Sleep Problems of Children with Autism
Prevalent, Relevant, and Treatable by Behavior Analysts

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ABAI
May, 2016

For more information (tutorial, etc.), go to:
www.practicalfunctionalassessment.com

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

Wiggs & Stores	*J Intellect Disabil Res*	1996
Richdale	*Dev Med Child Neurol*	1999
Schreck & Mulick	*J Autism Dev Disord*	2000
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*

% of children to receive CSHQ score of 41 or above

	ASD group (%)	TD group (%)

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

% of children to receive CSHQ score of 41 or above

	ASD group (%)	TD group (%)
All ages (n = 216)	82	50

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

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All ages (n = 216)	82	50
Ages 3–5 (n = 50)	84	72

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

% of children to receive CSHQ score of 41 or above

	ASD group (%)	TD group (%)
All ages (n = 216)	82	50
Ages 3–5 (n = 50)	84	72
Ages 6–9 (n = 118)	78	46

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All ages (n = 216)	82	50
Ages 3–5 (n = 50)	84	72
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Ages 10–17 (n = 48)	88	38

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

% of children to receive CSHQ score of 41 or above

	ASD group (%)	TD group (%)
All ages (n = 216)	82	50
Ages 3–5 (n = 50)	84	72
Ages 6–9 (n = 118)	78	46
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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**

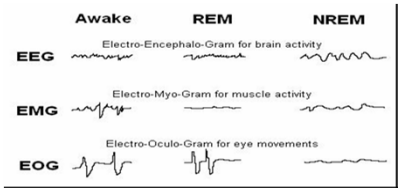
Clock genes
- **e.g., Per 3, BMAL, CRY**

It is still not clear whether there is anything physiologically unique about children with autism *<u>that is contributing to their sleep problems</u>*

E.g., Duration and quality of REM sleep

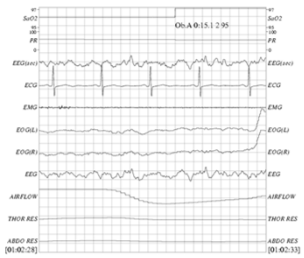
REM sleep: Long suspected of being of shorter duration and lower quality among children with autism

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)

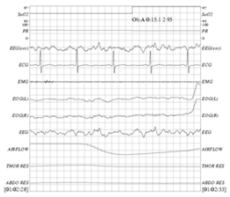


E.g., Duration and quality of REM sleep

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**



It is still not clear whether there is anything physiologically unique about children with autism *that is contributing to their sleep problems*

What else is correlated with sleep problems of children with autism?

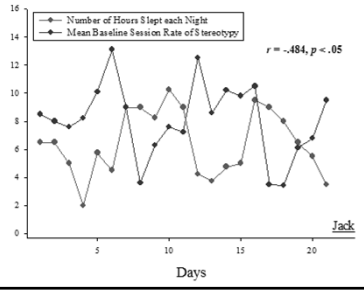
Richdale	*Dev Med Child Neurol*	1999
Schreck et al.	*Res in Dev Dis*	2004
Malow et al.	*Ped Neurol*	2006
Malow et al.	*Sleep*	2006
Liu et al.	*Child Psychiatry & Hum Dev*	2006
Krakowiak et al.	*J Sleep Res*	2008
Richdale & Schreck	*Sleep Med Rev*	2009
Goldman et al.	*Dev Neuropsychology*	2009
Cortesi et al.	*Sleep Medicine*	2010
Hollway & Aman	*Res in Dev Dis*	2011
Sikora et al.	*Pediatrics*	2012
DelaHaye et al.	*Res in Aut Spec Dis*	2013

Correlates of Sleep Problems for Children with autism

Cognitive impairment/IQ:	No
Autism Symptom Severity	
language impairment:	No
social reciprocity:	Yes
ritualistic/repetitive beh.:	Yes
stereotypy	Yes
Severe problem behavior:	Yes
Poor adaptive skill development:	Yes
Comorbid conditions	
ADHD	Yes
allergies:	Yes
asthma:	Yes
GI problems:	Yes
anxiety:	Yes
depression:	Yes
Health-related quality of life:	Yes

Example:

Limited hours of sleeping negatively correlated with rates of stereotypy



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depression:	Yes
Health-related quality of life:	Yes

Screening for the correlates

Reynolds & Malow ***Pediatr Clin N Am*** **2011**

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

Sadah et al.	***Dev. Psych.***	**2000**
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?

Stojanovski et al. *J Sleep & Sleep Dis Res* 2007

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

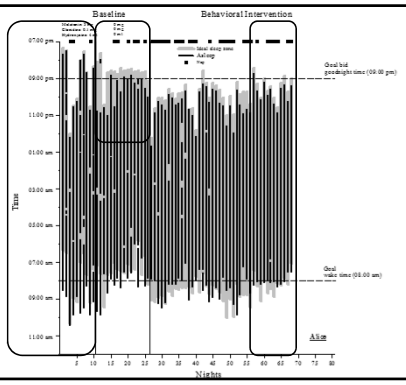
Families of children with autism are twice as likely to receive prescription to address insomnia of their children

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."



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 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 general 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 → Behavioral Quietude → **Sr**

- **That which is known:**
  - Reinforcer (Sr) for behavioral quietude is ***sleep***

Looking through the lens of a contingency

Conduct contingency analyses:

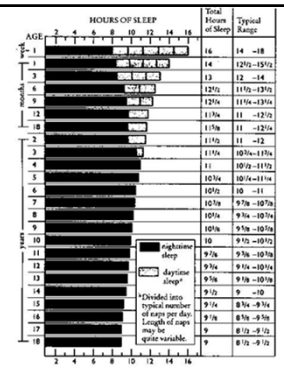
EO + SD → Behavioral Quietude → Sleep
?

In general,

children need less sleep as they get older.

Said another way,

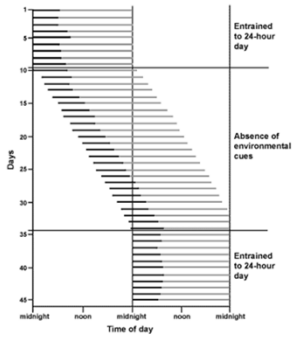
Sleep is valuable for less time as children get older



Adapted from: *Solve Your Child's Sleep Problems*, Richard Ferber, Simon & Schuster, 2006

In general,

Sleep is more valuable an hour later than the time a child fell asleep on the prior night



Copied from: *National Institute of Health (NIH) Sleep and Sleep Disorder's Teacher's Guide*

The value of sleep may be at its lowest at the family-expected bedtime

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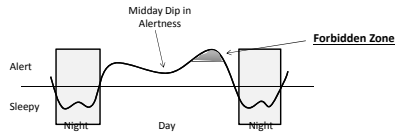

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Looking at behavioral quietude through the lens of a contingency

Abolishing Operations + SD → Falling Asleep → 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)

EO + SD → Behavioral Quietude → Sleep
?

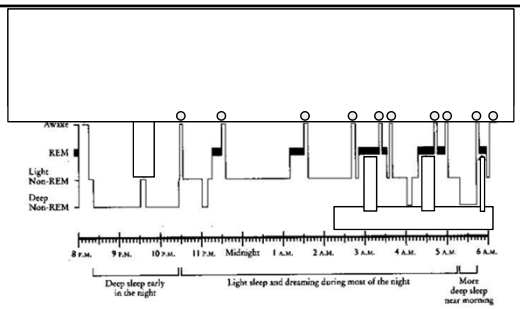

FIGURE 3. TYPICAL SLEEP STAGE PROGRESSION IN THE YOUNG CHILD

EO + SD → Behavioral Quietude → 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

EO + SD → Behavioral Quietude → Sleep

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:

$E\underset{?}{O}$ + $S\underset{?}{D}$ → Behavioral Quietude → Sleep

$E\underset{?}{O}$ + $S\underset{?}{D}$ → Interfering behaviors → $S\underset{?}{r}$- & $S\underset{?}{r}$+

EO + SD → Interfering behaviors → Sr- & Sr+

Behaviors that interfere with behavioral quietude necessary for falling asleep

<u>Common forms:</u>

leaving bed (curtain calls)
crying / calling out
playing in bed or in bedroom
(this includes motor or vocal stereotypy)
talking to oneself

EO + SD → Interfering behaviors → 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 → Interfering behaviors → Sr- & Sr+

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EO + SD → Interfering behaviors ↛ Sr- & Sr+

1 2 3

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**

Looking through the lens of a contingency

Conduct contingency analyses:

EO? + SD? → **Behavioral Quietude** → Sleep

EO? + SD? → **Interfering behaviors** → Sr-? & Sr+

Looking through the lens of a contingency

Conduct contingency analyses:

EO + SD → Behavioral Quietude → Sleep
1 **2**

EO + SD → Interfering behaviors ↛ Sr- & Sr+
3 **4** **5**

Behavioral Process Aims	
Establish value of sleep as reinforcer	**1**
Develop stimulus control over behavioral quietude in bedroom	**2**
Weaken value of reinforcers for SLIB	**3**
Weaken stimulus control over SLIB	**4**
Disrupt contingency between SLIB and its reinforcement	**5**

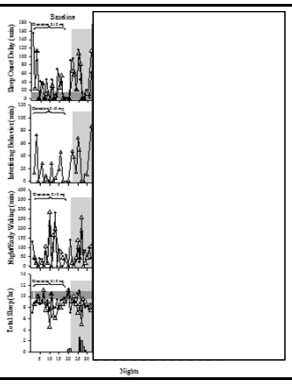
Normalized Aims	*Behavioral Process Aims*	
Part 1: Personalize Sleep Schedule	Establish value of sleep as reinforcer	1
Part 2: Routinize Nighttime Routine	Develop stimulus control over behavioral quietude in bedroom	2
Part 3: Optimize Bedroom Conditions	Weaken stimulus control over SLIB	4
Part 4: Regularize Sleep Dependencies	Develop stimulus control over behavioral quietude in bedroom	2
Part 5: Minimize Sleep Interfering Behavior (SLIB)	Weaken value of reinforcers for SLIB	3
	Disrupt contingency between SLIB and its reinforcement	5

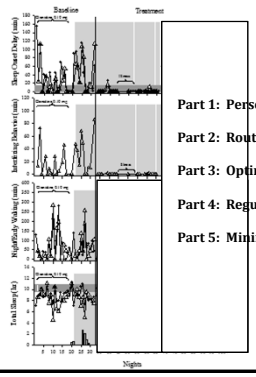
A typical case example

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

Part 2: Routinized Nighttime Routine

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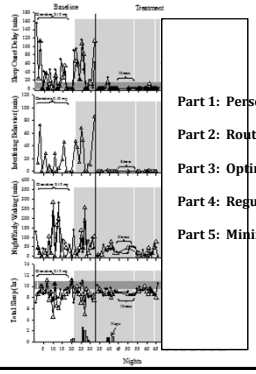
Part 4: Regularized Sleep Dependencies

Part 5: Minimized Sleep Interfering Behavior



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Journal of Applied Behavior Analysis

JOURNAL OF APPLIED BEHAVIOR ANALYSIS 2013, 9999, 1–20 NUMBER 9999 (SUMMER 2013)

AN INDIVIDUALIZED AND COMPREHENSIVE APPROACH TO TREATING SLEEP PROBLEMS IN YOUNG CHILDREN

C. Sandy Jin, Gregory P. Hanley, and Lauren Beaulieu

WESTERN NEW ENGLAND UNIVERSITY

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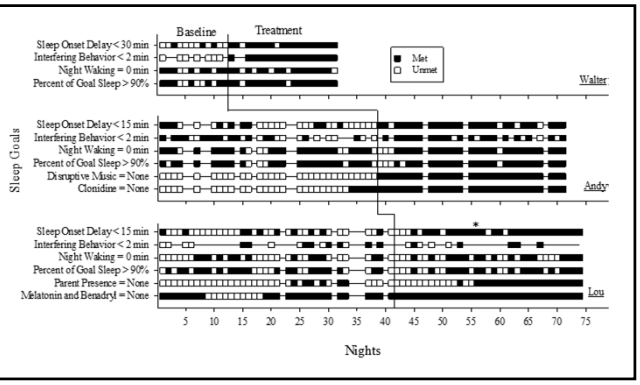


Social Acceptability Survey (Parents)

Table 1

Questions	Walter	Andy	Lou	Average (Range)
1. Acceptability of assessment procedures	7	6	7	6.7 (6-7)
2. Acceptability of treatment	7	6	7	6.7 (6-7)
3. Improvement in sleep	7	7	7	7
4. Consultation was helpful	7	6	7	6.7 (6-7)

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?

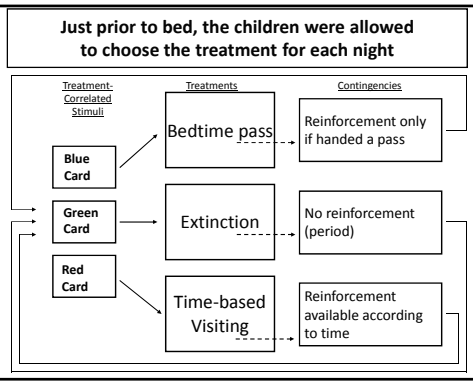
(Jin & Hanley, in prep.)

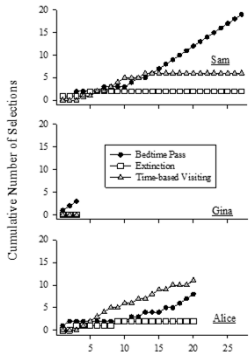
Treatments	Contingencies
Bedtime pass (DRA)	Reinforcement only if handed a pass
Extinction	No reinforcement (period)
Time-based Visiting (NCR)	Reinforcement available according to time

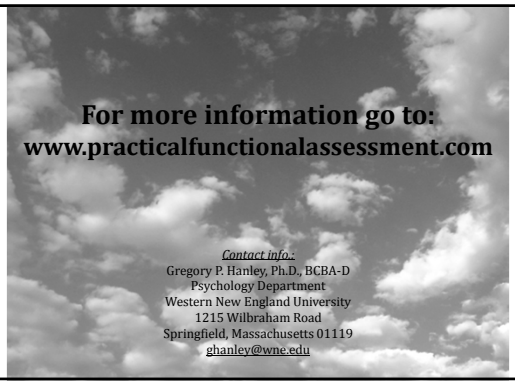
Results of Social Acceptability Questionnaire Administered to Parents

Gina	Sam		Alice
Mom	Mom	Dad	Mom
Bedtime Pass	**Time-based Visiting**	**Bedtime Pass**	**Extinction**
Extinction	Bedtime Pass	Extinction	Bedtime Pass
Time-based Visiting	Extinction	Time-based Visiting	Time-based Visiting

Note. 1 = most preferred strategy.






For more information go to:
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