Hubbard, Fabes & Adam, 2006; Krakowiak, Goodlin-Jones, Hertz-Picciotto, Croen, & Hansen, 2012; Souders et al., 2009).

For instance, using polysomnographic findings and caregiver report, Malow and colleagues (2006) compared sleep problems among typically developing children and their counterparts diagnosed with ASD. They reported that sleep problems were endorsed for nearly half of their ASD sample, while sleep problems were not endorsed for any of the typically developing sample (Malow et al., 2006). Among the children with ASD, the most common sleep issues were prolonged sleep

* Corresponding author at: Clinical Psychology, Department of Psychology, Louisiana State University, Baton Rouge, LA 70803, USA. Tel.: +1 7134172976.
E-mail address: hilary.l.adams@gmail.com (H.L. Adams).

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http://dx.doi.org/10.1016/j.rasd.2013.11.008

latency and decreased sleep efficiency. Other researchers have found high rates of bedtime resistance, insomnia, daytime sleepiness, night awakenings, and problems with sleep-onset in individuals with ASD (Krakowiak et al., 2012; Liu et al., 2006; Souders et al., 2009). These sleep difficulties appear to persist throughout the lifespan (Matson, Ancona & Wilkins, 2008) and to co-occur; that is, individuals with ASD who experience one sleep problem will also often experience coexisting sleep problems (Liu et al., 2006).

Some researchers suggest the cause of sleep problems in children with ASD may be associated with socialization impairments (Richdale & Prior, 1995). The sleep/wake cycle of human beings must be synchronized to environmental cues to experience normal sleep; individuals with ASD may have difficulty recognizing and interpreting those social cues necessary for the regulation of the circadian rhythm (Richdale & Prior, 1995; Richdale & Schreck, 2009). Increased anxiety and arousal in children with ASD may contribute to sleep difficulties as well (Richdale & Prior, 1995). Sleep problems in children with ASD have also been linked to faulty child rearing practices, genetic abnormalities related to melatonin production, comorbid attention-deficit/hyperactivity disorder (ADHD), asthma, and epilepsy, gastrointestinal problems, use of medications, and an increased sensitivity to external noise (Cortesi et al., 2010; Krakowiak et al., 2012; Liu et al., 2006).

Further, sleep problems have been found to exacerbate autism symptomology. Fewer hours of sleep and more sleep difficulties have been shown to correlate with and predict greater ASD symptom severity (Kozlowski, Matson, Belva & Rieske, 2012; Matson et al., 2008a; Richdale & Schreck, 2009; Schreck, Mulick & Smith, 2004). Children with ASD who have sleep problems score worse on socialization measures and exhibit significantly greater social skill deficits compared to children with ASD who do not experience sleep difficulties (Kuhn & Matson, 2004; Matson et al., 2008a; Richdale & Schreck, 2009; Schreck et al., 2004). Greater communication impairments are demonstrated by children with ASD who exhibit increased sensitivity to environmental stimuli at bedtime and screaming during night awakenings (Richdale & Schreck, 2009; Schreck et al., 2004). Fewer hours of sleep, screaming during awakenings, bedtime resistance, and settling difficulties have been correlated with higher rates of stereotypic behaviors and stricter adherence to non-functional routines (Schreck et al., 2004). In addition to exacerbating core symptoms of autism, sleep difficulties may lead to increased affective problems, disruption, aggression, and irritability, as well as greater rates of over-reactivity, noncompliance, and depression in individuals with ASD (Kuhn & Matson, 2004; Matson et al., 2008a; Malow et al., 2006; Schreck et al., 2004; Williams, Sears & Allard, 2004). Identifying and providing treatment for sleep problems in children with ASD is imperative for improving sleep, as well as encouraging more positive prognoses by improving daytime behavior and family functioning (Schreck et al., 2004).

Based on extant research literature, a relationship between ASD symptom severity and sleep problems is evident (Kozlowski et al., 2012; Matson et al., 2008a; Schreck et al., 2004). Nevertheless, the direction of this relationship (i.e., sleep problems influence ASD symptom severity, ASD symptom severity influences sleep problems, or both) remains unclear. The purpose of the current study was to investigate the relationship between sleep problems and ASD severity among children and adolescents. Specifically, two related questions were posed. First, do sleep problems exacerbate ASD symptom severity, as predicted by existing research literature? Furthermore, are sleep problems more common as ASD symptom severity increases?

2. Method

2.1. Participants

Participants were chosen from a pre-existing database of children and adolescents recruited from schools, outpatient clinics, parent advocacy groups, and family support groups in 16 states. The study was approved by the Louisiana State University Institutional Review Board, and parent or caregiver informants provided informed consent prior to participation. The informants completed the assessment battery utilized in the present study, the *Autism Spectrum Disorder Battery, Child Version* (ASD-C; Matson & González, 2007), as a portion of comprehensive evaluations completed by the research team.

To warrant inclusion in the study, individuals from the database were required to have valid data in terms of age, gender, item number 18 on the *Autism Spectrum Disorder-Comorbid-Child Version* (ASD-CC; Matson & González, 2007), and fewer than two omissions on the *Autism Spectrum Disorder-Diagnostic-Child Version* (ASD-DC; Matson & González, 2007). The resulting sample consisted of 548 children and adolescents. Diagnosis of ASD was not necessary for inclusion, and no diagnostic groups were created.

Following removal of individuals who did not meet inclusion criteria, 548 children and adolescents remained. Participants were 2–18 years ($M = 8.34$, $SD = 3.62$). The sample was composed of 70.6% males and 29.4% females, of which 70.8% were Caucasian, 10.4% were African American, 2.9% were Hispanic, 3.5% were of other ethnicity, and 12.4% did not have ethnicity data. Demographic data for the overall sample is presented in Table 1.

2.2. Measures

2.2.1. Autism spectrum disorder-child version (ASD-C, Matson & González, 2007)

The *ASD-C* is an informant-based measure consisting of a total of 97 items and comprised of three scales examining diagnostic symptomology, comorbid symptoms, and problem behaviors in children and adolescents 2–18 years of age. Each item is rated as either "0" – not a problem or impairment, "1" – mild problem or impairment or "2" – severe problem or impairment. For each of the three scales, items are summed to produce a total score. The current study utilizes the first two scales of the measure, *ASD-DC* and *ASD-CC*.