

UTILIZING ACTIGRAPHY TO EXAMINE SLEEP IN YOUNG CHILDREN WITH TYPE 1 DIABETES

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Type 1 Diabetes

- 1 in 400 children are diagnosed each year¹
 - Incidence in young children rising faster than other age groups
- The daily treatment regimen is complex and demanding
 - At this age, parents are responsible for the majority of diabetes management tasks
- Only 22% of young children (aged 2-5) meet the recommended treatment goal ($\text{HbA1c} < 7.5\%$)²

1) Vehiick et al., 2007

2) Miller et al., 2015

Impact of Sleep on Young Children with T1D

- Around 20-30% of typically developing young children experience problems with sleep¹ and children with chronic illness may be at an increased risk²
- Young children with T1D often have high insulin sensitivity and may be particularly vulnerable to sleep disturbances³
- Chronic sleep disturbances linked to emotional and behavioral problems in young children⁴
- Poor sleep habits also related to decreased insulin sensitivity and academic problems in adults and youth with type 1 diabetes⁵

1) Mindell et al., 2006

2) Hysing et al., 2009

3) Streisand & Monaghan, 2014

4) Reid et al., 2009

5) Perfect et al., 2012

Impact of Sleep on Parents of Young Children with T1D

- Parents of young children report constant vigilance, due to facing additional challenges related to child's age.¹
- For some parents, concern about hypoglycemia and seizures is heightened at nighttime and naptime²
- Rates of clinically significant stress/distress symptoms are evident in 22-74% of parents³

1) Jaser et al., 2009

2) Sullivan-Bolyai et al., 2003

3) Monaghan et al., 2012

Current Study

- Insufficient and poor quality sleep has been related to adverse outcomes for young children in the general population, as well as adolescents and adults with T1D
- We aimed to:
 - ▣ Demonstrate the feasibility of actigraphy in young children with type 1 diabetes
 - ▣ Describe sleep in these children and their parents using multi-method data.

Inclusion Criteria

- ❑ Child aged 2-5
- ❑ Child free of other major health problems or sleep disorders
- ❑ Child diagnosed with T1D > 6 months ago
- ❑ Parent able to speak and read English

Sample

- Young Children (N=10)
 - ▣ Age: $M = 4.6$ years (Range = 3-5)
 - ▣ Gender: 7 female, 3 male
 - ▣ Race: 8 White Non-Hispanic, 2 Black Non-Hispanic
 - ▣ Duration of Diabetes: $M = 2.5$ years (Range = 8 months-5 years)
 - ▣ HbA1c: $M = 8.4\%$ (Range = 6.9-10%)
 - ▣ 5 of the children used insulin pumps
 - ▣ 1 of the children used a continuous glucose monitoring system

Sample

- Parents (N = 10)
 - Age: 31 years (Range = 23-38)
 - 9 Biological Mothers, 1 Biological father
 - Race/Ethnicity: 8 White Non-Hispanic, 2 Black Non-Hispanic
 - Marital Status
 - 9 married/partnered
 - Annual Family Income
 - 1 < 20,000/year
 - 5- \$40,000-\$80,000/year
 - 4- > \$80,000/year

Procedure

- Parents completed questionnaires on demographic variables, their sleep routine, and their child's sleep. Glycemic control (HbA1c) and glucometers were downloaded



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- Parents received both verbal and written instruction on use of the actigraphy watch and sleep diary
- Children were given a special t-shirt to wear the actigraphy watch in while sleeping



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- Children were given a special t-shirt to wear the actigraphy watch in while sleeping
- Children wore the watch (in the t-shirt) at bedtime and parents filled out the sleep diary for 10 days

Initial Data
Collection

Watch
Training

Watch Data
Collection

Sleep Questionnaire Measures

□ Parent Sleep

- ▣ Pittsburgh Sleep Quality Index (PSQI)¹
- ▣ Cut-off Score of ≥ 5

□ Child Sleep

- ▣ Child Sleep Habits Questionnaire (CSHQ)²
- ▣ Cut-off Score of ≥ 41

1) Buysse et al., 1998

2) Goodlin-Jones et al., 2008

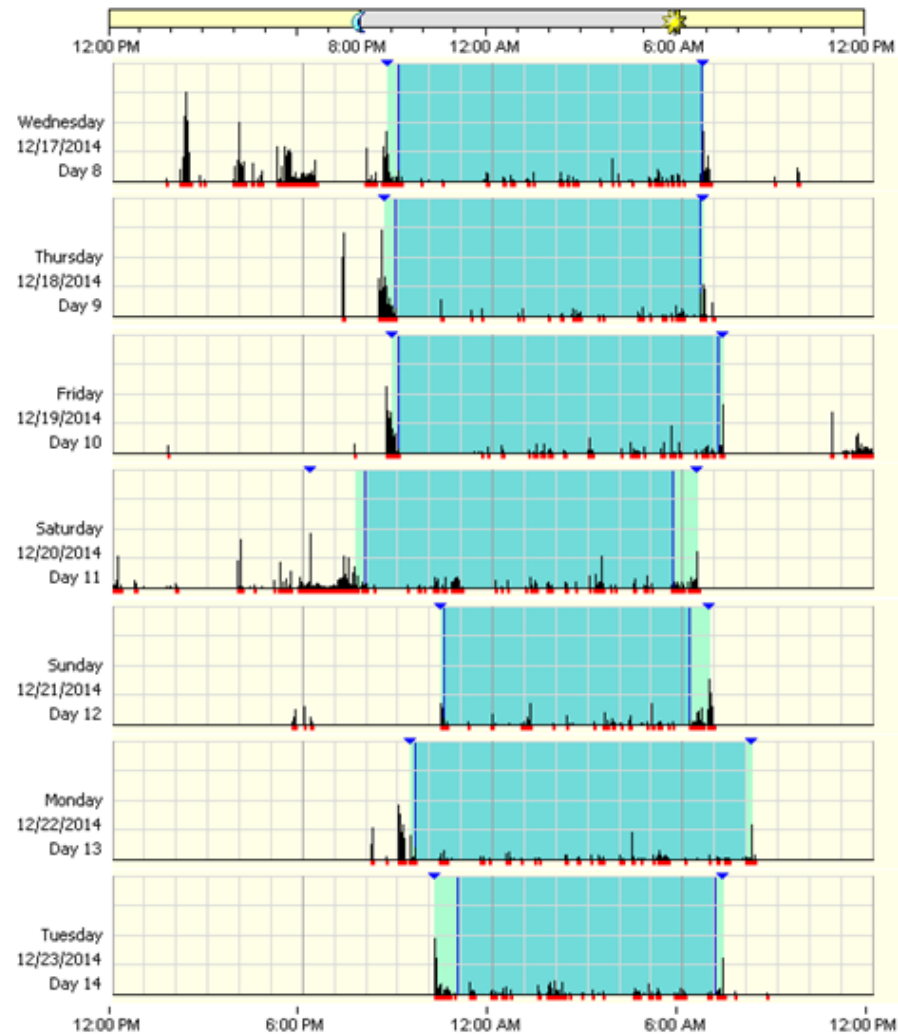
Actigraphy



- 9/10 children chose to wear the actigraphy watch in the pocket of a t-shirt (one child preferred to wear the watch on her wrist)
- The t-shirt or watch was placed on the child under pajamas (or on the wrist) during their normal bedtime routine
- Once the parent was done interacting with the child (lights out) he/she would press the button
- The parent would press the button once again when the child woke up

Sample Actigraphy Data

Actogram:



SLEEP DIARY DAY 1

BEDTIME 10:30pm

Night 1 Survey

1. Rate your stress level for the day.(Circle)
⊗ 0 ① 2 3 4 5 6 7 8 9 10 ⊗
2. Rate your child's behavior today.(Circle)
⊗ 0 ① 2 3 4 5 6 7 8 9 10 ⊗
3. Please list the time and length of any naps your child took today.

Time	Length
3:20 pm	1 hr 25 min

WAKE TIME 9.00 am

Morning 1 Survey

1. Did your child wake up before you this morning? YES ☒ NO ☐
2. Did the watch fall off during the night? YES ☐ NO ☒
3. Record any times your child woke up during the night below. (NOT INCLUDING BLOOD GLUCOSE CHECKS)

Time	Length	Reason

DATE: 1-26

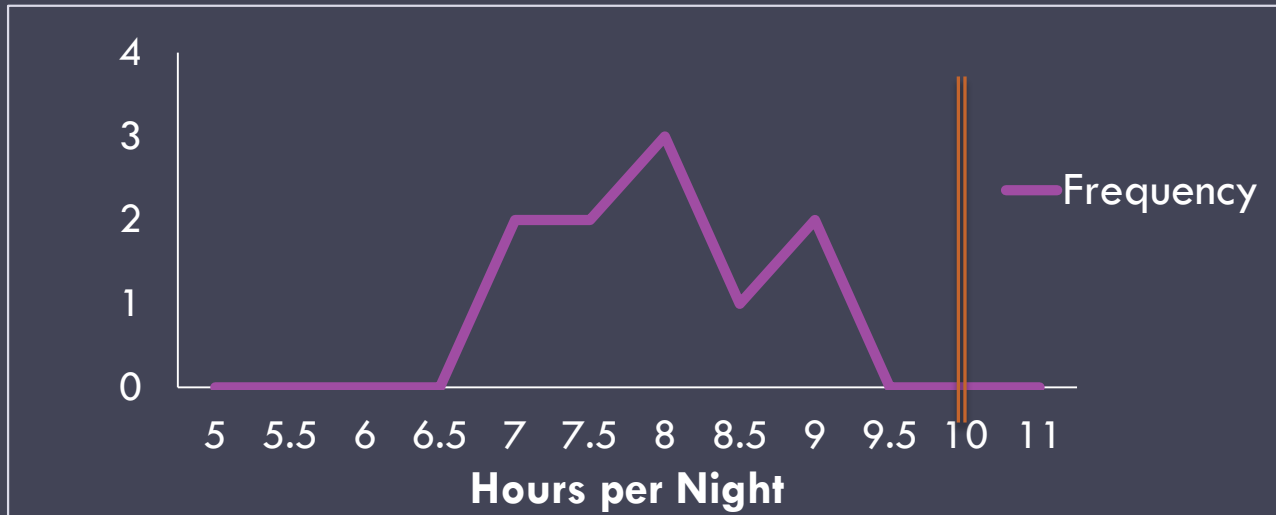
Night Time Blood Glucose Checks

Time	Result
10:15 PM	227
2:00 AM	185

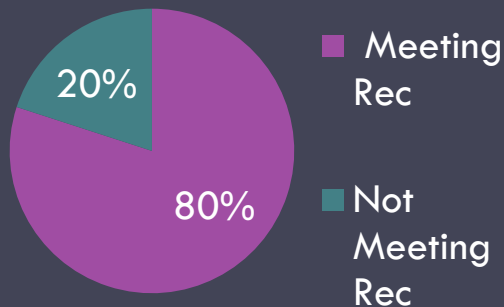
NOTES: Please note any unusual circumstances or changes in routine today or tonight (sickness, medications given, different caregiver putting child to bed)

Description of Child Sleep

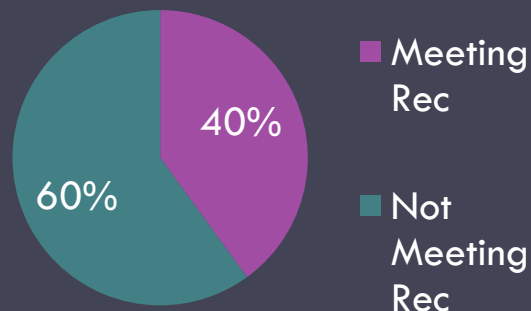
Distribution Curve of Sleep Duration



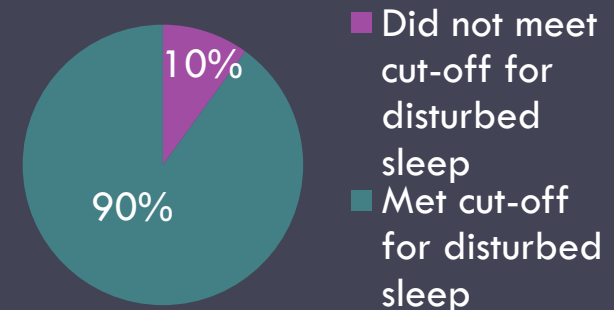
Sleep Latency



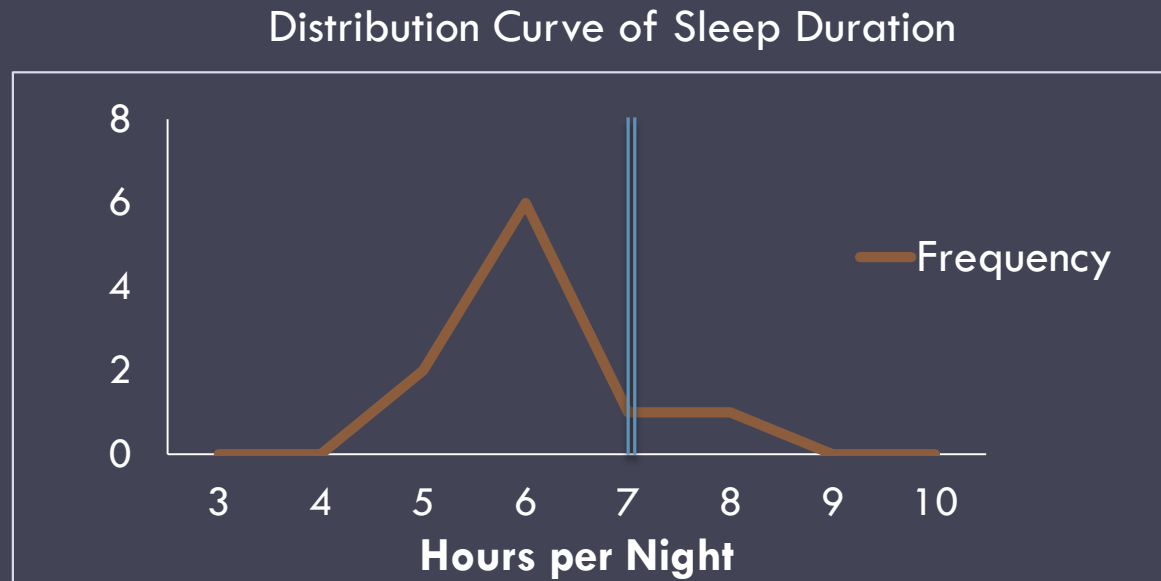
Sleep Efficiency



Child Sleep Habits Questionnaire



Description of Parent Sleep

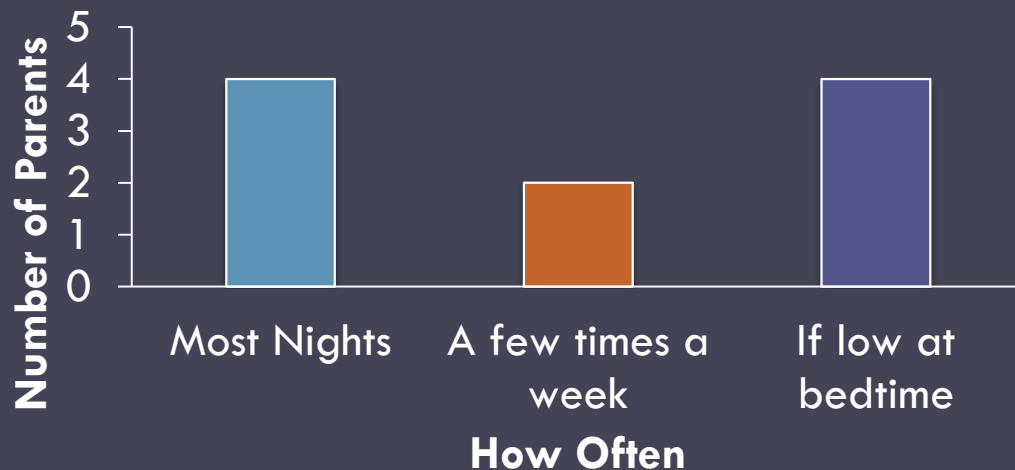


- 100% of parents had a total global PSQI score indicative of poor sleep quality

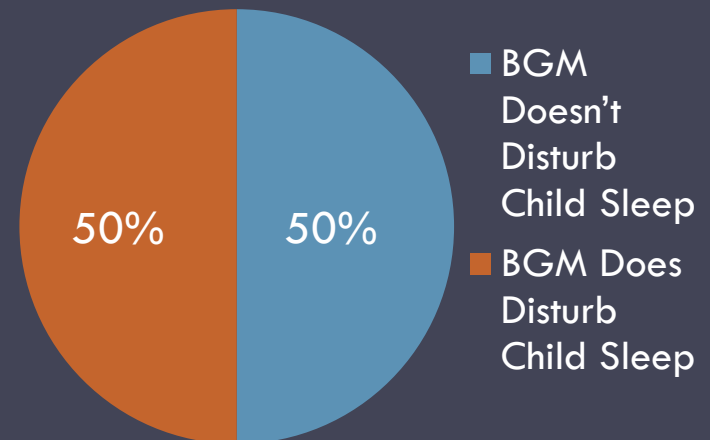
Nocturnal Caregiving

- 100% of parents reported checking their child's blood sugar at night
 - Average number of nighttime checks ranged from 0.6-4.1 (m=1.7)
 - Average nighttime glucose ranged from 154-313.7 (m=226.31)

Nighttime BGM Checked:



Exit Interviews



Conclusions

- Neither parents nor children met recommendations for total amounts of sleep
 - Child's sleep efficiency was lower than recommended, despite most children falling asleep within 30 minutes
- Disturbed sleep is common in young children with T1D and their parents
 - Nocturnal caregiving behaviors may play a part in disturbing sleep

Limitations

- Small sample size
 - ▣ May not be generalizable (although it was representative of the clinic population)
 - ▣ Not sufficient statistical power to examine associations between variables (sleep and glycemic control, BGM)

Future Directions

- Future studies are needed to examine the associations between child and parent sleep, parenting stress, and diabetes management.
 - However, these findings highlight sleep as a potential target for intervention to reduce parenting stress
- Clinical implications – providers should be aware that young children with T1D and their parents are at high risk for sleep disturbances.

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