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Penn State University

Assessment and Treatment of Sleep Problems in Young Children:

Designing Individualized, Function-based, and
Consumer Friendly Interventions
Through the Lens of a Contingency

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Parents and
Caregivers

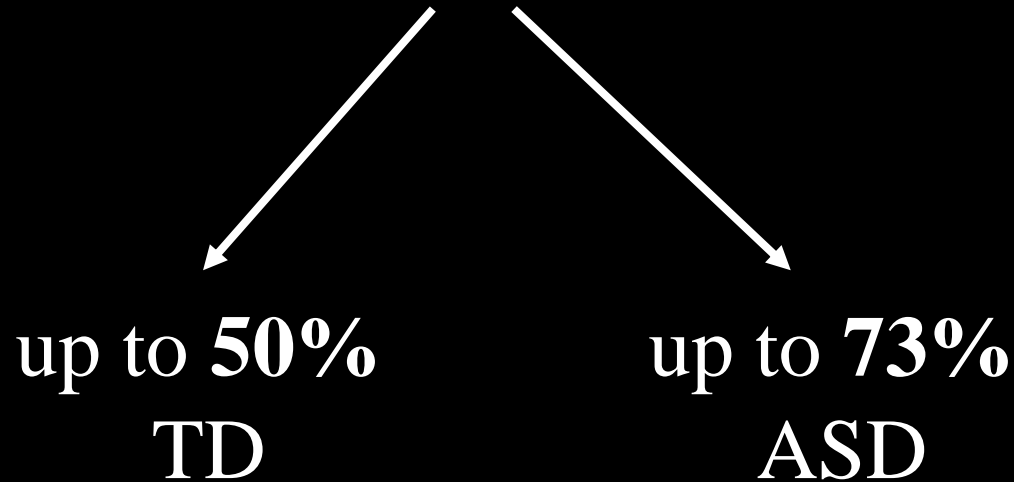
Behavior
Analysts

Pediatricians

Child
Psychologists



Prevalent



Polimeni et al. (2005)

Persistent

(Kataria et al. , 1987; Zuckerman et al., 1987)

Negative Impact on Children

- 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)

Negative 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

- 25% rated themselves as confident in treating sleep problems
(Owens, 2001)

Mainstream Treatment Recommendation

Pharmacological and/or Behavioral Interventions

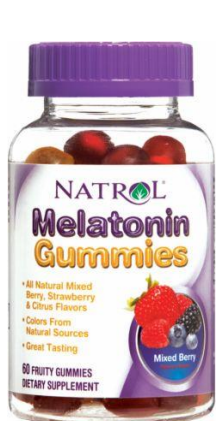


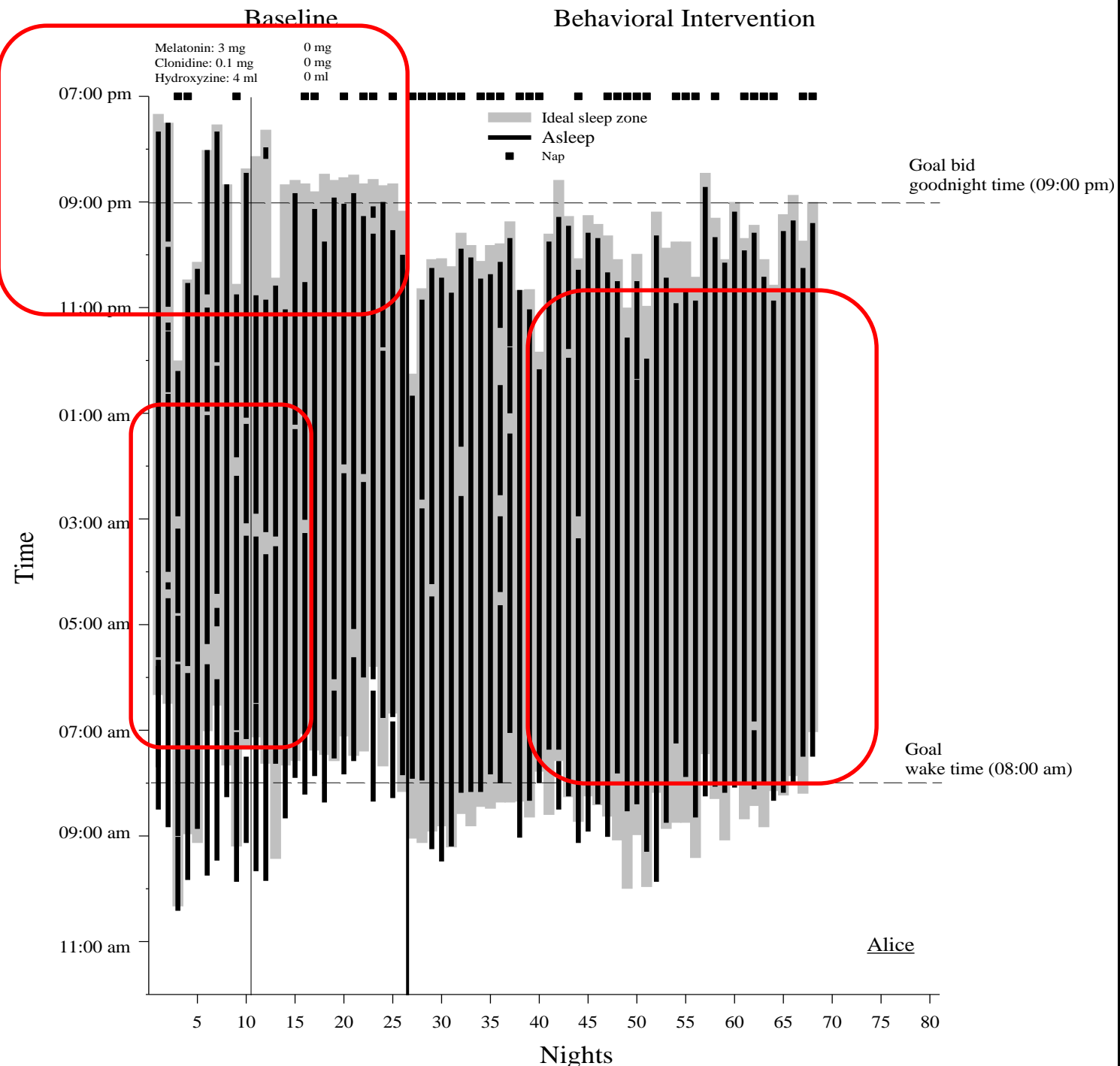
- Antihistamines, Melatonin, Clonidine, Trazodone etc...
- ~81 % of children's visits result in medication (Stojanovski, et al. 2007)
 - No prescribing guidelines
 - No drug approved by FDA
 - Limited research on efficacy, tolerability and acceptability
- ~75% of primary care pediatricians reported recommending nonprescription medication
- ~50% reported prescribing sleep medication

(Owens et al. 2013)

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





Mainstream Behavioral Interventions

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

- More modification than ANALYSIS
- Antecedent-oriented strategies (e.g., positive routine)
- Strategies associated with low treatment acceptability or very few alternatives
- Not personalized or function-based

Parents and
Caregivers

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Psychologists



Assumptions of Behavior Analysis

**Autism is NOT a life sentence of
poor sleep and tired days**

Assumptions of Behavior Analysis

- Falling asleep is a **behavior / skill** (Bootzin, 1972).
- Influenced by
 - Evolutionary history (selection at the level of **phylogeny**)
 - Past and present experiences in one's sleeping environment (selection at the level of **ontogeny**)
 - Cultural practice (selection at the level of **culture**)

Assumptions of Behavior Analysis

- Sleep problems are **skill deficits**
- Can be addressed by **understanding** the controlling variables and **teaching** the relevant skills

Lens of Contingency

?

Behavior ?

?



Through the Lens of a Contingency



Today

- What are the common sleep problems?
- What are the common factors that influence good sleep and sleep problems?
- How do we design personalized, function-based, and consumer friendly interventions?

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

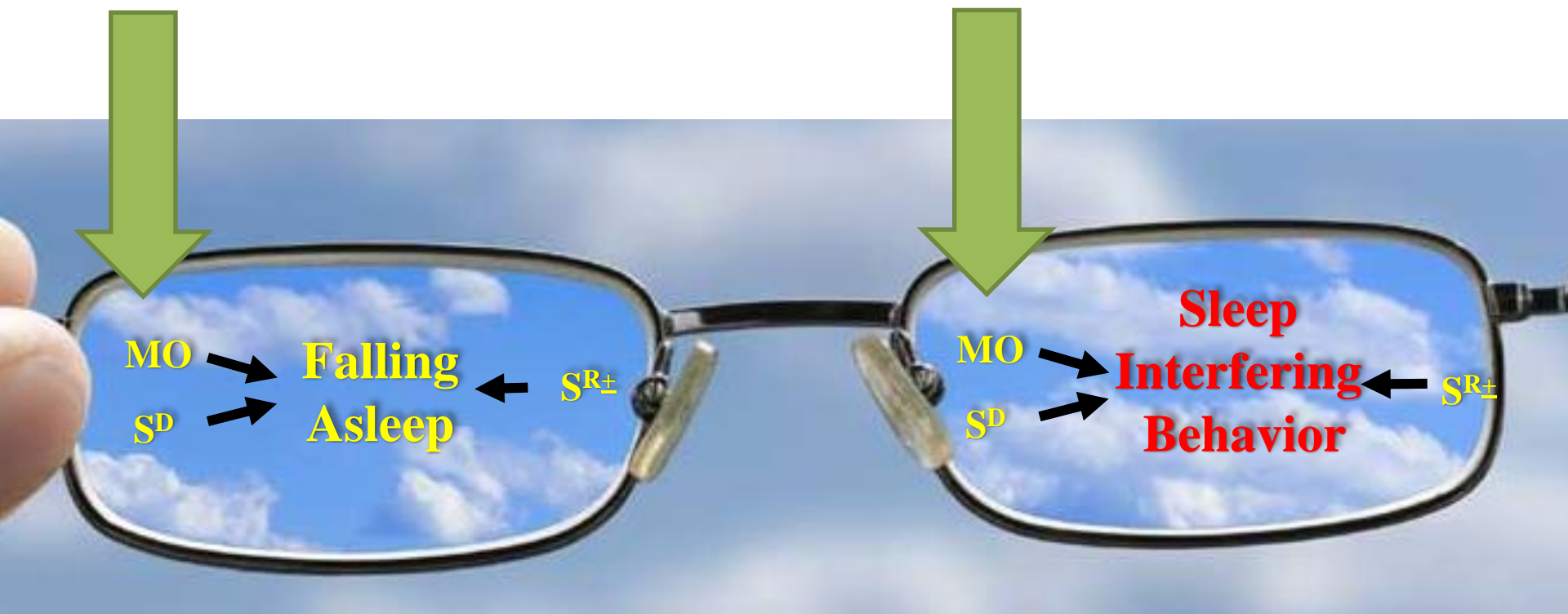
Good Sleep

- Falling asleep quickly
- Staying asleep throughout the night
- Obtaining a developmentally appropriate amount of sleep
 - Waking without much trouble
 - Not feeling drowsy during the day

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

Antecedents (what motivates or demotivates?)



Develop Optimal Schedule By:

A. Recognize age-appropriate sleep amounts

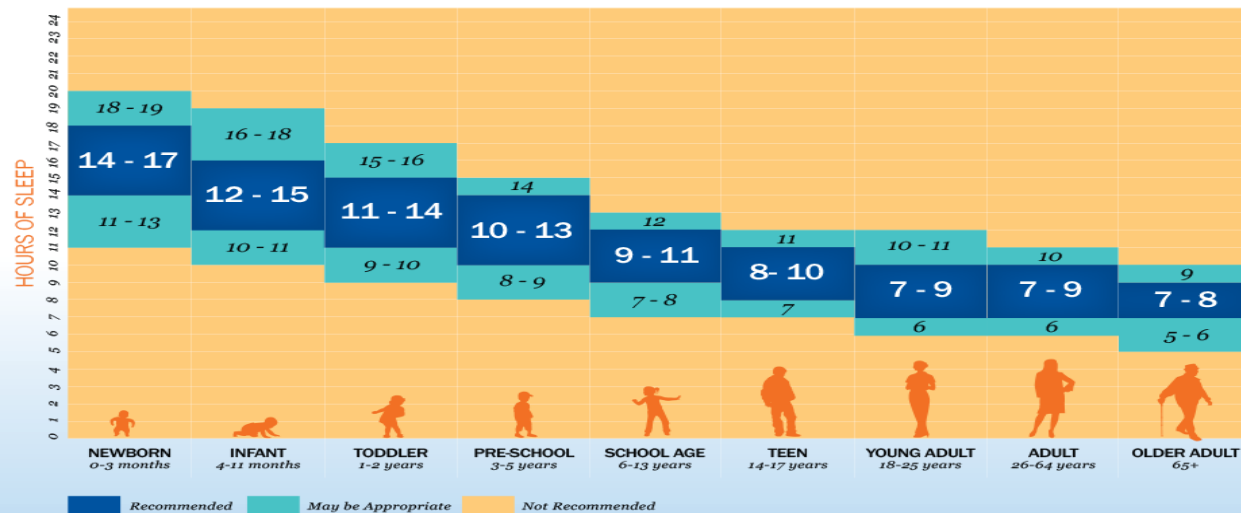
B. Importance of current sleep phase and
“forbidden zone”

C. Universal tendency of to go bed later and wake
up later

Schedule a Developmentally Appropriate Amount of Sleep



SLEEP DURATION RECOMMENDATIONS



SLEEPFOUNDATION.ORG | SLEEP.ORG

Hirshkowitz M, The National Sleep Foundation's sleep time duration recommendations: methodology and results summary, Sleep Health (2015), <http://dx.doi.org/10.1016/j.sleh.2014.12.010>

Caution:

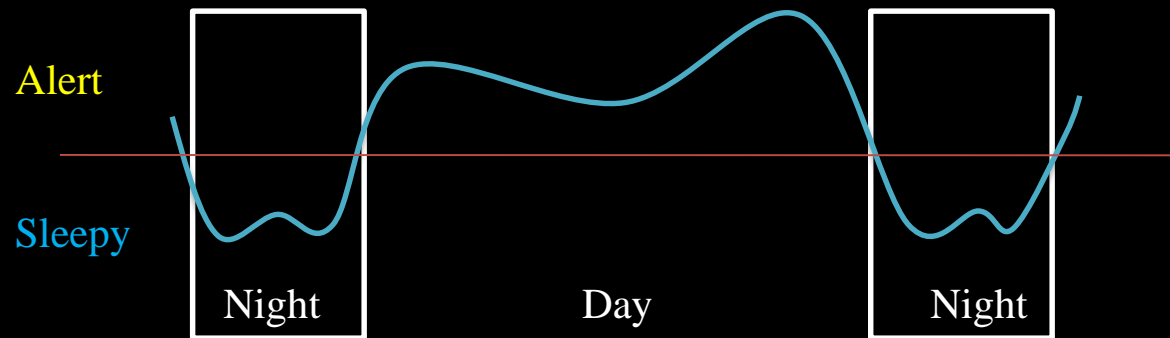
Difficulty falling asleep, staying asleep, or complying with nighttime routines may occur if child is expected to be in bed too long

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

Solution:

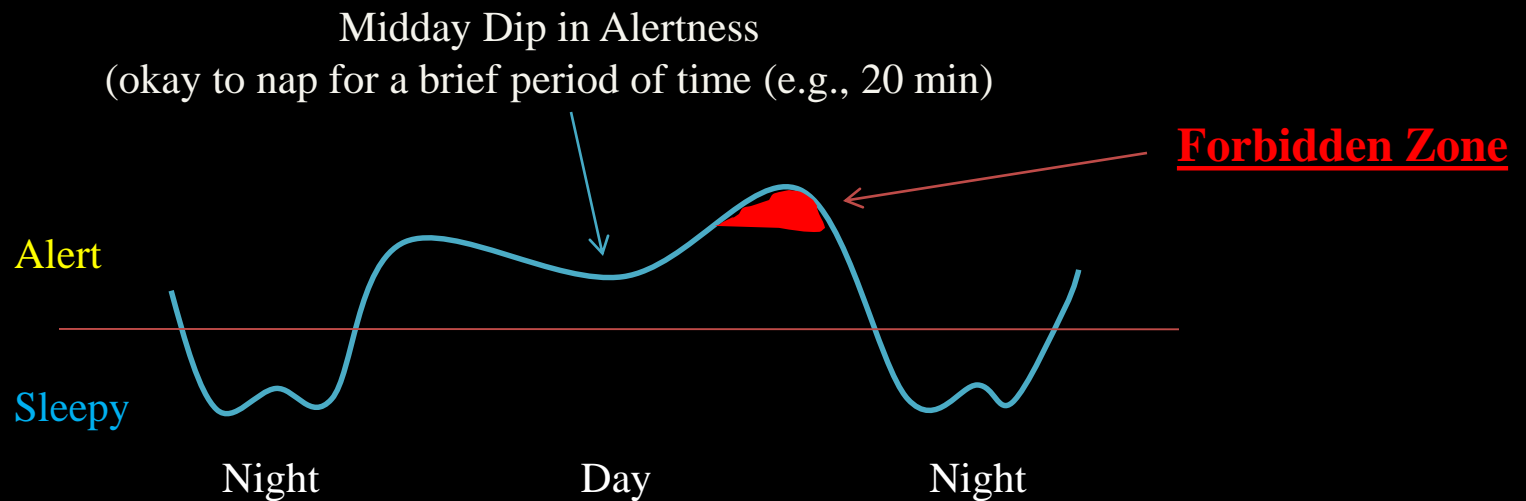
Schedule a developmentally-appropriate amount of sleep

Sleep Phase



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

Forbidden Zone of Sleep

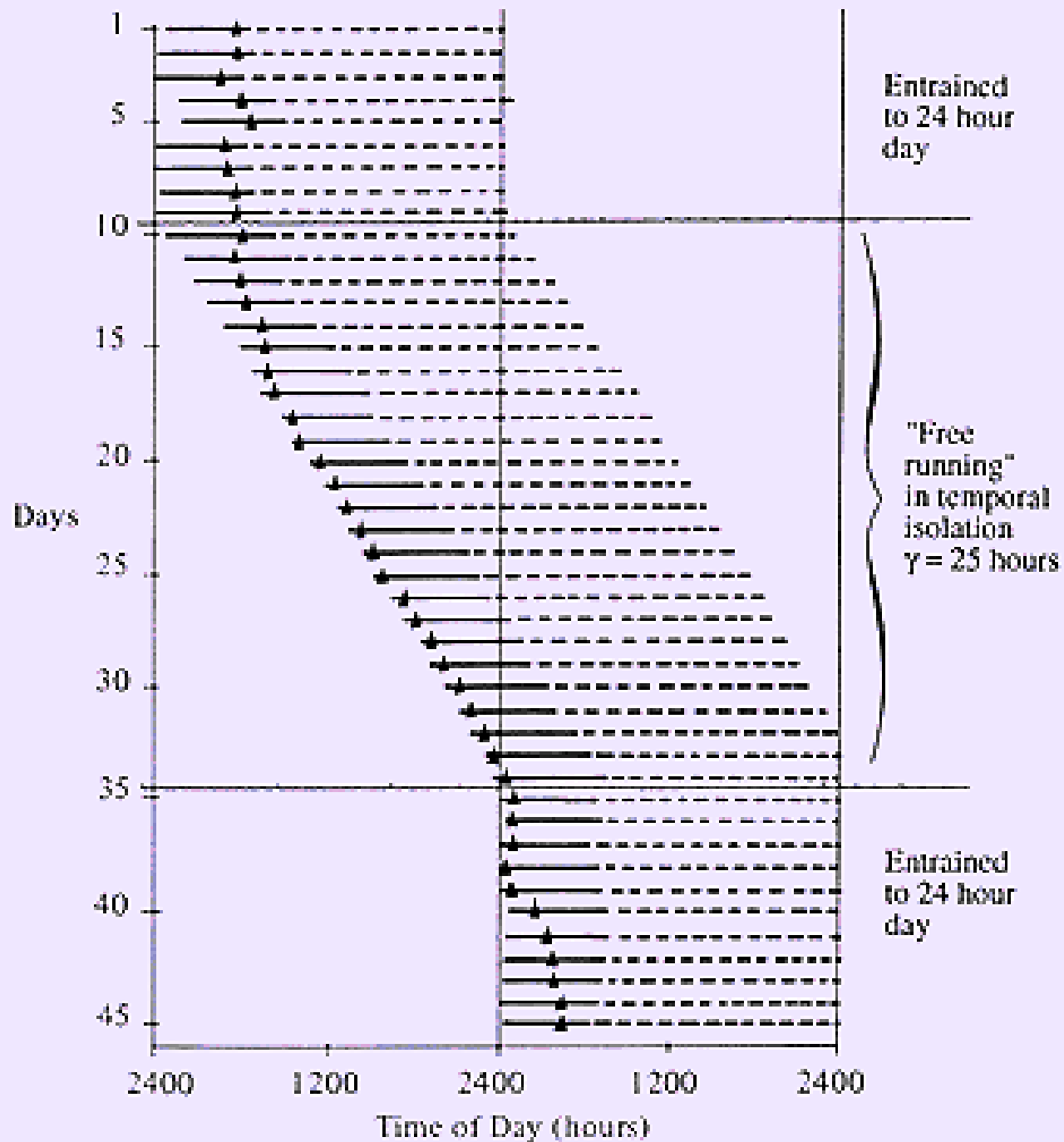


Adapted from: *Solve Your Child's Sleep Problems*, Richard Ferber, Simon & Schuster, 2006

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



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)

Antecedents (signal/cue?)



A. Sleep Dependencies

Transition to sleep depends on stimuli associated with falling asleep

These stimuli must be present throughout the night because children wake up multiple times

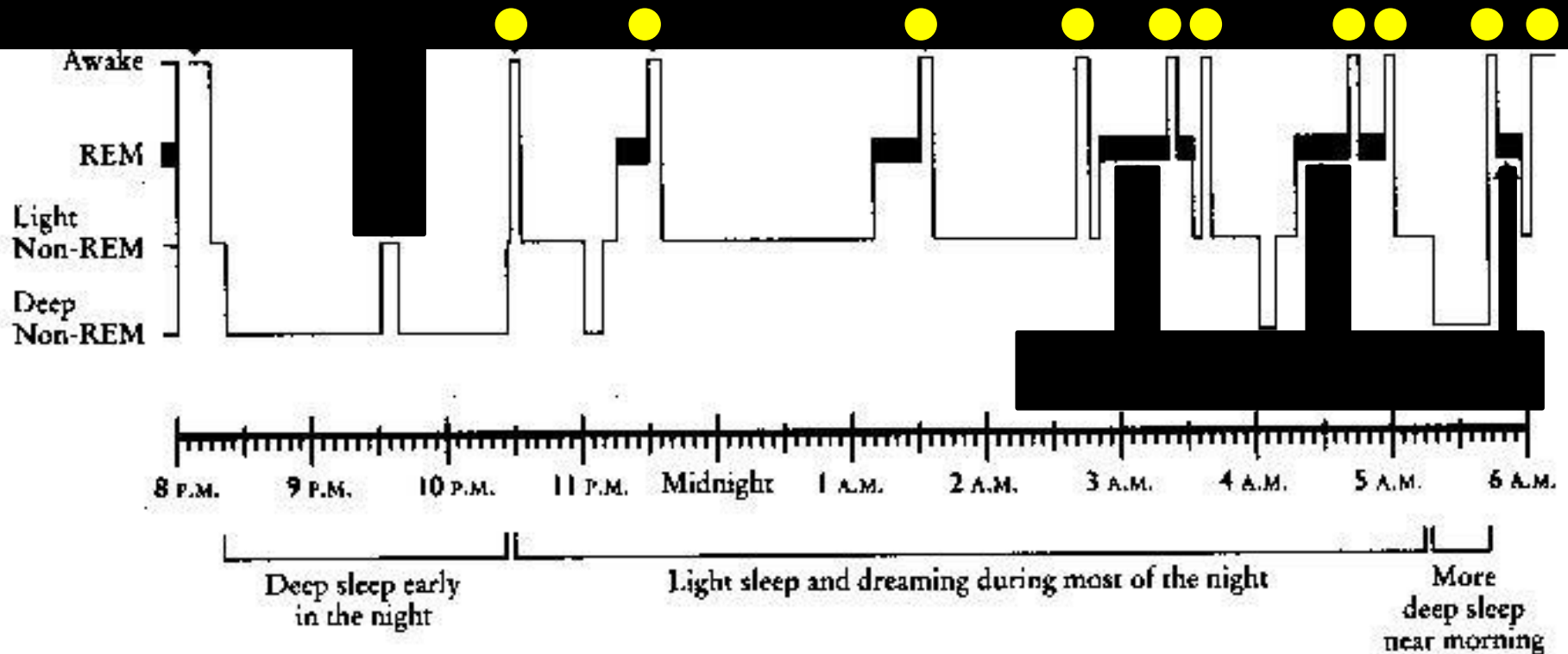


FIGURE 3. TYPICAL SLEEP STAGE PROGRESSION IN THE YOUNG CHILD

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

B. 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

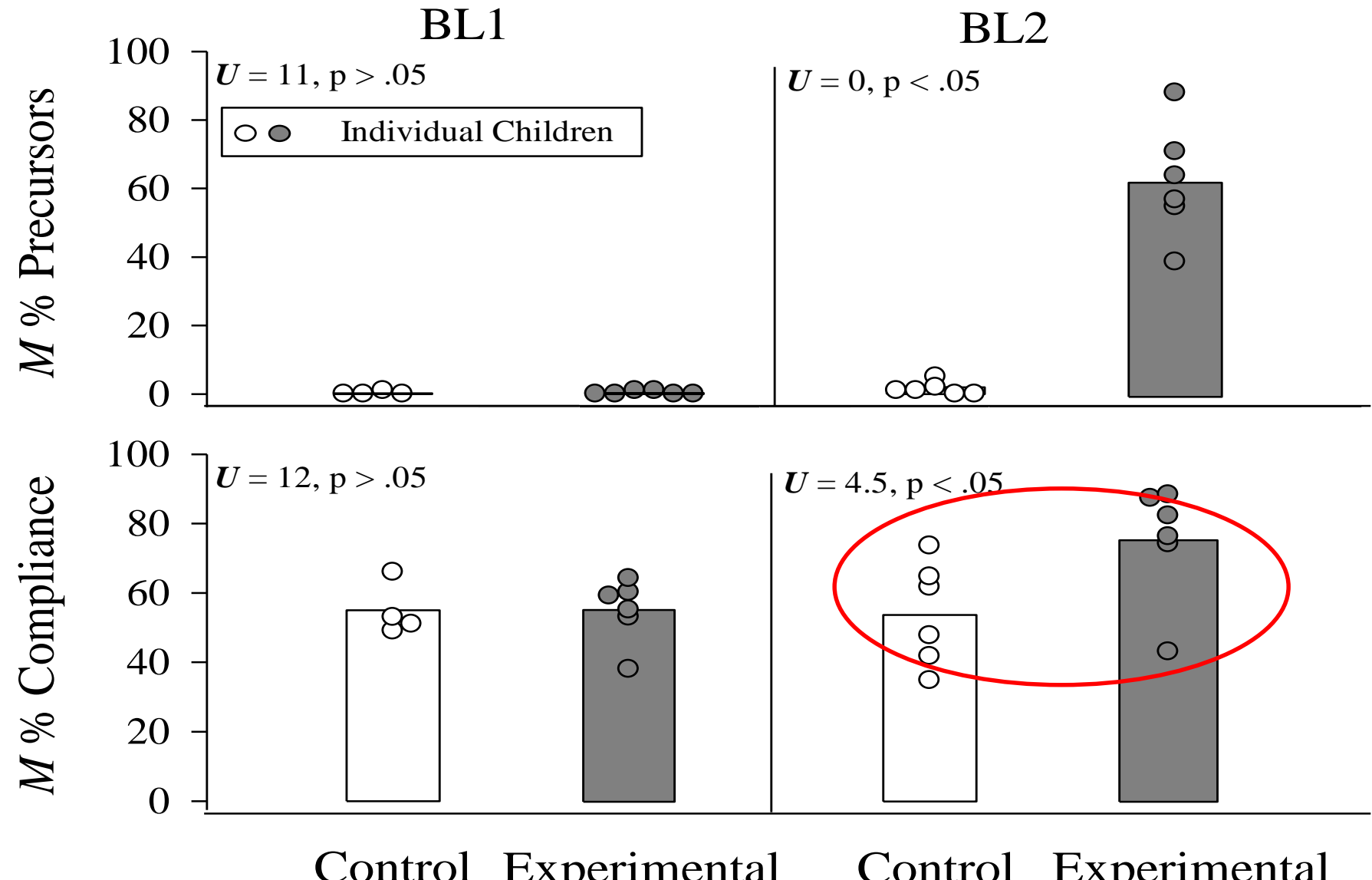
Tendency to not follow instructions during bedtime (e.g., brush teeth, put on PJs etc...)

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*)

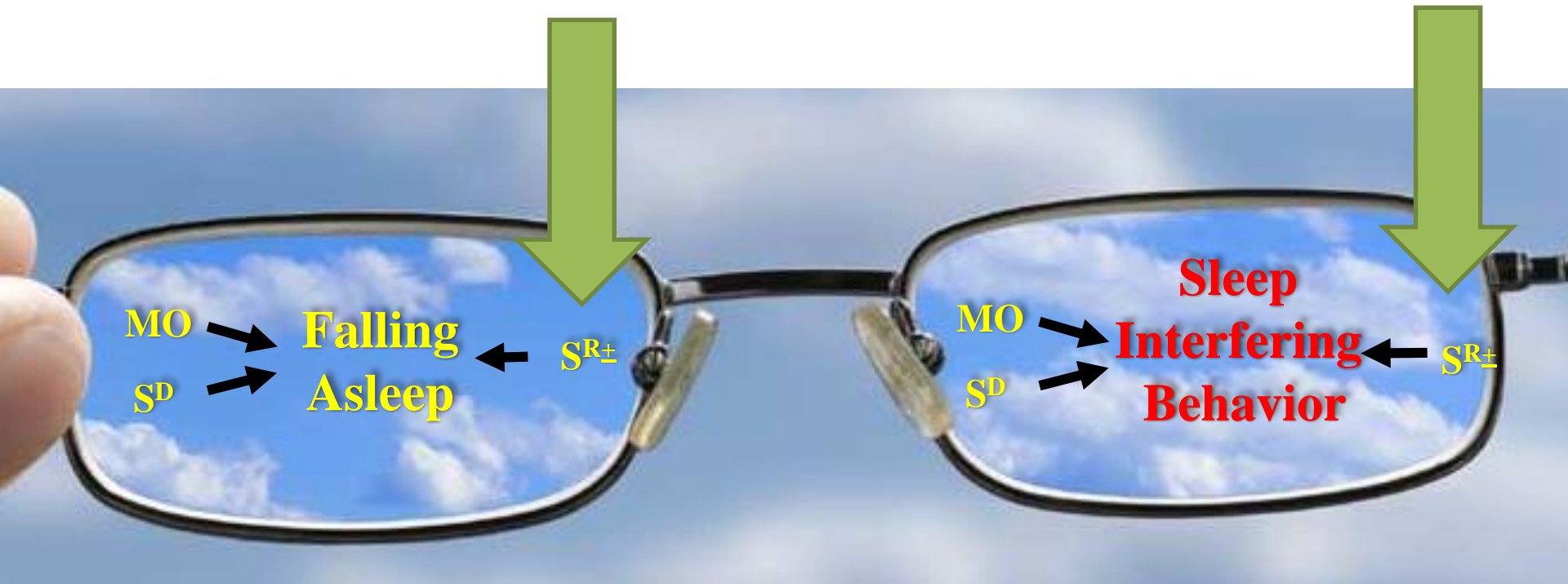


C. Optimize Bedroom Environment

- 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)

Consequences (Reinforcers?)



Interfering Behavior

- 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)

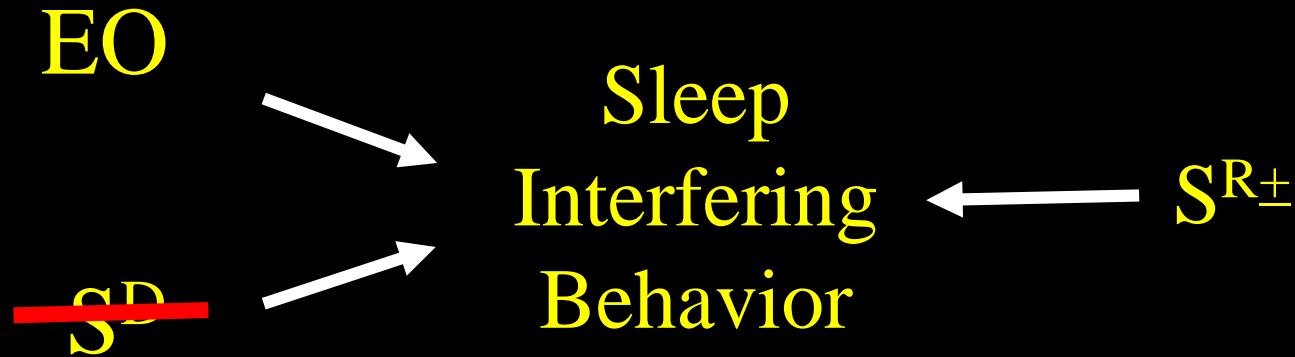
Possible Reinforcers

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

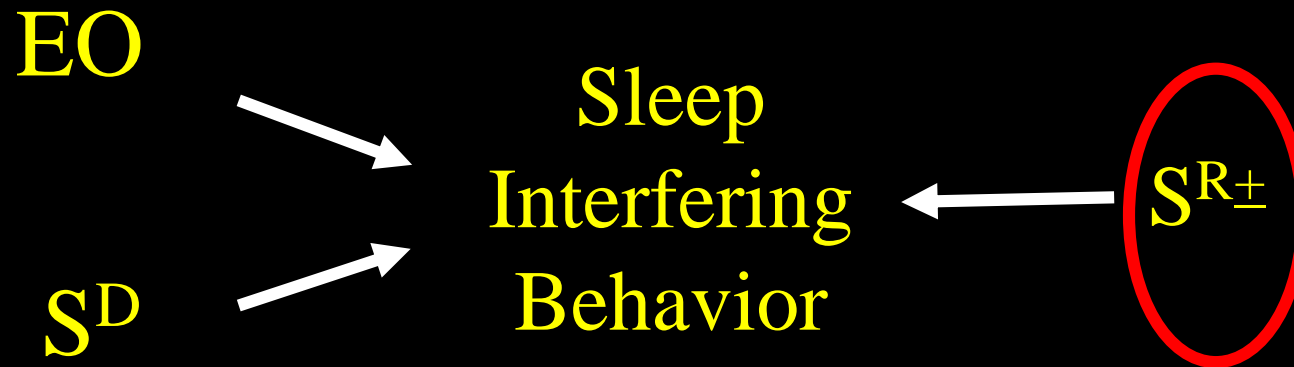
How to Disrupt the Contingency?



- Abolish the value of the reinforcer for SLIB
- Consider provide the presumed reinforcer prior to bidding goodnight
 - Access to stereotypy
 - Access to interaction/attention



- 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



- 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

Day	First visit	Second visit	Third visit	Fourth visit	Fifth visit	Sixth visit	Seventh visit
1	10 s	30 s	1 min	3 min	5 min	10 min	30 min
2	30 s	1 min	3 min	5 min	10 min	30 min	
3	30 s	3 min	5 min	10 min	30 min		
4	1 min	3 min	5 min	10 min	30 min		
5	1 min	5 min	10 min	30 min			
6	5 min	10 min	30 min				
7	5 min	30 min					

Differential Reinforcement

QUIET-BASED VISITING

Visit after increasingly larger intervals of quiet

BEDTIME PASS

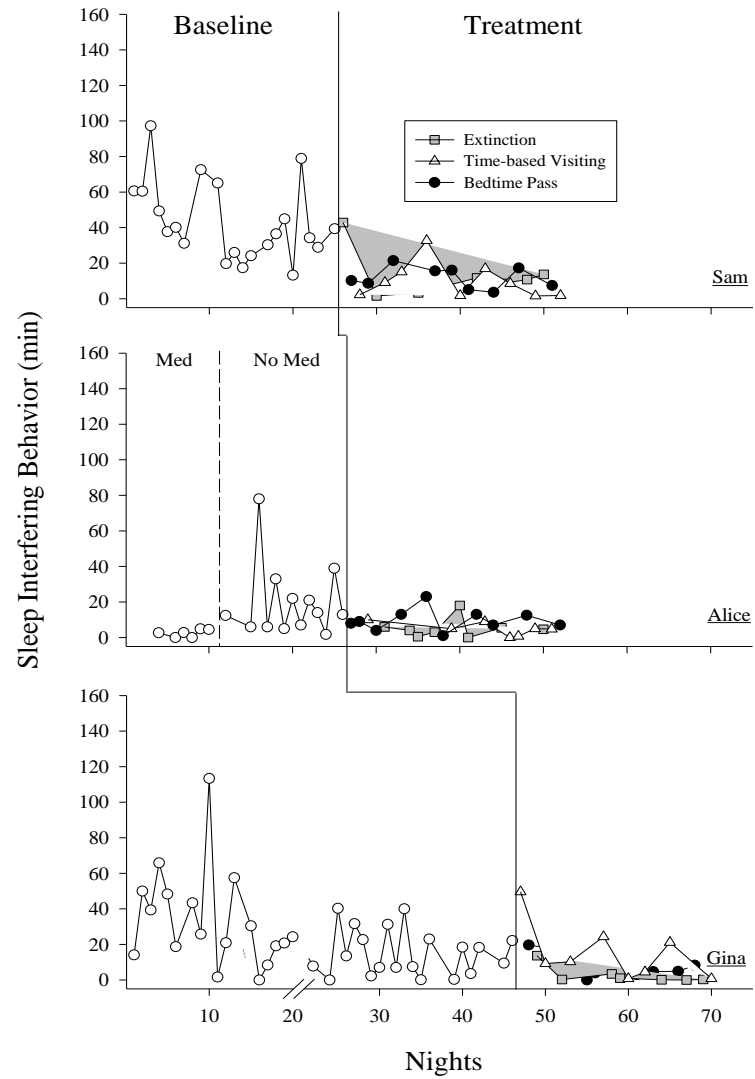
Give your child one or more bedtime pass(es) to be used as needed after the bidding good night to exchange for reinforcers (e.g., grant request).

- *Ideal component?*

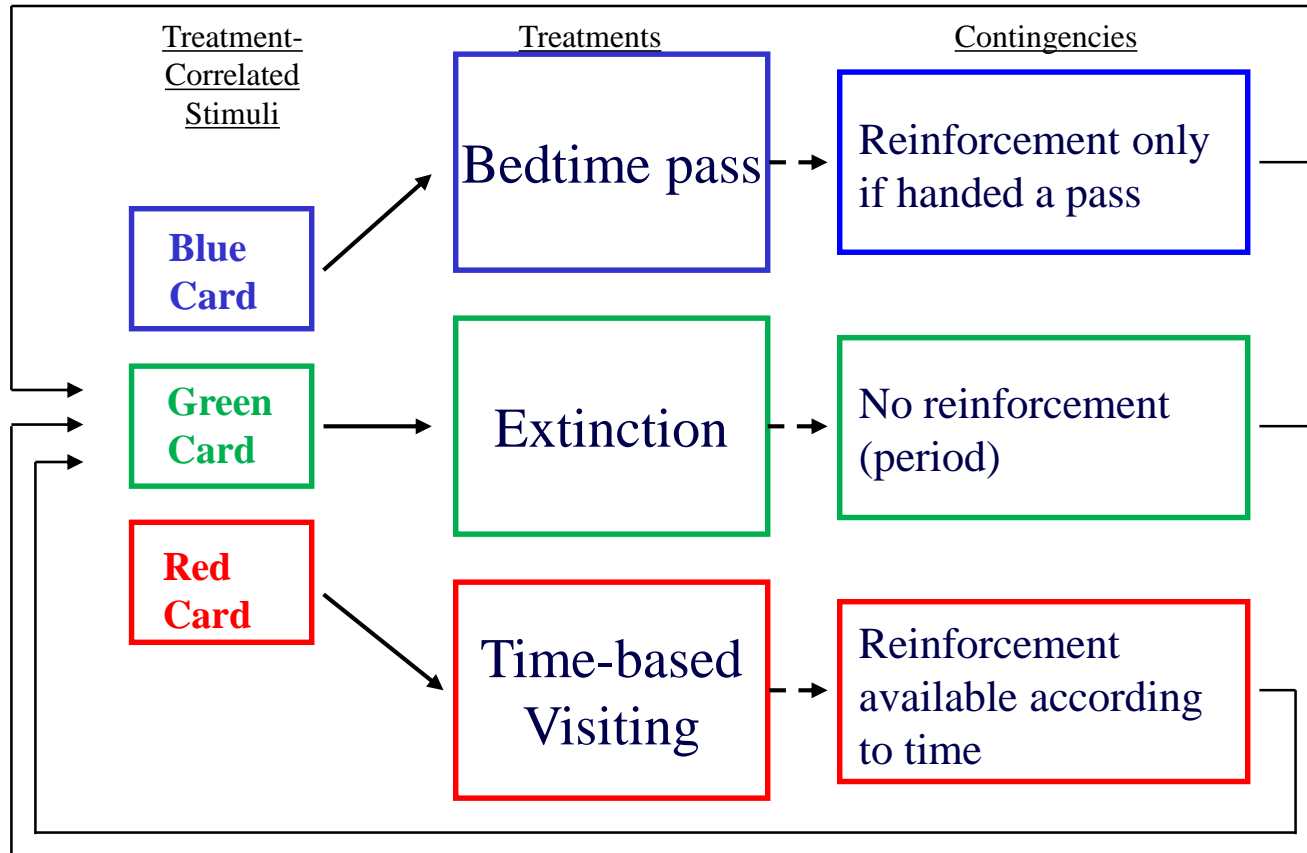
- *EXT*
- *NCR*
- *DRA*



- *Consumer preference?*



Just prior to bed, the children were allowed to choose the treatment for each night



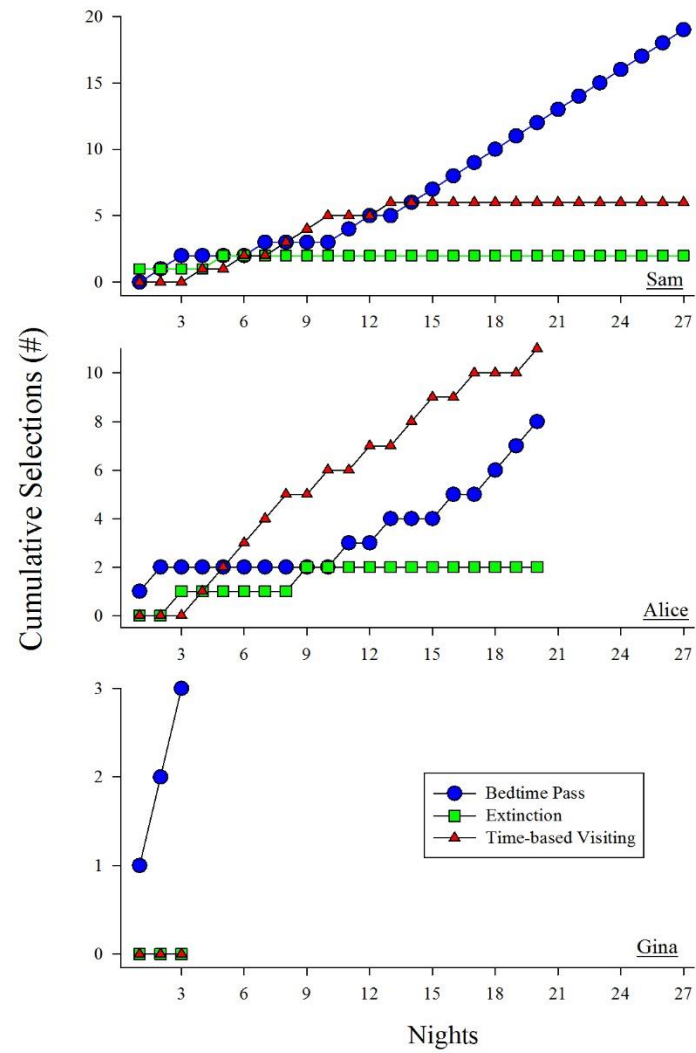


Table 1

Results of Social Acceptability Questionnaire Administered to Parents

Ranking	Sam		Alice	Gina
	Mom	Dad	Mom	Mom
1	Time-based Visiting	Bedtime Pass	Extinction	Bedtime Pass
2	Bedtime Pass	Extinction	Bedtime Pass	Extinction
3	Extinction	Time-based Visiting	Time-based Visiting	Time-based Visiting

Note. 1 = most preferred strategy.

Assess, Assess, Assess

- SATT (Hanley, 2009)

Initial intake interview

- rule out medical conditions (e.g., sleep apnea, narcolepsy etc...)

Baseline measurement

- socially acceptable and objective measurement system

Functional behavior 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

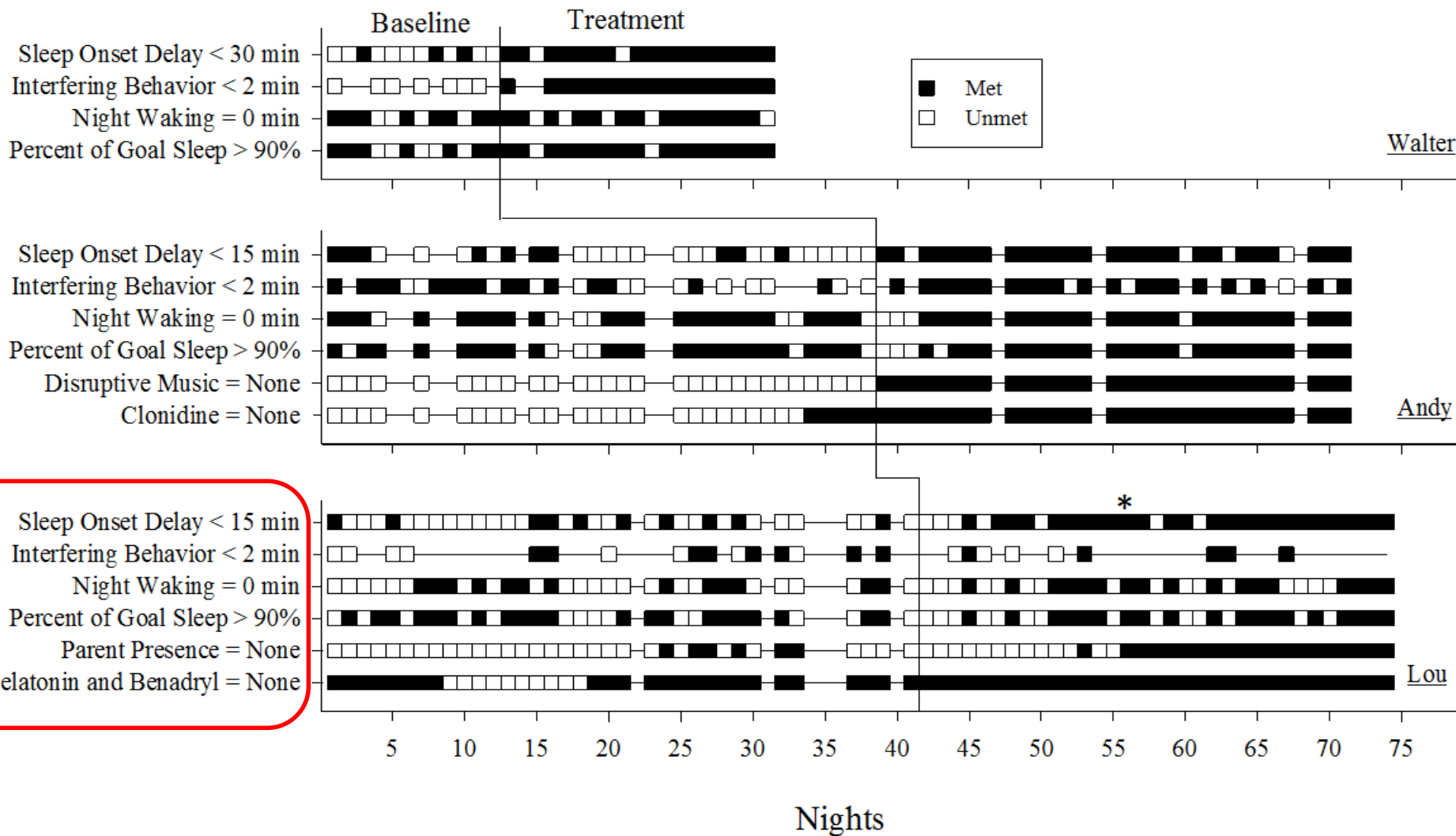
Treatment implementation with measurement

- support, frequent feedback, reinforce treatment compliance

Social validity

- efficacy AND effectiveness

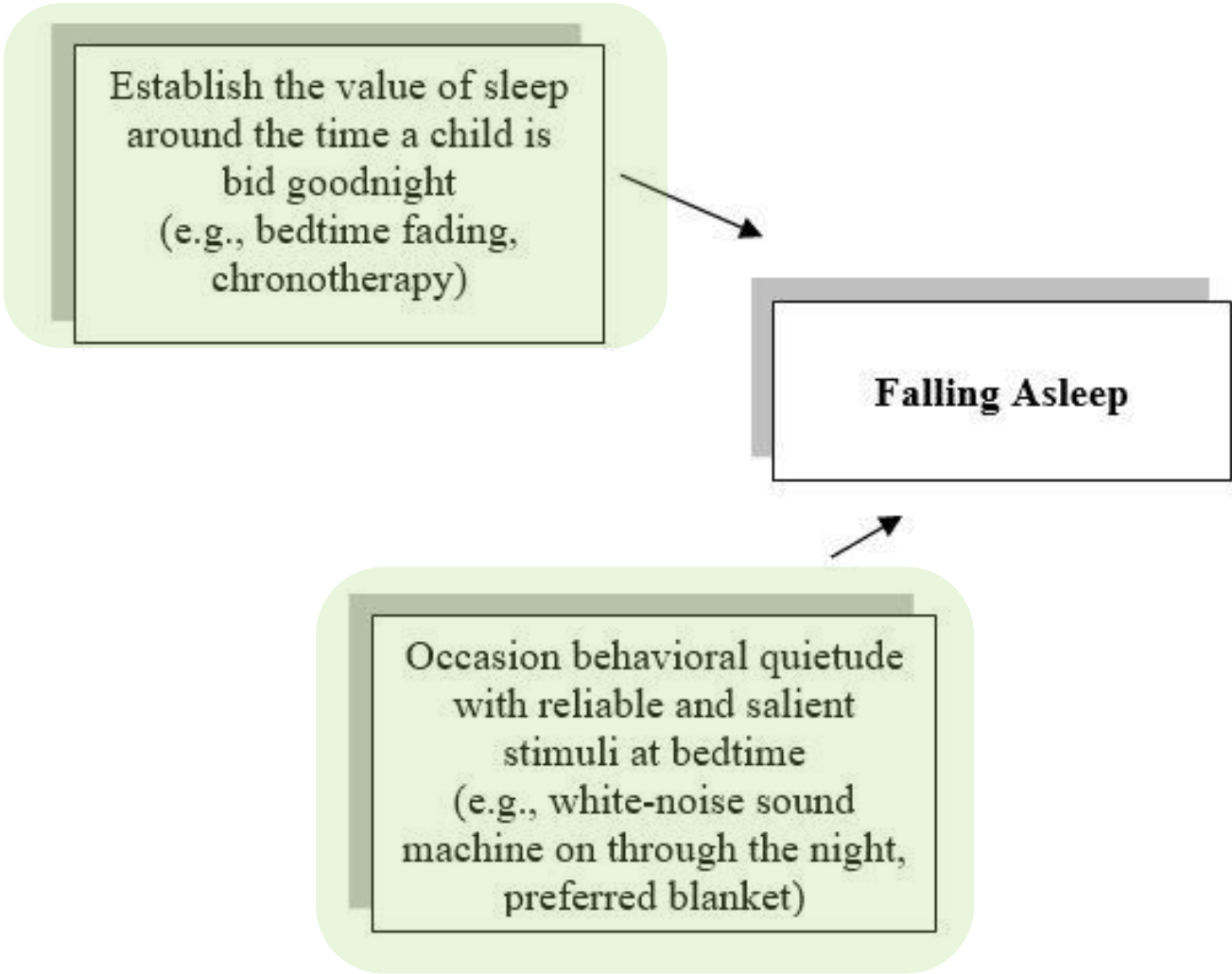
Follow-up



Summary

- Function-based treatment approach could be both efficacious and socially acceptable
 - Identify controlling variables prior to designing intervention
 - Encourage parents to participate in the design of intervention

Establish the value of sleep
around the time a child is
bid goodnight
(e.g., bedtime fading,
chronotherapy)



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graph TD; A["Establish the value of sleep around the time a child is bid goodnight (e.g., bedtime fading, chronotherapy)"] --> C["Falling Asleep"]; B["Occasion behavioral quietude with reliable and salient stimuli at bedtime (e.g., white-noise sound machine on through the night, preferred blanket)"] --> C;
```

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,)

Considerations

- Small sample size
 - (need more direct and systematic replications)
- Data collection effortful
 - Directly observing both child and caregiver behavior
- Parent training costly

Future Areas of Research

- Conditions under which pharmacological interventions are needed
- Better parent training tactics
 - Contingency analysis of parents
- Identify boundary conditions
- More studies targeting both efficacy AND effectiveness

Thank you!

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