Unveiling the Mysteries of Sleep Disorders in Children with Autism

Gregory P. Hanley Ph.D., BCBA-D

Public Lecture
University of Auckland / ABA awareness Week
October 2016
Learn more by reading the sleep research articles authored by these behavior analysts:

Neville Blampied
Richard Bootzin
Mark Durand
Karen France
Patrick Friman
Carl Merle Johnson
Cathleen Piazza
Common Sleep Problems

Delayed sleep onset (long latency to fall asleep)
- Sleep-interfering behavior
  - crying, calling out, curtain calls, playing, stereotypy, talking to oneself, etc.

Night awakenings / Early awakenings

Short sleep duration

Phase shifts (sleeping at wrong times thus conflicting with daily routines)
Sleep Problems of Children with Autism

(1) Prevalent

(2) Do not abate over time
Sleep Problems of Children with Autism

(3) Probably anchoring children’s deficits
(Interfere with skill development)
Sleep Problems of Children with Autism

(4) Worsen maternal mental health
(negatively affect family functioning)
Sleep Problems of Children with Autism

(5) Probably not caused directly by the unique neurobiology of children with autism

(6) Best understood as a learning issue
Sleep Problems of Children with Autism

(7) Worsened by the most common treatments
Sleep Problems of Children with Autism

(8) Meaningfully addressed with comprehensive treatments

that involve changes to the variables in two competing contingencies
Sleep Problems of Children with Autism

(9) Best solved by first understanding the child-specific variables operating on two competing behaviors:

behavioral quietude vs interfering behavior
Sleep Problems of Children with Autism

(10) May be addressed best by behavior analysts
Sleep problems are prevalent, especially for children with autism

10-50% of children without autism

50-80% of children with autism

Richdale, *Dev Med Child Neurol* 1999
Couturier et al., *J Am Acad Child Adolesc Psychiatry* 2005
Malow et al., *Sleep* 2006
Krakowiak et al., *J Sleep Res* 2008
Richdale & Schreck, *Sleep Med Rev* 2009
Souders et al., *Sleep* 2009
Cortesi et al., *Sleep Medicine* 2010
Hodge et al., 2014, *Res in Dev Dis*

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Hodge et al., 2014, *Res in Dev Dis*

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Sleep problems generally do not resolve on their own, especially for children with autism

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What is different about children with autism and children of typical development with regards to sleep?

**Suspects:**
- Sleep architecture
  - e.g., Duration and quality of REM sleep
- Neurotransmitters and related biochemical pathways
  - Serotonin levels
  - Endogenous melatonin levels
    - ASMT (melatonin biochemical pathway)
  - GABA
  - GABAergic interneurons
- Clock genes
  - e.g., Per 3, BMAL, CRY

It is still not clear whether there is anything physiologically unique about children with autism that is contributing to their sleep problems.
E.g., Duration and quality of REM sleep

REM sleep: Long suspected of being of shorter duration and lower quality among children with autism

Tanguay et al. J Autism Child Schizophr 1976
Diomedi et al. Brain Dev 1999
Thirumalai et al. J Child Neurol 2002
Buckley et al. Arch Pedatr Adolesc Med 2010
E.g., Duration and quality of REM sleep

Malow et al. (Sleep, 2006)
E.g., Duration and quality of REM sleep

Malow et al. (*Sleep*, 2006) showed no difference in sleep structure, including quality and duration of REM sleep between children with and without autism.

**Important considerations:**

- Only Malow et al. restricted their study to children with no history of pharmacological intervention.
- Many drugs given to children with autism to facilitate sleep onset or to address irritability/problem behavior negatively affect the duration and quality of REM.
What else is correlated with sleep problems of children with autism?

<table>
<thead>
<tr>
<th>Author(s)</th>
<th>Journal/Magazine</th>
<th>Year</th>
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<tr>
<td>Richdale</td>
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<td>1999</td>
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## Correlates of Sleep Problems for Children with autism

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<tr>
<th>Cognitive impairment/IQ:</th>
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<tr>
<td>language impairment:</td>
<td>No</td>
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<td>social reciprocity:</td>
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<td>ritualistic/repetitive beh.:</td>
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<td>stereotypy</td>
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<td>Severe problem behavior:</td>
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Example:
Limited hours of **sleeping** negatively correlated with rates of **stereotypy**

![Graph showing the relationship between number of hours slept each night and mean baseline session rate of stereotypy.](image)

- Number of Hours Slept each Night
- Mean Baseline Session Rate of Stereotypy

$r = -0.484$, $p < 0.05$
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Screening for the correlates


See this article for a Screening Checklist:
May achieve more traditional objectives if you resolve the sleep problem

- Improve compliance with instructions
- Decrease severe problem behavior
- Gain stimulus control over stereotypy
- Decrease trials to master social and academic skills

... (this is a most important area of research)
May achieve more extraordinary objectives if you resolve the sleep problem

Improve parental sleep problems
Miminize maternal stress, malaise, and depression
Enhance family functioning/quality of life

Meltzer & Mindell  *J Fam Psychol*  2007
Hoffman et al.  *Focus on Aut and Oth Dev Dis*  2008
Meltzer  *Res in Aut Spec Dis*  2011
Hodge et al.  *J Aut & Dev Dis*  2013

*(this too is an important area of research)*
Maybe some other helping professionals will address the problem?

Mindell et al. *Pediatrics* 1994

Pediatricians receive only about 5 hours of training on sleep problems

Owens et al. *Pediatrics* 2001

In a survey of 626 pediatricians in New England, only 25% rated themselves as confident in treating pediatric sleep problems.
Maybe some other helping professionals will address the problem?

81% of children’s visits to pediatricians, psychiatrists, or family physicians for sleep problems result in a prescription for a medication

Owens et al. *Pediatrics* 2013
Families of children with autism are twice as likely to receive prescription to address insomnia of their children despite no FDA approval, no medication labeled for pediatric insomnia, no (or inconsistent) efficacy signal in literature
Treatment Options?

From: National Academy of Sciences, Committee on Sleep Medicine and Research, Board on Health Sciences Policy (2006)

“There have been no large-scale trials examining the safety and efficacy of hypnotics in children and adolescents. Other pharmacological classes used for insomnia include sedating anti-depressants, antihistamines, and antipsychotics, but their efficacy and safety for treating insomnia have not been thoroughly studied.”
### Baseline

- **Goal**
  - Wake time (08:00 am)
  - Goodnight time (09:00 pm)

### Behavioral Intervention

- **Behavioral Intervention**
  - **Melatonin**: 3 mg
  - **Clonidine**: 0.1 mg
  - **Hydroxyzine**: 4 ml

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**Graph Details**

- **Ideal sleep zone**
- **Asleep**
- **Nap**

**Timeline**

- **Goal**
  - Wake time (08:00 am)
  - Goodnight time (09:00 pm)

---

**Graph Labels**

- **Nights**: 5 10 15 20 25 30 35 40 45 50 55 60 65 70 75 80
- **Time**
- **Alice**
Freedom from sleep problems is possible and probable with:

**Individualized assessment**

**Individualized and comprehensive treatment:**

**Part 1:** Personalize Sleep Schedule

**Part 2:** Routinize Nighttime Routine

**Part 3:** Optimize Bedroom Conditions

**Part 4:** Regularize Sleep Dependencies

**Part 5:** Minimize Sleep Interfering Behavior

To learn more, go to [www.practicalfunctionalassessment.com](http://www.practicalfunctionalassessment.com)

For:

- Video-tutorial
- Workbook
- Downloadable assessment
- Handout for parents
- Powerpoint
- Peer-reviewed article
How do we assess and treat children’s sleep problem?

• With an open-ended interviews to identify the personal factors influencing the sleep problem
  – SATT: Sleep Assessment and Treatment Tool

• Through a conceptually systematic understanding of the common factors that influence good sleep and sleep problems

• By developing treatments with parents based on the controlling variables
Assumptions

• Behavioral quietude /Falling asleep are the behaviors of interest
  – Blampied and France, 1993; Bootzin, 1972

• Is influenced by past and present experiences in one’s sleeping environment
  – can be motivated (or demotivated)
  – can become reliant on environmental cues
  – can be affected by other reinforcers for other behaviors available at night
Looking through the lens of a contingency

Conduct a contingency analysis:

EO + SD \rightarrow \text{Behavioral Quietude} \rightarrow \text{Sr}

• That which is known:
  – Reinforcer (Sr) for behavioral quietude is \text{sleep}
Looking through the lens of a contingency

Conduct contingency analyses:

EO + SD → Behavioral Quietude → Sleep
In general, children need less sleep as they get older.

Said another way, Sleep is valuable for less time as children get older.
In general,

Sleep is more valuable an hour later than the time a child fell asleep on the prior night.
The value of sleep may be at its lowest at the family-expected bedtime
The value of sleep may be at its lowest at the family-expected bedtime

Adapted from: *Solve Your Child's Sleep Problems*, Richard Ferber, Simon & Schuster, 2006
Looking at behavioral quietude through the lens of a contingency

Abolishing Operations + SD $\rightarrow$ Falling Asleep $\rightarrow$ Sleep

What decreases the value of sleep when a child is put to bed?

– Having slept within 6 hours of being put to bed (e.g., cat naps on couch)
– Having slept too many hours the previous night
– Being put to bed in “forbidden zone” (2-3) hours prior to natural sleep phase
– Caffeine within 6 hours of being put to bed
– Exercise, hot bath, wrestling with parent right before bedtime
– Availability of other reinforcers after the bid goodnight
  • social reinforcers like parental attention/interaction/affection
  • automatic reinforcers via iPad, television or movies, internet browsing, etc.
  • automatic reinforcers via stereotypy or ritualistic behavior
– Overly warm, bright, or noisy sleep context
Looking at behavioral quietude through the lens of a contingency

EO + SD → BQ → Sleep

What increases the value of sleep as a reinforcer for BQ?

– Sleeping on the previous night for or just under the number of hours of sleep needed given age
– Being put to bed at the same time or slightly later than when one fell asleep the night before (and gradually fading back to desired time)
– Limiting daytime hours of sleep (napping for less than 20 min)
– Extending hours since last slept (not napping after 3pm)
– Dimming lights prior to bedtime / Making bedroom darker
– Scheduling access to literary classics like *Beowulf*
– Gradual transition between den to bed (minimize rich to lean transition)
Extreme Sleep Phase Shift?

Try **chronotherapy** if sleep phase is more than 4 hours past desirable sleep time:

Move sleep and awake times *forward* by 1 to 2 hours each night (larger leaps can be made with older children)
EO + SD → Behavioral Quietude → Sleep

Is the nighttime routine somewhat consistent and appropriate?

Are the sleep dependencies appropriate?
Routinize Nighttime Routine

*Some emphases prior to bid goodnight*

- Activities progress from active to passive
  - Make gradual changes in fun factor--avoid rich to barren context transition

- Exercise/baths earlier in routine

- Ambient light gets progressively dimmer

- Light snacks without caffeine

- Arrange big discrepancy in consequences for compliance vs. noncompliance to routine (avoid DRA with extinction)
FIGURE 3. TYPICAL SLEEP STAGE PROGRESSION IN THE YOUNG CHILD

Deep sleep early in the night
Light sleep and dreaming during most of the night
More deep sleep near morning
EO + SD $\rightarrow$ Behavioral Quietude $\rightarrow$ Sleep

Things that occasion sleep are not present when the child wakes up during the night = **Night Awakenings**

Things that occasion sleep are suddenly removed or inconsistently available = **Sleep Onset Delay** and possibly **sleep interfering behavior**

Troublesome SDs due to their inconsistent presence when children wake up during the night: TV, radio, bottles, “full belly,” presence of another person, being rocked or patted, lights, fallen stuffed animals
Occasion sleep with things that:
  - don’t require parental presence,
  - can be there the entire night, and
  - are transportable

  (e.g., for vacations or nights at Grandparent’s home)

Such as:
  - pillow, blanket, stuffed animal (with bed rails),
  - sound machine on continuous

Forquer & Johnson, Child and Fam Beh Ther, 2005

Eliminate or fade “bad” ones and replace with “good” ones
Looking through the lens of a contingency

Conduct contingency analyses:

EO + SD → Behavioral Quietude → Sleep

EO + SD → Interfering behaviors → Sr^- & Sr^+
Behaviors that interfere with behavioral quietude necessary for falling asleep

**Common forms:**

- leaving bed (curtain calls)
- crying / calling out
- playing in bed or in bedroom
  - (this includes motor or vocal stereotypy)
- talking to oneself
EO + SD $\Rightarrow$ Interfering behaviors $\Rightarrow$ Sr- & Sr+

Consider possible reinforcer(s):

- Attention, Interaction
- Food, drink
- Access to TV or toys
- Escape/avoidance of dark or of bedroom
- Automatic reinforcers
  (those directly produced by the behavior)

Combination of one or more
EO + SD $\rightarrow$ Interfering behaviors $\rightarrow$ Sr- & Sr+

Consider possible reinforcer(s):

- Attention, Interaction
- Food, drink
- Access to TV or toys
- Escape/avoidance of dark or of bedroom
- Automatic reinforcers
  - (those directly produced by the behavior)

Combination of one or more
1. Provide the presumed reinforcer prior to bidding the child good night

2. Remove SDs for reinforcers for interfering behavior

3. After bid goodnight, disrupt contingency between interfering behavior and its reinforcement

   e.g., Time-Based Visiting, Bedtime Pass

\[ EO + SD \rightarrow \text{Interfering behaviors} \rightarrow \text{Sr- & Sr+} \]
Behavioral Process Aims

- Establish value of sleep as reinforcer
- Develop stimulus control over behavioral quietude in bedroom
- Weaken value of reinforcers for SLIB
- Weaken stimulus control over SLIB
- Disrupt contingency between SLIB and its reinforcement
### Normalized Aims

**Part 1:** Personalize Sleep Schedule  
**Part 2:** Routinize Nighttime Routine  
**Part 3:** Optimize Bedroom Conditions  
**Part 4:** Regularize Sleep Dependencies  
**Part 5:** Minimize Sleep Interfering Behavior (SLIB)

### Behavioral Process Aims

- Establish value of sleep as reinforcer  
- Develop stimulus control over behavioral quietude in bedroom  
- Weaken stimulus control over SLIB  
- Develop stimulus control over behavioral quietude in bedroom  
- Weaken value of reinforcers for SLIB  
- Disrupt contingency between SLIB and its reinforcement
A typical case example

Ray

4-year-old-boy with Autism and hyperactivity

Parents tried multiple medications for sleep problems and physically restrained him to sleep each night
Part 1: Personalized Sleep Schedule
Faded bedtime: 11pm-9am → 9pm-7am

Part 2: Routinized Nighttime Routine
Pillow, blanket only available during sleep
No caffeine w/in 6 hrs of bed
Snuggle time with dimly lit movie on small screen outside of bed

Part 3: Optimized Bedroom Conditions
Made room colder

Part 4: Regularized Sleep Dependencies
White noise machine
No parental presence in bed

Part 5: Minimized Sleep Interfering Behavior
Time-based exiting
Part 1: Personalize Sleep Schedule

Part 2: Routinize Nighttime Routine

Part 3: Optimize Bedroom Conditions

Part 4: Regularize Sleep Dependencies

Part 5: Minimize Sleep Interfering Behavior
Social Acceptability Survey (Parents)

Table 1

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<th>Questions</th>
<th>Walter</th>
<th>Andy</th>
<th>Lou</th>
<th>Average (Range)</th>
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<tbody>
<tr>
<td>1. Acceptability of assessment procedures</td>
<td>7</td>
<td>6</td>
<td>7</td>
<td>6.7 (6-7)</td>
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<tr>
<td>2. Acceptability of treatment</td>
<td>7</td>
<td>6</td>
<td>7</td>
<td>6.7 (6-7)</td>
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<tr>
<td>3. Improvement in sleep</td>
<td>7</td>
<td>7</td>
<td>7</td>
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<tr>
<td>4. Consultation was helpful</td>
<td>7</td>
<td>6</td>
<td>7</td>
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Note: Likert scale: 1 to 7. 1 (not acceptable, not satisfied, not helpful), 7 (highly acceptable, highly satisfied, highly helpful)
Which is more effective and preferred for addressing sleep interfering behavior? (Jin & Hanley, in prep.)

Treatments

- Bedtime pass (DRA)
- Extinction
- Time-based Visiting (NCR)

Contingencies

- Reinforcement only if handed a pass
- No reinforcement (period)
- Reinforcement available according to time
### Results of Social Acceptability Questionnaire Administered to Parents

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<th></th>
<th>Gina</th>
<th>Sam</th>
<th>Alice</th>
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<td>Mom</td>
<td></td>
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#### Note

1 = most preferred strategy.
Just prior to bed, the children were allowed to choose the treatment for each night.
Cumulative Number of Selections

- **Bedtime Pass**
- **Extinction**
- **Time-based Visiting**

- **Sam**
- **Gina**
- **Alice**
For you to consider...

Start on Friday
Exercise
Avoid medicating to sleep
Avoid caffeine

Reflect on the day and tomorrow *before* you are in bed

and
Address sleep onset delay by:

- Making your bedtime 1 hr. later than usual,
- Getting out of bed if not asleep within 10-15 min, and sitting in chair & read a literary classic for 15 min or until drowsy,
- Gradually adjusting sleep and wake times to desired times.

To address difficulties getting out of bed in morning

- Use Sleep Cycle app as morning alarm
For more information go to:
www.practicalfunctionalassessment.com

Questions?

Contact info:
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