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Brief Report: Sleep Disturbances in Young Children with Type 1 Diabetes

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Summary

This multi-method study, including actigraphy, sleep diaries, and questionnaires, indicated significant sleep disturbances in young children with type 1 diabetes (age 3–5) and insufficient sleep duration in children and their parents. Results provide initial support for sleep as a potential target to improve both diabetes outcomes and parental distress.

Keywords

sleep; psychological stress; type 1 diabetes mellitus; parenting

1. Introduction

Type 1 diabetes (T1D) affects 1 in every 400 individuals under the age of 20 years, and recent studies suggest that the incidence of T1D in young children (under age 5 years) is rising faster than in other age groups (1). Parents of young children with T1D face management challenges related to hypoglycemic unawareness, limited communication, and irregular food and activity patterns (2), and only 22% of young children (ages 2–5 years) meet the recommended treatment goal (3). Sleep disturbances occur in about 30% of youth in the general population (4), and children with T1D may be particularly vulnerable to sleep disturbances, as parents often wake children at night to avoid nocturnal hypoglycemia (5). The purpose of the current study was to conduct a pilot study to collect multi-method data on sleep in young children with T1D. We hypothesized that young children and their parents would exhibit significant sleep disturbances.

2. Research Design and Methods

Families were eligible if the child was between the ages of 2–5 years, diagnosed with T1D for at least 6 months, and had no diagnosed sleep disorders (e.g., restless leg syndrome, sleep apnea, narcolepsy). Participants included 10 children with type 1 diabetes and 10

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parents (mean child age = 4.1, 30% female, 80% White, non-Hispanic, 20% Black). The majority of parents were married/partnered (90%), with median family income of $40,000–59,999. Half of the children used insulin pumps, and one used a continuous glucose monitor. Mean HbA1c of the sample was 8.4% ± 1.2 (68 mmol/mol).

In line with our protocol approved by the Institutional Review Board, after providing informed consent, parents completed questionnaires and received detailed training for the use of actigraphy and sleep diaries. Children wore the accelerometer at bedtime for 10 days (the majority chose to wear it in the pocket of a snug-fitting shirt (6)). Parents completed sleep diaries daily to record the child's daytime sleep-related behaviors (e.g., behavior, naps), and nocturnal sleep characteristics (bedtime, night wakings, glucose values before bed).

Child sleep was measured objectively with the Phillips Actiwatch, an activity meter, which samples activity data at frequent intervals (i.e., every 30 seconds), allowing for calculation of sleep parameters (sleep latency, sleep efficiency, total sleep time, and wake time after sleep onset). Watches provided a mean of 8.3 nights of usable data; data were manually scored using sleep diaries to verify bedtime/waketime.

Parents completed the Children's Sleep Habits Questionnaire (CSHQ) (7, 8), consisting of 45 items to measure bedtime resistance, sleep anxiety, sleep onset delay, sleep duration, and night waking. Higher scores indicate greater frequency of sleep problems, and a total Sleep Disturbance score of 41 indicates clinically significant sleep disturbances. Parents also reported on their own sleep duration and nocturnal caregiving.

Glycemic control was measured with hemoglobin A1C (HbA1c), an average of blood glucose values over the past 8–12 weeks. The target for children with T1D is < 7.5% (58 mmol/mol) (9).

3. Results

As seen in Table 1, based on nighttime actigraphy data, mean sleep duration in our sample was 8.1 hours, below the most recent recommendations for sleep duration in this age group (10–13 hours/night) (10). Mean sleep latency (amount of time to fall asleep) was 26.7 minutes, and average sleep efficiency was 82.5%, slightly below the recommended range of 85%. The mean wake after sleep onset time (time awake after initially falling asleep, but before waking for the day; $M = 56.9$ minutes) was above the recommended range. Questionnaire data indicated that the majority of children in our sample experienced significant sleep problems; 90% of scored above the clinical cutoff for sleep disturbances on the CSHQ (mean score = 44.70). Bedtime ranged from 8:18–10:42 pm (mean time: 9:34 pm).

Parents' reports of their own sleep revealed sleep duration of 6.2 (± 0.9) hours/night, and 80% reported sleep duration less than the recommended 7–9 hours. Further, 100% of parents reported checking blood glucose at night, and glucometer downloads indicated an average of 1.7 checks per night.

4. Conclusions

The current pilot study is the first, to our knowledge, to examine sleep in young children with T1D using objective measures. In line with our hypothesis, the majority of children in our sample were experiencing significant sleep disturbances and obtaining insufficient sleep. Parents in our sample also reported that their own sleep was also insufficient, which may impair their ability to effectively manage their children's diabetes. This is consistent with other studies, finding that caregivers of children with chronic health conditions experience frequent sleep disruptions, which increases parenting stress and impairs daytime functioning (12). Similar to previous studies (11), we found that all of the parents in our sample reported nighttime blood glucose checks of their young children. Although some nighttime checks are appropriate (i.e., when the child's blood glucose is low at bedtime), it is likely that parental anxiety is contributing to excessive nighttime checking (4), as none of the children in our sample had a nighttime glucose before 150 in the month before or during the study period. This nighttime caregiving has been associated with increased parenting stress (11), and insufficient sleep in parents (12).

Although small, the sample was representative of the clinic population and similar to national samples of youth with T1D (3). The current study builds on previous work in this area by using more objective measures, including actigraphy to measure sleep, and glucometer data to measure nighttime caregiving. In our future work, we plan to collect actigraphy data on parental sleep as well. Future studies are also needed to determine whether the use of continuous glucose monitoring improves child and parent sleep by reducing the need for nocturnal blood glucose checks.

While sleep disruptions have biological, circadian, and neurodevelopmental causes, they are also influenced by environmental and behavioral factors, which may be modified (5). Further, insufficient and poor quality sleep has been related to child behavior problems in the general population, and to decreased insulin sensitivity and poorer glycemic control in adolescents and adults with T1D (13,14). The high rates of clinically significant sleep disturbance in this population support sleep as a potential target for intervention to reduce parenting stress and improve diabetes outcomes in young children with T1D.

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References

1. Vehik K, Hamman RF, Lezotte D, et al. Increasing incidence of type 1 diabetes in 0–17-year-old Colorado youth. Diabetes Care. 2007; 30:503–509. [PubMed: 17327312]
2. Smaldone A, Ritholz MD. Perceptions of parenting children with type 1 diabetes diagnosed in early childhood. J Pediatr Health Care. 2011; 25:87–95. [PubMed: 21320680]
3. Miller KM, Foster NC, Beck RW, et al. Current state of type 1 diabetes treatment in the U.S.: Updated data from the T1D Exchange clinic registry. Diabetes Care. 2015; 38:971–978. [PubMed: 25998289]

4. Monaghan MC, Hilliard ME, Cogen FR, et al. Nighttime caregiving behaviors among parents of young children with Type 1 diabetes: associations with illness characteristics and parent functioning. Fam Syst Health. 2009; 27:28–38. [PubMed: 19630443]
5. Mindell JA, Kuhn B, Lewin DS. Behavioral treatment of bedtime problems and nigh wakings in infants and young children. Sleep. 2006; 29:1263–1276. [PubMed: 17068979]
6. Adkins KW, Goldman SE, Fawkes D, et al. A pilot study of shoulder placement for actigraphy in children. Behav Sleep Med. 2012; 10:138–147. [PubMed: 22468931]
7. Owens J, Spirito A, McGuinn M. The Chidlren's Sleep Habits Questionnaire (CSHQ): Psychometric properties of a survey instrument for school-age children. Sleep. 2000; 23:1–9.
8. Goodlin-Jones BL, Sitnick SL, Tang K, et al. The Children's Sleep Habits Questionnaire in toddlers and preschool children. J Dev Behav Pediatr. 2008; 29:82–88. [PubMed: 18478627]
9. American Diabetes Association. Standards of medical care in diabetes-- 2016. Diabetes Care. 2016; 39:S1–S106. [PubMed: 26696671]
10. National Sleep Foundation. How Much Sleep Do We Really Need? [Accessed 15 Dec 2015] https://sleepfoundation.org/how-sleep-works/how-much-sleep-do-we-really-need.
11. Monaghan MC, Herbert LJ, Cogen FR, et al. Sleep behaviors and parent functioning in young children with Type 1 Diabetes. Child Health Care. 2012; 41:246–259. [PubMed: 25035574]
12. Meltzer LJ, Moore M. Sleep disruptions in parents of children and adolescents with chronic illnesses: prevalence, causes, and consequences. J Pediatr Psychol. 2008; 33:279–291. [PubMed: 18084038]
13. Perfect MM, Patel PG, Scott RE, et al. Sleep, glucose, and functioning in youth with type 1 diabetes. Sleep. 2012; 35:81–88. [PubMed: 22215921]
14. Donga E, Van Dijk M, Van Dijk JG, et al. Partial sleep restriction decreases insulin sensitivity in type 1 diabetes. Diabetes Care. 2010; 33:1573–1577. [PubMed: 20357381]

Highlights

- Young children with T1D experience high rates of sleep disturbances.
- The majority of both children with T1D and parents do not obtain sufficient sleep.
- Parents report frequent nocturnal caregiving, which may disrupt sleep.

Table 1

Descriptive Statistics and Recommendations for Child and Parent Sleep Parameters

	Range	Mean (SD)	Recommendations
Total Sleep Time (hours)	7.1 – 9.4	8.1 (0.8)	10–13
Sleep Efficiency (percent)	72.2 – 90.6	82.5 (5.6)	>85
Sleep Latency (minutes)	15.1 – 84.7	26.7 (21.7)	<30
Wake After Sleep (minutes)	25.9 – 105.4	56.9 (22.0)	<30
Number Awakenings	27.8 – 58.3	42.5 (8.0)	n/a
CSHQ Total Score	39–48	44.7 (3.0)	< 43
Parent Sleep Duration	5.0 – 8.0	6.2 (0.9)	7–9
Average Nighttime Checks	0.6–4.1	1.7 (1.1)	n/a

Note. Recommendations from National Sleep Foundation.[9]