Assessment and Treatment of Sleep Problems in Young Children

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Common Goal: Improve the Health and Development of Young Children

- Parents and Caregivers
- Pediatricians
- Behavior Analysts
- Child Psychologists
Behavior Analysis
Assumptions of Behavior Analysis Regarding Sleep

• Sleep problems are skill deficits

• Can be addressed by understanding the controlling variables and teaching the relevant skills
Assumptions of Behavior Analysis Regarding Sleep

• Falling asleep is a BEHAVIOR (Bootzin, 1972)

• Influenced by
  – Evolutionary history (phylogenetic selection)
  – Past and present experiences in one’s sleeping environment (ontogenic selection)
  – Cultural practice (cultural selection)
Why Assess and Treat Sleep Problems?
Sleep Problems in Children

• Commonly reported child-rearing difficulty

• Frequently complained to pediatricians

• One of the primary reasons for prescribing psychotropic medications to children

(Minde, 1998; Mindell et al., 1994)
Prevalent

up to 50% TD  up to 73% ASD

Polimeni et al. (2005)
Impact on Children

Associated with increased risk of:

- Unintentional injuries  (Koulouglioti et al., 2008)
- Difficult temperament (Richman, 1981)
- Obesity  (Bell & Zimmerman, 2010; Magee & Hale, 2012)
- Poor academic performance  (Dewald et al., 2010)
- Problem behaviors: noncompliance, aggression, & self-injury  (Wiggs & Stores; 1996)
Impact on Family

- Poor sleep quality (Meltzer & Mindell, 2007)
- Poor daytime functioning (Meltzer & Mindell, 2007)
- Maternal depression (Richman, 1981)
- Marital discord (Chavin & Tinson, 1980)
When Seeking Treatment Options…

On their own

Pediatricians
• ~5 hours training on sleep
• May say children outgrow these problems
  (Mindell et al. 1994)
• 25% rated themselves as confident in treating sleep problems
  (Owens, 2001)

Sleep Problems Stay Persistent
(Kataria et al., 1987; Zuckerman et al., 1987)
Pharmacological Interventions

• ~81% of children’s visits result in medication (Stojanovski, et al. 2007)
  - No prescribing guidelines
  - No drug approved by FDA
  - Limited research on efficacy, tolerability and acceptability

• ~75% of primary care pediatricians reported recommending nonprescription medication
• ~50% reported prescribing sleep medication (Owens et al. 2013)
What is being recommended?

Big Three

- **Antihistamine** (83% pediatricians reported use)
- **Clonidine** (46%)
- **Melatonin** (42%)

(Schnoes et al., 2006)
Melatonin

• Endogenous hormone secreted by the pineal gland (release suppressed by light)
• Nocturnal peak makes it a synchronizer of circadian rhythm
• Some evidence suggesting that it yields statistically significant improvement in sleep onset delay with minimal side effect
But…

- Studies that reported average sleep onset delay:
Nights

5 10 15 20 25 30 35 40 45 50 55 60 65 70 75 80

Time

07:00 pm
09:00 pm
11:00 pm
01:00 am
03:00 am
05:00 am
07:00 am
09:00 am
11:00 am

Baseline

Goal wake time (08:00 am)

Goal bid
goodnight time (09:00 pm)

Behavioral Intervention

Melatonin: 3 mg
Clonidine: 0.1 mg
Hydroxyzine: 4 ml
0 mg
0 mg
0 ml

Alice
Take-home Point

Chronic medication use is NOT the solution to sleep problems in young children
Behavioral Intervention

Recommended 22% of time (Stojanovski et al., 2007)

More modification than analysis
Some are no behavioral or evidence-based

- Commercially available products
  (e.g., candles and lotions, sleep fairy storybook)
- Positive routines
- Regular sleep schedule
- Changes to bedroom environment
- “letting the child cry it out”
- “Ferber” method
Limitations of Existing Behavioral Sleep Intervention

#1. Problems with measurement

- Emphasis on survey instruments
- Rely exclusively on subjective measurement (i.e., parental sleep diary)
- Intrusive and expensive objective measurement that yields little information regarding problem behavior (i.e., polysomnography at Sleep Lab)

Many other options available (e.g., nighttime video, actigraphy, edentrace system)
Limitations of Existing Behavioral Sleep Intervention

#2. Insensitive to social acceptability (measurement, context of treatment delivery, or treatment itself)

For example:

- Measurement or treatment within in-patient facilities (not home-based)
- Ignoring the child’s problem behavior (cry-out or severe problem behavior)

May result in poor treatment compliance and loss of confidence
Limitations of Existing Behavioral Sleep Intervention

#3. Not predicated on functional assessment

- Not based on an understanding of the contingency
- Neither personalized nor comprehensive
  - Focus on only one aspect of the problem, or
  - One-intervention-works-for-all-problems approach
Is Assessment-based Approach Effective?
• rule out medical conditions (e.g., sleep apnea, narcolepsy etc…)

Baseline measurement
• socially acceptable and objective measurement system

Functional assessment (SATT, Hanley 2009)
• identify sleep problems and controlling variables

Design personalized and comprehensive intervention
• encourage parents to develop goals and interventions with clinicians

Parent training
• behavior skills training: instruction, modeling, role-play, and feedback

Treatment implementation with measurement
• support, frequent feedback, reinforce treatment compliance

Social validity

Follow-up
Sleep Onset Delay (min)

- **Baseline**
  - Andy
  - Walter

- **Treatment**
  - Clonidine: 0.50 mg, 0.25 mg, 0.00 mg
  - Melatonin/Benadryl: 0/0 mg
  - Time-based Visiting: 0/0 mg
  - Parent Presence: 5/25 mg
# Social Validity Questionnaire

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<tr>
<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>
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<td>6</td>
<td>7</td>
<td>6.7 (6-7)</td>
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<tr>
<td>2. Acceptability of treatment</td>
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<td>6</td>
<td>7</td>
<td>6.7 (6-7)</td>
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<td>3. Improvement in sleep</td>
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<td>4. Consultation was helpful</td>
<td>7</td>
<td>6</td>
<td>7</td>
<td>6.7 (6-7)</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)*
Today

• What are the common sleep problems?

• What are the common factors that influence good sleep and sleep problems?

• How do we design personalized and comprehensive intervention based on this understanding of the factors that influence sleep?

• What are some strategies to include in our consideration?
Your Turn: What is Good Sleep?
Develop Reasonable Sleep Goals

– Falling asleep within minutes (e.g., 5-15 min)
– Staying asleep throughout the night or fall back asleep within minutes
– “Independent” sleep
  • Not relying on your presence
  • Not relying on medication
– Developmentally-appropriate amount of sleep
– Waking without much trouble and not feeling excessive drowsy during the day
Commonly Reported Sleep Problems

- Bedtime routine noncompliance
- Sleep interfering behavior (e.g., crying, calling out, getting out of bed, aggression, playing etc…)
- Delayed sleep onset
- Night awakenings
- Early awakenings
- Phase shift
- Insufficient sleep
Through the Lens of a Contingency

EO → Falling Asleep → SR+
SD → Sleep Interfering Behavior → SR+
Consideration #1

What occasions falling asleep by momentarily increasing value of sleep as a reinforcer?

- What occasions falling asleep by momentarily increasing value of sleep as a reinforcer?
Develop Optimal Schedule By:

A. Recognize age-appropriate sleep amounts

B. Importance of current sleep phase and “forbidden zone”

C. Universal tendency of to go bed later and wake up later
# Age-Based Sleep Averages:

<table>
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<tr>
<th>Age</th>
<th>Total Sleep</th>
<th>Night Sleep</th>
<th># Naps</th>
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<tr>
<td>2</td>
<td>11 hrs 30 min</td>
<td>9.5 hours</td>
<td>1 (2 hrs)</td>
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<td>3</td>
<td>11 hrs 15 min</td>
<td>10 hours</td>
<td>1 (1hr15min)</td>
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<td>4</td>
<td>11 hrs</td>
<td>10 -11 hours</td>
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<td>5</td>
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<td>10 hrs 30 min</td>
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<td>9 hrs 15 min</td>
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<td>18</td>
<td>9 hrs</td>
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Adapted from: *Solve Your Child's Sleep Problems*, Richard Ferber, Simon & Schuster, 2006
New NSF Recommendation

The graph shows recommended sleep hours for different age groups:
- **Newborn (0-3 months)**: 14-17 hours
- **Infant (4-11 months)**: 12-15 hours
- **Toddler (1-2 years)**: 11-14 hours
- **Preschool (3-5 years)**: 10-13 hours
- **School Age (6-13 years)**: 9-11 hours
- **Teen (14-17 years)**: 12 hours
- **Young Adult (18-25 years)**: 10-11 hours
- **Adult (26-64 years)**: 7-9 hours
- **Older Adult (65+)**: 5-6 hours

Colors indicate:
- **Blue**: Recommended
- **Light Blue**: May be Appropriate
- **Yellow**: Not Recommended
Caution:

Difficulty falling asleep, staying asleep, or complying with nighttime routines may occur if child is expected to be in bed too long

Difficulty waking up or day time tiredness may be related to child being in bed for too short of a time

Solution:

Schedule a developmentally-appropriate amount of sleep
Sleep Phase

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

Midday Dip in Alertness
(okay to nap for a brief period of time (e.g., 20 min)

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

We have a tendency to go to bed later and wake up later because of our 24.2 hr clock.

Artificial light and nighttime activity availability leads to a 25-hour clock.
Entrained to 24 hour day

"Free running" in temporal isolation $\gamma = 25$ hours

Entrained to 24 hour day
Caution:
Putting children to bed during the Forbidden Zone will increase the likelihood of delayed sleep onset, sleep interfering behavior, and routine noncompliance.

Solution:
Faded bedtime (response cost may not be necessary)

At the beginning of sleep treatment:
set the start of the sleep routine slightly later than when the child fell asleep the previous night.
Then gradually transition sleep phase earlier
if child falls asleep within 15 min, move bedtime 15-30 min earlier next night until desired bedtime is achieved (Piazza et al., 1991)
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)
Your Turn
Consideration #2

- What occasions falling asleep by signaling the availability of sleep as a reinforcer?
- Are those signals consistently available throughout the night?
A. Routinize Nighttime Routine

• Develop a nighttime routine that occasions “behavioral quietude”
• Routine consistently across nights
• Activities progress from active to passive
  – Consider providing choices (e.g., on a picture schedule)
  – Gradual transition from rich to barren environment
• Exercise and baths earlier in the routine
• Progressively dimming ambient light
• Light snacks without caffeine given earlier in the routine and before brushing teeth
Nighttime Routine Noncompliance

Tendency to not follow instructions during bedtime (e.g., brush teeth, put on PJs etc…)

Solution:

- Promote instruction following during the day (different workshop)
  - First consider proactive strategies (form of instruction, reinforce responding to name etc..), then consider reactive strategies (three-step etc…)
- Make sure sleep is valuable (e.g., child is sleepy) when starting routine. Start just prior to “natural” sleep phase
- Discrepancy in consequences for compliance vs noncompliance
  - Avoid TEACHING instruction-following at bedtime
  - Avoid reactive strategies at bedtime (extinction or punishment)
  - Differentially reinforce
Teaching Responding to Name
Beaulieu et al. (2013 JABA)

BL1

$U = 11, p > .05$

Individual Children

BL2

$U = 0, p < .05$

$U = 12, p > .05$

$U = 4.5, p < .05$
B. Optimize Bedroom Environment

• Bed with comfortable mattress

• Cool temperature
  – Can the child control the temperature?

• Indirect nightlight, curtains closed

• Non-undulating noise

(note these conditions increase the likelihood of healthy sleep dependencies)
C. Sleep Dependencies

Transition to sleep depends on stimuli associated with falling asleep
Sleep from Infancy to Adulthood

Sleep patterns from newborn infant to adult, showing the changes in sleep duration and patterns over time.
Sleep from Infancy to Adulthood

[Graph showing sleep patterns from infancy to adulthood]
Transition to sleep depends on stimuli associated with falling asleep (i.e., sleep dependencies).

These stimuli must be present throughout the night because children wake up multiple times.
Caution:
Things that occasion sleep are suddenly removed, inconsistently available, or not present when the child wakes up during the night = Sleep Onset Delay, Night Awakenings, and possibly Sleep Interfering Behavior

Examples: TV, electronics, radio, books, bottles, “full belly,” presence of another person, being rocked or patted, lights, fallen stuffed animal or blanket
Solution:
Eliminate or fade “bad” sleep dependencies and occasion sleep with things that don’t require your presence, can be there in the middle of the night, and are transportable (e.g., for vacations or nights at Grandparent’s home)

*Examples*: preferred blanket, stuffed animal, **white-noise** sound machine on continuously
Your Turn
Consideration #3

EO  Sleep  S^{R+}

SD  Interfering Behavior

• Examples:
  – Leaving bed (curtain calls)
  – Crying/calling out/excessive requests
  – Talking to oneself
  – Playing in bed with toys, iPads, etc…
  – Motor or vocal stereotypy
  – Severe problem behavior (SIB, property destruction)
Possible Reinforcers

- Attention/interaction
- Food/drink
- Access to toys, TV, electronics etc…
- Escape/avoidance of the dark
- Automatic reinforcers directly produced by the behavior
- Combination
Remember to Assess, Assess, Assess

- SATT (Hanley, 2009)
• Abolish the value of the reinforcer for SLIB
• Consider provide the presumed reinforcer prior to bidding goodnight
  – Access to stereotypy
  – Access to interaction/attention
Consideration #4

- Eliminate stimuli that occasion SLIB
- Consider bidding the “toys, iPads, books” goodnight routine
- Eliminate the presence of preferred activities
- Eliminate the sight of food/drinks/snacks
- Eliminate the signals of interaction/attention
Consideration #5

- Withhold access to the presumed reinforcer following SLIB (Disrupt the contingency)
  - “complete” withholding from the start (extinction)
  - Gradual elimination (thinning the reinforcer)
  - Deliver reinforcer independent of SLIB (NCR)
  - Reinforce alternatives, incompatibles, or the absence of SLIB (DRA, DRI, DRO)
**EXTINCTION**: withholding reinforcer following EACH occurrence of SLIB

- Extinction is procedurally different for attention-, escape-, automatic-maintained SLIB (letting the child cry it out is extinction for only attention-maintained SLIB)
- Rapid reduction of SLIB when consistently implemented

**CAUTION:**
- Poor treatment compliance may exacerbate the problem
- Extinction procedure does not match the function

**Solution:**
- Adequate training before implementation
- Frequent support and feedback
- Functional assessment before implementation
- Consider alternatives
Gradual elimination

– reducing the magnitude/intensity of the reinforcer
e.g., **QUALITY FADING**: gradually reduce the quality of interaction for att-SLIB

– Progressively increase the time from SLIB to the reinforcer
e.g., **PROGRESSIVE WAITING** (Ferber method)
  (risk of exacerbating SLIB)
Deliver the reinforcer independent of SLIB (NCR)

**TIME-BASED VISITING** for att-SLIB (also consider time-based exiting)

Visit your child at increasingly larger intervals after the bid good night and across nights (hopefully before IB occurs); during visit re-tuck them, bid good night, and leave

<table>
<thead>
<tr>
<th>Day</th>
<th>First visit</th>
<th>Second visit</th>
<th>Third visit</th>
<th>Fourth visit</th>
<th>Fifth visit</th>
<th>Sixth visit</th>
<th>Seventh visit</th>
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Differential Reinforcement

QUIET-BASED VISITING
Visit after increasingly larger intervals of quiet

BEDTIME PASS
Give your child one or more bedtime pass(es) to be used as needed after the bidding good night to exchange for reinforcers (e.g., grant request).
Bedtime pass

Blue Card
Reinforcement only if handed a pass

Green Card
No reinforcement (period)

Red Card
Reinforcement available according to time

Extinction

Time-based Visiting

Contingencies

Treatments

Treatment Correlated Stimuli

Bedtime pass

Reinforcement only if handed a pass

No reinforcement (period)

Reinforcement available according to time

Contingencies

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Reinforcement available according to time

Contingencies

Treatments

Bedtime pass

Reinforcement only if handed a pass

No reinforcement (period)

Reinforcement available according to time

Contingencies

Treatments

Bedtime pass

Reinforcement only if handed a pass

No reinforcement (period)

Reinforcement available according to time

Contingencies

Treatments

Bedtime pass

Reinforcement only if handed a pass

No reinforcement (period)

Reinforcement available according to time

Contingencies

Treatments

Bedtime pass

Reinforcement only if handed a pass

No reinforced
Parent Preference Idiosyncratic

Table 1

Results of Social Acceptability Questionnaire Administered to Parents

<table>
<thead>
<tr>
<th>Ranking</th>
<th>Sam</th>
<th>Alice</th>
<th>Gina</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Mom</td>
<td>Dad</td>
<td>Mom</td>
</tr>
<tr>
<td>1</td>
<td>Time-based Visiting</td>
<td>Bedtime Pass</td>
<td>Extinction</td>
</tr>
<tr>
<td>2</td>
<td>Bedtime Pass</td>
<td>Extinction</td>
<td>Bedtime Pass</td>
</tr>
<tr>
<td>3</td>
<td>Extinction</td>
<td>Time-based Visiting</td>
<td>Time-based Visiting</td>
</tr>
</tbody>
</table>

Note. 1 = most preferred strategy.
Your Turn
Establish the value of sleep around the time a child is bid goodnight (e.g., bedtime fading, chronotherapy)

Falling Asleep

Occasion behavioral quietude with reliable and salient stimuli at bedtime (e.g., white-noise sound machine on through the night, preferred blanket)
Abolish the value of the reinforcer for SLIB prior to and following the bid goodnight (e.g., story time with parents, provide access to stereotypy)

Sleep Interfering Behavior (SLIB)

Disrupt the contingency between SLIB and its reinforcer (e.g., extinction, bedtime pass, time-based visiting, quiet-based visiting)

Eliminate discriminative stimuli for SLIB at bedtime (e.g., setting clear barriers to toys,)

Summary
Summary

• Assess, Understand, Design, and Treat
Thank you!

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