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## Sleeping Patterns in Children with Developmental Disabilities

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### Abstract

**Introduction:** Sleep is one of the most important components of overall health. Children with developmental disabilities are at a higher risk of having sleep problems.

**Purpose:** The goal of the present study is to compare sleep patterns of children with developmental disabilities with those of typically developing children. In particular, we examined whether children with an intellectual disability (ID), children with an autism spectrum disorder (ASD) and typically developing children differ in sleep duration, number of night's waking, screen time (time spent on smartphones, tablets, TV), and outdoor activities.

**Methods:** The sample for this study consisted of 114 children (34 children with ASD, 40 children with ID and 40 typically developing children) aged 2 to 14 years (mean age= 6.4 years, SD = 3.0). Information on children's sleep patterns was obtained through an online survey completed by the parents of the children. We also collected information regarding the strategies parents use to settle their children for sleep, as well as information regarding screen time and outdoor activities.

**Results:** The results of this study indicate that sleep duration was shortest for children with ID and longest for children without developmental disabilities. Another finding in this study is that screen time and not the outdoor activities was associated with sleep duration. Children with ASD were more likely to use melatonin to fall asleep, while the children with ID were more likely to use medications.

**Conclusion:** Children with ID have shorter sleep duration than children with ASD and typically developing children. Parents have several cognitive and behavioural strategies at their disposal to improve their children's sleep.

**Key words:** sleep, children with intellectual disability, children with autism spectrum disorder, health

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## 1. Introduction

Sleep is one of the most basic human needs and is universally regarded as a foundation of good health, well-being and quality of life (Matricciani et al., 2019). However, many children have sleep problems. Studies have reported that approximately 25-40% of children aged 1 to 5 years have some form of sleeping problems (Galland & Mitchell, 2010). Most common sleep problems include bedtime resistance, delayed sleep onset, short sleep duration, and frequent nocturnal awakening. Short sleep duration is associated with a number of negative physical, socio-emotional and cognitive outcomes (Matricciani et al., 2013). In addition to this, poor sleep has also been implicated as a potential causal factor of aggression and violence (Kamphuis et al., 2012; Schlieber & Han, 2018). Children with a developmental disability such as an intellectual disability (ID) or an autism spectrum disorder (ASD) are at an even higher risk of having sleeping problems than typically developing children (Bourke-Taylor et al., 2013; Keenan et al., 2007; Souders et al., 2017). Estimates of sleeping problems prevalence among individuals with developmental disabilities vary from 13% to 86% (Didden & Sigafos, 2001). Research on children and adolescents with ASD has shown that sleep problems, especially insomnia, range from 40% to 80% in this population (Cortesi et al., 2010). These authors stress the importance of improving sleep patterns in children with disabilities as it will probably lead to better daytime behaviour and better overall family functioning. The most common sleep problems in children with an ID are settling difficulties, night waking, long sleep latencies and early morning waking (Richdale et al., 2000). It has long been shown that the chronic sleep problems of children with a developmental disability affect the whole family and add additional stress for family functioning (Hoare et al., 1998). The reasons of poor sleep in children with a developmental disability are manifold. Some of these factors contributing to poor sleep are inherent to central nervous factors, gastroesophageal reflux, pain, and epileptic seizures (Dodge & Wilson, 2001). It is evident that sleep problems in people with a developmental disability have multifactorial etiology with various contributions of neurologic, medical, and psychiatric factors (Angriman et al., 2015).

The behavioural reasons for poor sleep and sleeping problems involve long screen time, especially in bed, lack of physical activity and excessive sugar-sweetened beverages consumption (Morrissey et al., 2019). Screen time involves time spent using a device with a screen such as smartphone, tablet, laptop, TV, etc. Many researchers have examined the negative effects of screen time on sleep (Ghekiere et al., 2019; Janssen et al., 2020). Some researchers have also found a link between endocrine activity and sleep patterns (Hatzinger et al., 2008). Several studies have compared sleep problems in typically developing children and children with developmental disabilities (Buckley et al., 2010; Polimeni et al., 2005). Results of these studies have shown that children with developmental disabilities have more sleep problems than typically developing children. However, there are few studies that examined and compared parental experiences regarding their children's sleep patterns.

### 1.1 Aim of the Study

The goal of the present paper is to examine sleep patterns in children with an ID, children with an ASD, and typically developing children. Additionally, we wanted to examine what strategies parents use to settle their children for sleep and whether there are differences in supplements/medications that children use for sleeping. More specifically, the research questions we set to answer in this study were:

1. Are there differences in the mean sleep duration in children with an ID, children with an ASD and typically developing children?
2. Are there differences in the number of times children wake in the night with IDs, children with an ASD and typically developing children?
3. Are there differences in screen time between children with an ID, children with an ASD and typically developing children?
4. What is the effect of screen time on sleep duration?
5. Are there differences in time spent outdoors between children with an ID, children with an ASD and typically developing children?
6. What is the effect of time spent outdoors on sleep duration?
7. What supplements or medications do children use for sleep?
8. What strategies do parents use to settle their children for sleep?

## 2. Method

### 2.1 Participants

The sample for this study consisted of parents of 114 children. Of those, there were parents of 40 children with an ID (29 boys, 11 girls), parents of 34 children with an ASD (26 boys, 8 girls), and parents of 40 typically developing children (23 boys, 17 girls). The children's ages were between 2 to 14 years (mean age 6.4 years, SD- 3.0 years). All children attended pre-school and elementary schools in Canton Sarajevo, Bosnia and Herzegovina.

### 2.2 Procedure

Parents of children with developmental disabilities and parents of typically developing children were recruited through an online survey sent to different non-governmental organisations and parental preschool and elementary school associations. The total number of completed surveys was 34 for children with an ASD, 40 for children with an ID, and 260 for typically developing children. We also had 11 surveys completed for children with other disabilities (sensory and motor impairments), but these were not included in the analysis due to the small number. To reduce unequal variance between samples and to reduce Type I error, we randomly (through random number generator in Microsoft Excel) chose 40 parents of typically developing children to be included in this study.

### 2.3 Instrument

We created a survey form consisting of demographic data and sleep patterns data. Demographic data included information on child's age, gender, and diagnosis and parent's educational level. Sleep patterns data included eight questions:

1. On average, how long does your child sleep during the night?
2. Does your child wake up during the night? (rarely, often, always)
3. How much screen time does your child have during the day?

4. How much time does your child spend outside (play, walking)?
5. What supplements/medications does your child use to fall asleep?
6. How do you settle your child for sleep?
7. If your child wakes up during the night, how do you settle him back to sleep?
8. Any additional comments?

The first four questions were numerical (quantitative) and could be statistically analyzed. Questions 5-8 were narrative (qualitative) in nature, but in cases where a few categories were present (as in question number 5), we presented data quantitatively.

### 2.4 Statistical Analysis

Data were presented descriptively through frequencies, mean scores, and standard deviations. One way analysis of variance (ANOVA) was used to measure differences in mean sleep duration among the groups followed by Tukey's test for comparison of groups. A chi square test was used to evaluate the relationship between the number of times a child wakes in the night and the children's group status, screen time and group status and outdoor activity and group status. An alpha level of .05 was set for all statistical tests. The statistical analysis was performed with the computer program SPSS v.27 for Windows (IBM, 2020)

## 3. Results

Results have been discussed as per each research question.

The first research question was to compare the mean sleep duration time in children with an ID, children with an ASD and typically developing children. These results are shown in Table 1.

As can be seen from Table 1, there is a statistically significant difference in the mean sleep duration between the groups. According to the Tukey's HSD test, statistically significant difference was between typically developing children and children with an ID.

**Table 1**

*Mean sleep duration time in children with an ID, an ASD, and typically developing children*

Group	n	Mean	SD	F ratio	p
Children with an ASD.	34	8.06	1.2		
Children with an ID	40	7.35	1.8	4.03	.02
Typical children	40	8.20	1.1		

Note. Mean- mean sleep duration in hours.

Children with an ASD did not statistically significantly differ from children with an ID and from typically developing children.

The second research question was how often the child wakes up during the night in relation to a child's diagnosis. These results are presented in Table 2.

**Table 2**  
*Contingency table of children waking up during a night's sleep*

Group	Does the child wake up during the night's sleep?					
	Rarely		Often		Always	
	N	%	N	%	N	%
Children with an ASD	29	85.3	5	14.7	0	0
Children with an ID	19	47.5	19	47.5	2	5
Typical children	36	90	4	10	0	0

It is evident from Table 2 that the distribution of answers differs in relation to a child's diagnosis which is confirmed by the results of Chi square test ( $\chi^2 = 22.8$ ;  $p < .01$ ). Again, children with an intellectual disability seem to wake up more frequently during a night's sleep compared to the other two groups.

The third research question was to examine differences in screen time in relation to the child's group. These results are presented in Table 3.

According to the results of Chi square test, there were no statistically significant differences in screen time in relation to the child's diagnosis ( $\chi^2 = 4.2$ ;  $p < .65$ ).

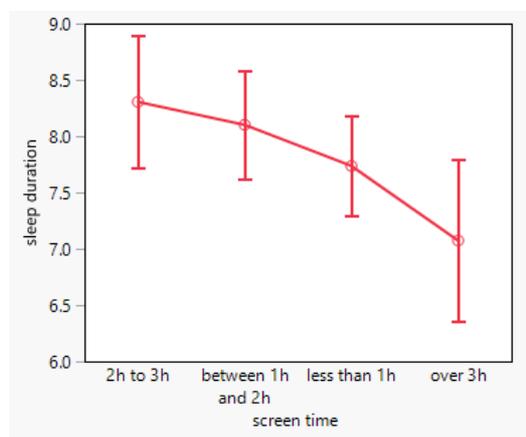
The fourth research question was to examine the relationship between screen time and sleep duration.

These results are presented in Figure 1.

From the Figure 1, we can see there is no linear relationship between screen time and sleep duration, however it is evident that children who had the most screen time tend to have the shortest sleep duration. However, according to the results of Tukey HSD test the only significant difference in mean sleep duration was between the groups of a) over 3h and b) 2h to 3h. The fifth and sixth research questions were related to outdoor activities. We first examined were there any differences in the amount of time spent outdoors between the groups. These results are shown in Table 4.

**Table 3**  
*Contingency table of children's screen time*

Group	How much screen time does the child have during the day?							
	Less than 1h		1h-2h		2h-3h		More than 3h	
	N	%	N	%	N	%	N	%
Children with an ASD	11	32.35	11	32.35	9	26.48	3	8.82
Children with an ID	16	40.0	12	30.0	6	15.0	6	15.0
Typical children	13	32.5	10	25.0	8	20.0	9	22.5



**Figure 1. Sleep duration in relation to screen time**

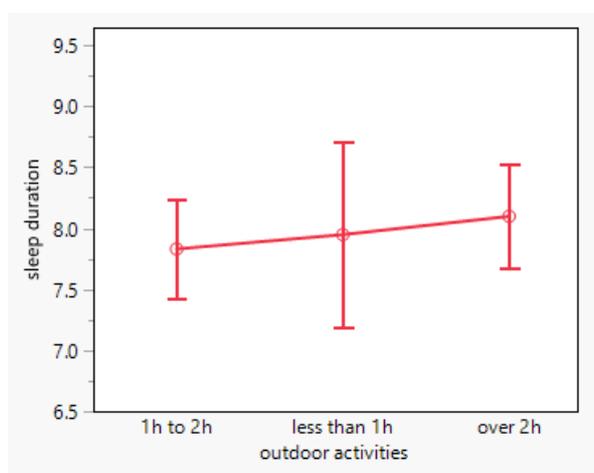
**Table 4**  
Contingency table of time children spend outside the home/school

Group	How much time does the child spend outdoors?					
	Less than 1h		1h-2h		More than 2h	
	N	%	N	%	N	%
Children with an ASD	4	11.76	15	44.12	15	44.12
Children with an ID	13	33.33	14	35.90	12	30.77
Typical children	3	7.5	18	45.0	19	47.50

The Chi square test revealed statistically significant differences in the time spent outside the home in relation to child's diagnosis ( $\chi^2 = 10.3$ ;  $p < .03$ ). According to these results, it seems that children with an ID spend considerably less time outside of home

than their peers with an ASD and typically developing children.

For the sixth research question we examined how outdoor activities affected sleep duration. These results are shown in Figure 2.



**Figure 2. Sleep duration in relation to outdoor activities**

According to the one-way ANOVA, there were no statistically significant differences in sleep duration in relation to the amount of outdoor activities ( $F=0.41$ ;  $p=.67$ ).

The seventh research question was what supplements / medications children used for their sleeping problems. These results are presented in Table 5.

**Table 5**  
Supplements/medications children use for sleep problems

Group	What supplements/medications children use for sleep problems?							
	Nothing		Herbal Tea		Melatonin		Diazepam	
	N	%	N	%	N	%	N	%
Children with an ASD	28	82.36	2	5.88	4	11.76	0	0
Children with an ID	30	75.0	1	2.5	2	5.0	7	17.5
Typical children	38	95.0	2	5.0	0	0	0	0

It is obvious from Table 5. that children with an ASD were more likely to use melatonin as a sleep aid, while children with an ID were more likely to use other medication for sleep problems.

The last research question was how the parents settled their children for sleep and back to sleep. To these

questions, parents provided various responses. The most common answer was bedtime story reading, followed by lying together in bed and cuddling the child to sleep, music, and some parents reported that children fall asleep independently.

In relation to the answers and comments provided to these questions (question number 6 and question number 7) in the survey, there were no systematic differences in the answers parents provided in relation to their child's diagnostic status. That means that parents of all children use the same or similar strategies to settle their children for sleep.

For the last question, several parents provided additional comments such as: "it is very important to establish a routine for sleep", "my child has frequent nocturnal fears", "my child is sensitive to weather changes and then has an exceptionally hard time falling asleep", "stress caused by COVID 19 makes things worse as children cannot enjoy their childhood".

#### **4. Discussion**

The neuro atypical children often have skewed sleeping patterns. The first research question in this study related to sleep duration. Results in this study indicate that children with an ID had statistically significantly shorter sleep duration than children with an ASD and typically developing children. We are not aware of any other study that compared sleep duration in these two groups of children with developmental disabilities. There are, however, a few studies that compared sleep in children with an ASD to those of typically developing children and children with an ID to typically developing children (Krakowiak et al., 2008; Richdale et al., 2000). Our study is in line with these studies although we did not find statistically significant differences in sleep duration between children with an ASD and typically developing children. It is important to note that all children in this sample did not have adequate amount of sleep. The average amount of sleep for the mean age of this group is around 11 hours (Iglowstein et al., 2003). The average amount of sleep in this sample was significantly lower. However, we only collected data on nighttime sleep. Unfortunately, we did not collect information on day-time sleep, so it is possible that the total sleep duration time was a bit longer than reported.

Our second research question was to determine whether there are group differences in the amount of waking during the night's sleep. Again, children with an ID had statistically more waking during the night than children with an ASD and typically developing children. Children with an ASD, in turn, had more waking during the night than typically developing

children. The interpretation of this research question is not straightforward. The potential answers were: rarely, often, and always. As these adverbs were not quantified (for example, rarely means less than 2 times per week), we do not know whether parents interpreted them in the same way. Rarely for one parent can mean once a night, while for the other it can mean once a week. This issue should be corrected in future surveys.

Third and fourth research questions dealt with the amount of screen time (mobile phone use, tablets use, TV) and its relationship with sleeping. We found no differences in the screen time between the groups of children. It seems that screen time has become a frequent occupation for children both at home and at school (Dadson et al., 2020) and presence of a disability does not have an effect on the duration of screen time. The second result is that children who had the most screen time had the shortest duration of sleep. We expected this result as it is in line with many studies conducted on this topic (Falbe et al., 2015; Magee et al., 2014). However, it was surprising to find that this relationship between screen time and sleep duration was not linear. One potential explanation is that shorter amount of screen time (less than 3h) does not significantly affect sleep. Another equally likely explanation is related to the type of screen media used. Earlier studies have shown that different type of screen media have different effect on sleep (Hisler et al., 2020). It might be the case that the groups differed in a systematic way in the type of screen media used. For example, it is possible that children who had more than 3 hours of screen time played PC games, while for the groups who had less than 3 hours, the main screen media was TV. Future studies should take into consideration, besides screen time, the type of screen media.

The fifth and sixth research questions were related to outdoor activities and the impact on sleep. Results in this study have shown that children with an ID spent less time engaged in outdoor activities than children with an ASD and typically developing children. Studies have shown that children with an ID participate in less social activities, recreational activities, family-enrichment and formal activities than typically developing children (Shields et al., 2014). The importance of outdoor activities and physical activity cannot be overstressed. The positive effects are evident in all domains of human functioning, ranging from physical health (McCurdy

et al., 2010), cognitive domain (Duvall, 2011), psychosocial domain (Memisevic & Hodzic, 2010) to mental health (Biddle & Asare, 2011). Given that children with ID are especially at risk of not getting enough outside activities, programs should be made to increase their participation. More concretely, schools should provide more opportunities for children to participate in physical activities that are tailored to their individual needs (Marie Alricsson et al., 2008).

However, in this study we did not find evidence that longer outdoor activities improves sleep duration. Although, there was a linear relationship between amount of outdoor activity and mean sleep duration, the difference was not statistically significant. Again, one potential explanation might be in poor question design, as we only had three options (less than 1h, 1h-2h, and more than 2h). It would have been better if have used an open-ended question in which parents could provide us with the exact amount of time their children spend in outdoor activities.

The last research question was related to the strategies parents use to settle their children for sleep. As for supplements, the majority of children did not use any supplements/medication for sleep problems. The most commonly used supplement in children with an ASD was melatonin, while in children with an ID the most common medication was diazepam. A plethora of studies have reported on the use of melatonin for sleep in children with an ASD (Malow et al., 2012; Rossignol & Frye, 2011). Research indicates that melatonin is probably a safe and well-tolerated treatment for sleep disturbances in children with an ASD (Andersen et al., 2008). Diazepam is a medically prescribed drug and we do not know whether it was prescribed to children with an ID for sleep problems only or for some other psychiatric comorbidity. It is also possible that some children might be addicted to the use of diazepam and thus the shorter sleep duration in this group.

As for the strategies to settle their children for sleep, parents mentioned bedtime story reading, lying next to him/her and listening to music. In the last question we asked parents to write down their comments and some parents reported their children have nocturnal fears and that it might have an effect on child's sleep. The good news is that nocturnal fears are very susceptible to treatments (Galland & Mitchell, 2010). One of the effective treatment is bedtime stories read by parents (Gordon & King, 2002). It is evident from

the qualitative analysis parents provided us with, that the strategies used to settle children for sleep are the same and very similar in all parents, regardless of whether their child has a disability or not.

Treatment of sleep problems should be prioritised given the importance of sleep for everyday functioning. Although the exact amount of sleep needed has not been firmly established, there is a growing concern that many people are not getting enough sleep (Ferrara & De Gennaro, 2001). This is especially true for children as they need more sleep than the adults.

Improvement of sleep has often been set as one of the primary therapeutic goals in developmental disabilities as it has been proven that sleep disruption worsens the symptoms of autism (Esposito et al., 2020). Fortunately, there are many strategies at the disposal of parents such as reinforcement, bedtime routine and standard extinction that can help in improving their children's sleep (Thackeray & Richdale, 2002). A number of cognitive and behavioural interventions are available for children, especially if the underlying reason for poor sleep is psychological in nature (Murawski et al., 2018). Cognitive Behaviour Therapy (CBT) is a widely used therapeutic modality for treating sleep problems (Dewald-Kaufmann et al., 2019). Research has shown that applying CBT elements can provide a lot of help in managing sleep problems, especially now in the time of the COVID-19 pandemic (Altena et al., 2020). In addition to this, CBT can be used successful in people with an ID and an ASD (Carrigan & Allez, 2017).

#### 4.1 Limitations

There are several important limitations in this study worth mentioning. First, as with any survey, there is a risk that the data collected might be subjective and we did not have the means to verify the answers. Secondly, we did not take into consideration some factors that might be linked to sleep such as obesity level. Next, we do not know how valid the diagnoses of ID and ASD are as they were only reported by the parents in the survey. It is highly likely that the sleep quality is related to the severity of ID and ASD symptoms and we did not collect information on symptom severity. Also, another interesting topic that deserves more attention is the relationship between sleep patterns and behaviour in the child the following day. Lastly, we should have collected more precise data for some questions such as "Does the child wake

up during the night?”. The potential answers are rarely, often and always. However, rarely for one parent can mean once a night, while for the another parent it can mean once a week. We should have collected continual data for several other items such as questions regarding outdoor activity and screen-time.

## 5. Conclusions

Children with an ID had less sleep duration and more night waking than children with an ASD and typically developing children. Children who have more than 3 hours of screen time have shorter sleep duration. The amount of outdoor activity was not statistically correlated with sleep duration. The most commonly used supplement to aid a child’s sleep was melatonin (in children with an ASD) and the most commonly used medication to aid sleep was diazepam (children with an ID). Parents have many cognitive and behavioural strategies to help their children sleep better.

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## Conflicts of interest

Authors declare no conflict of interests.

## References

- Altena, E., Baglioni, C., Espie, C. A., Ellis, J., Gavrilloff, D., Holzinger, B., Schlarb, A., Frase, L., Jemelöv, S., & Riemann, D. (2020). Dealing with sleep problems during home confinement due to the COVID-19 outbreak: Practical recommendations from a task force of the European CBT-I Academy. *Journal of Sleep Research*, 29(4), e13052. <https://doi.org/https://doi.org/10.1111/jsr.13052>
- Andersen, I. M., Kaczmarek, J., McGrew, S. G., & Malow, B. A. (2008). Melatonin for Insomnia in Children With Autism Spectrum Disorders. *Journal of Child Neurology*, 23(5), 482-485. <https://doi.org/10.1177/0883073807309783>
- Angriman, M., Caravale, B., Novelli, L., Ferri, R., & Bruni, O. (2015). Sleep in children with neurodevelopmental disabilities. *Neuropediatrics*, 46(3), 199-210. <https://doi.org/10.1055/s-0035-1550151>
- Biddle, S. J. H., & Asare, M. (2011). Physical activity and mental health in children and adolescents: a review of reviews. *British Journal of Sports Medicine*, 45(11), 886-895. <https://doi.org/10.1136/bjsports-2011-090185>
- Bourke-Taylor, H., Pallant, J. F., Law, M., & Howie, L. (2013). Relationships between sleep disruptions, health and care responsibilities among mothers of school-aged children with disabilities. *Journal of Paediatrics and Child Health*, 49(9), 775-782. <https://doi.org/https://doi.org/10.1111/jpc.12254>
- Buckley, A. W., Rodriguez, A. J., Jennison, K., Buckley, J., Thurm, A., Sato, S., & Swedo, S. (2010). Rapid Eye Movement Sleep Percentage in Children With Autism Compared With Children With Developmental Delay and Typical Development. *Archives of Pediatrics & Adolescent Medicine*, 164(11), 1032-1037. <https://doi.org/10.1001/archpediatrics.2010.202>
- Carrigan, N., & Allez, K. (2017). Cognitive Behaviour Therapy for Post-Traumatic Stress Disorder in a person with an Autism Spectrum Condition and Intellectual Disability: A Case Study. *Journal of Applied Research in Intellectual Disabilities*, 30(2), 326-335. <https://doi.org/https://doi.org/10.1111/jar.12243>
- Cortesi, F., Giannotti, F., Ivanenko, A., & Johnson, K. (2010). Sleep in children with autistic spectrum disorder. *Sleep Medicine*, 11(7), 659-664. <https://doi.org/https://doi.org/10.1016/j.sleep.2010.01.010>
- Dadson, P., Brown, T., & Stagnitti, K. (2020). Relationship between screen-time and hand function, play and sensory processing in children without disabilities aged 4–7 years: A exploratory study. *Australian Occupational Therapy Journal*, 67(4), 297-308. <https://doi.org/https://doi.org/10.1111/1440-1630.12650>
- Dewald-Kaufmann, J., de Bruin, E., & Michael, G. (2019). Cognitive Behavioral Therapy for Insomnia (CBT-i) in School-Aged Children and Adolescents. *Sleep*

- Medicine Clinics*, 14(2), 155-165. <https://doi.org/10.1016/j.jsmc.2019.02.002>
- Didden, R., & Sigafoos, J. (2001). A review of the nature and treatment of sleep disorders in individuals with developmental disabilities. *Research in Developmental Disabilities*, 22(4), 255-272. [https://doi.org/https://doi.org/10.1016/S0891-4222\(01\)00071-3](https://doi.org/https://doi.org/10.1016/S0891-4222(01)00071-3)
- Dodge, N. N., & Wilson, G. A. (2001). Melatonin for Treatment of Sleep Disorders in Children With Developmental Disabilities. *Journal of Child Neurology*, 16(8), 581-584. <https://doi.org/10.1177/088307380101600808>
- Duvall, J. (2011). Enhancing the benefits of outdoor walking with cognitive engagement strategies. *Journal of Environmental Psychology*, 31(1), 27-35. <https://doi.org/https://doi.org/10.1016/j.jenvp.2010.09.003>
- Esposito, D., Belli, A., Ferri, R., & Bruni, O. (2020). Sleeping without Prescription: Management of Sleep Disorders in Children with Autism with Non-Pharmacological Interventions and Over-the-Counter Treatments. *Brain Sciences*, 10(7), 441. <https://www.mdpi.com/2076-3425/10/7/441>
- Falbe, J., Davison, K. K., Franckle, R. L., Ganter, C., Gortmaker, S. L., Smith, L., Land, T., & Taveras, E. M. (2015). Sleep Duration, Restfulness, and Screens in the Sleep Environment. *Pediatrics*, 135(2), e367-e375. <https://doi.org/10.1542/peds.2014-2306>
- Ferrara, M., & De Gennaro, L. (2001). How much sleep do we need? *Sleep Medicine Reviews*, 5(2), 155-179. <https://doi.org/https://doi.org/10.1053/smr.2000.0138>
- Galland, B. C., & Mitchell, E. A. (2010). Helping children sleep. *Archives of Disease in Childhood*, 95(10), 850-853. <https://doi.org/10.1136/adc.2009.162974>
- Ghekiere, A., Van Cauwenberg, J., Vandendriessche, A., Inchley, J., Gaspar de Matos, M., Borraccino, A., Gobina, I., Tynjälä, J., Deforche, B., & De Clercq, B. (2019). Trends in sleeping difficulties among European adolescents: Are these associated with physical inactivity and excessive screen time? *International Journal of Public Health*, 64(4), 487-498. <https://doi.org/10.1007/s00038-018-1188-1>
- Gordon, J., & King, N. (2002). Children's night-time fears: an overview. *Counselling Psychology Quarterly*, 15(2), 121-132. <https://doi.org/10.1080/09515070110104097>
- Hatzinger, M., Brand, S., Perren, S., Stadelmann, S., von Wyl, A., von Klitzing, K., & Holsboer-Trachsler, E. (2008). Electroencephalographic sleep profiles and hypothalamic-pituitary-adrenocortical (HPA)-activity in kindergarten children: Early indication of poor sleep quality associated with increased cortisol secretion. *Journal of Psychiatric Research*, 42(7), 532-543. <https://doi.org/https://doi.org/10.1016/j.jpsychires.2007.05.010>
- Hisler, G., Twenge, J. M., & Krizan, Z. (2020). Associations between screen time and short sleep duration among adolescents varies by media type: evidence from a cohort study. *Sleep Medicine*, 66, 92-102. <https://doi.org/https://doi.org/10.1016/j.sleep.2019.08.007>
- Hoare, P., Harris, M., Jackson, P., & Kerley, S. (1998). A community survey of children with severe intellectual disability and their families: psychological adjustment, carer distress and the effect of respite care. *Journal of Intellectual Disability Research*, 42(3), 218-227. <https://doi.org/https://doi.org/10.1046/j.1365-2788.1998.00134.x>
- IBM. (2020). *IBM SPSS Statistics for Windows 27.0*. In Armonk, NY: IBM Corp.
- Iglowstein, I., Jenni, O. G., Molinari, L., & Largo, R. H. (2003). Sleep Duration From Infancy to Adolescence: Reference Values and Generational Trends. *Pediatrics*, 111(2), 302-307. <https://doi.org/10.1542/peds.111.2.302>
- Janssen, X., Martin, A., Hughes, A. R., Hill, C. M., Kotronoulas, G., & Hesketh, K. R. (2020). Associations of screen time, sedentary time and physical activity with sleep in under 5s: A systematic review and meta-analysis. *Sleep Medicine Reviews*, 49, 101226. <https://doi.org/https://doi.org/10.1016/j.smr.2019.101226>
- Kamphuis, J., Meerlo, P., Koolhaas, J. M., & Lancel, M. (2012). Poor sleep as a potential causal

- factor in aggression and violence. *Sleep Medicine*, 13(4), 327-334. <https://doi.org/https://doi.org/10.1016/j.sleep.2011.12.006>
- Keenan, R. A., Wild, M. R., McArthur, I., & Espie, C. A. (2007). Children with Developmental Disabilities and Sleep Problems: Parental Beliefs and Treatment Acceptability. *Journal of Applied Research in Intellectual Disabilities*, 20(5), 455-465. <https://doi.org/https://doi.org/10.1111/j.1468-3148.2007.00382.x>
- Krakowiak, P., Goodlin-Jones, B., Hertz-Picciotto, I., Croen, L. A., & Hansen, R. L. (2008). Sleep problems in children with autism spectrum disorders, developmental delays, and typical development: a population-based study. *Journal of Sleep Research*, 17(2), 197-206. <https://doi.org/https://doi.org/10.1111/j.1365-2869.2008.00650.x>
- Magee, C. A., Lee, J. K., & Vella, S. A. (2014). Bidirectional Relationships Between Sleep Duration and Screen Time in Early Childhood. *JAMA Pediatrics*, 168(5), 465-470. <https://doi.org/10.1001/jamapediatrics.2013.4183>
- Malow, B., Adkins, K. W., McGrew, S. G., Wang, L., Goldman, S. E., Fawkes, D., & Burnette, C. (2012). Melatonin for Sleep in Children with Autism: A Controlled Trial Examining Dose, Tolerability, and Outcomes. *Journal of Autism and Developmental Disorders*, 42(8), 1729-1737. <https://doi.org/10.1007/s10803-011-1418-3>
- Marie Alricsson, Debra Domalewski, Ulla Romild, & Ragnar Asplund. (2008). Physical activity, health, body mass index, sleeping habits and body complaints in Australian senior high school students. *International Journal of Adolescent Medicine and Health*, 20(4), 501-512. <https://doi.org/doi:10.1515/IJAMH.2008.20.4.501>
- Matricciani, L., Blunden, S., Rigney, G., Williams, M. T., & Olds, T. S. (2013). Children's sleep needs: is there sufficient evidence to recommend optimal sleep for children? *Sleep*, 36(4), 527-534. <https://doi.org/10.5665/sleep.2538>
- Matricciani, L., Paquet, C., Galland, B., Short, M., & Olds, T. (2019). Children's sleep and health: A meta-review. *Sleep Medicine Reviews*, 46, 136-150. <https://doi.org/https://doi.org/10.1016/j.smrv.2019.04.011>
- McCurdy, L. E., Winterbottom, K. E., Mehta, S. S., & Roberts, J. R. (2010). Using Nature and Outdoor Activity to Improve Children's Health. *Current Problems in Pediatric and Adolescent Health Care*, 40(5), 102-117. <https://doi.org/https://doi.org/10.1016/j.cppeds.2010.02.003>
- Memisevic, H., & Hodzic, S. (2010). The effects of equine-assisted therapy in improving the psychosocial functioning of children with autism. *The Journal of Special Education and Rehabilitation*, 11(3/4), 57-67.
- Morrissey, B., Allender, S., & Strugnell, C. (2019). Dietary and Activity Factors Influence Poor Sleep and the Sleep-Obesity Nexus among Children. *International Journal of Environmental Research and Public Health*, 16(10), 1778. <https://www.mdpi.com/1660-4601/16/10/1778>
- Murawski, B., Wade, L., Plotnikoff, R. C., Lubans, D. R., & Duncan, M. J. (2018). A systematic review and meta-analysis of cognitive and behavioral interventions to improve sleep health in adults without sleep disorders. *Sleep Medicine Reviews*, 40, 160-169. <https://doi.org/https://doi.org/10.1016/j.smrv.2017.12.003>
- Polimeni, M. A., Richdale, A. L., & Francis, A. J. P. (2005). A survey of sleep problems in autism, Asperger's disorder and typically developing children. *Journal of Intellectual Disability Research*, 49(4), 260-268. <https://doi.org/https://doi.org/10.1111/j.1365-2788.2005.00642.x>
- Richdale, A., Francis, A., Gavidia-Payne, S., & Cotton, S. (2000). Stress, behaviour, and sleep problems in children with an intellectual disability. *Journal of Intellectual & Developmental Disability*, 25(2), 147-161. <https://doi.org/10.1080/13269780050033562>
- Rossignol, D. A., & Frye, R. E. (2011). Melatonin in autism spectrum disorders: a systematic review and meta-analysis. *Developmental Medicine & Child Neurology*, 53(9), 783-792.

<https://doi.org/https://doi.org/10.1111/j.1469-8749.2011.03980.x>

- Schlieber, M., & Han, J. (2018). The sleeping patterns of Head Start children and the influence on developmental outcomes. *Child: Care, Health and Development*, 44(3), 462-469. <https://doi.org/https://doi.org/10.1111/cch.12522>
- Shields, N., King, M., Corbett, M., & Imms, C. (2014). Is participation among children with intellectual disabilities in outside school activities similar to their typically developing peers? A systematic review. *Developmental Neurorehabilitation*, 17(1), 64-71.

<https://doi.org/10.3109/17518423.2013.836256>

- Souders, M. C., Zavodny, S., Eriksen, W., Sinko, R., Connell, J., Kerns, C., Schaaf, R., & Pinto-Martin, J. (2017). Sleep in Children with Autism Spectrum Disorder. *Current Psychiatry Reports*, 19(6), 34. <https://doi.org/10.1007/s11920-017-0782-x>
- Thackeray, E. J., & Richdale, A. L. (2002). The behavioural treatment of sleep difficulties in children with an intellectual disability. *Behavioral Interventions*, 17(4), 211-231. <https://doi.org/https://doi.org/10.1002/bin.123>

## Appendix

Survey form "Sleeping patterns in Children with Developmental Disabilities"

Dear parents,

The purpose of this survey is to find out more about sleeping patterns of children with developmental disabilities. Please complete the form to the best of your knowledge.

1. Child's age \_\_\_\_\_
2. Child's diagnosis \_\_\_\_\_
3. On average, how long does your child sleeps during the night? \_\_\_\_\_
4. Does your child wake up during the night? Rarely Often Always
5. How much screen time does your child have during the day? \_\_\_\_\_
6. How much time does your child spend outside (play, walking)? \_\_\_\_\_
7. What supplements/medications does your child use to fall asleep? \_\_\_\_\_
8. How do you settle your child for sleep? \_\_\_\_\_
9. If your child wakes up during the night, how do you settle him back to sleep? \_\_\_\_\_
10. Any additional comments? \_\_\_\_\_