


Improving sleep for families

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SickKids

Learning Objectives

At the end of this session you will be able to:

- Understand the physiological and psychological processes of sleep
- Implement sleep assessment strategies
- Advise parents on techniques that can be easily implemented to improve sleep
 - Infants
 - Toddlers
 - Adolescents

Introduction *zzz...*

- Sleep serves restorative and reparative roles
- Loss of sleep affects physiological and psychological health
- Sleep disturbance has consequences for social and family health

Why care about sleep? zzzz...

Sleep is extremely important for a child's growth and development including:

- Behavioural regulation
 - Irritability/argumentativeness
 - Hyperactivity
- Emotions/mood
 - Low mood
 - Anxiety
 - Depression

Why care about sleep? zzzz...

Sleep is extremely important for a child's growth and development including:

- Cognitive functioning/school performance
 - Poor recall
 - Impaired problem-solving
 - Absenteeism
 - Low grades

Why care about sleep? zzzz...

Sleep is extremely important for a child's growth and development including:

- Growth and healing of tissue
- Immune function
 - Increased common illness
- Endocrine function/glucose regulation
 - Weight gain, obesity
 - Impaired glucose tolerance, type 2 diabetes
- Cardiovascular health
 - Increased blood pressure

zzz...

Why care about sleep?

Sleep is extremely important for a child's growth and development including:

- Risk-taking behaviour
 - Smoking
 - Substance use
 - Accidental injury
 - Drowsy driving

Normal Sleep Physiology

- There are two types of sleep
 - REM (Rapid Eye Movement)
 - Non-REM (Slow Wave Sleep)
- REM sleep stimulates the development of the brain by exciting neurons, synapses, and visual pathways
 - Newborns spend 50% of sleep in REM
 - 5 years old+ spend 25% of sleep in REM
- In NREM sleep, the body rests and restores itself

NREM Sleep

- 4 stages of NREM sleep are parallel to the 'depth of sleep'

- Arousal threshold is lowest in stage 1, highest in stage 4

REM Sleep

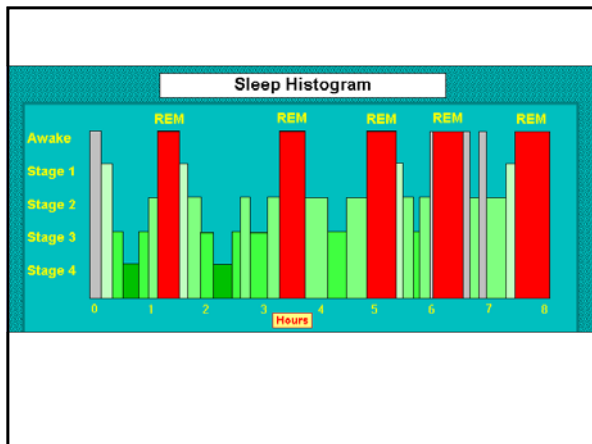
- In REM sleep, there is paralysis or nearly absent muscle tone (except the control of one's breathing)
- There is increased levels of brain activity
- Dreaming occurs during the REM portion of sleep

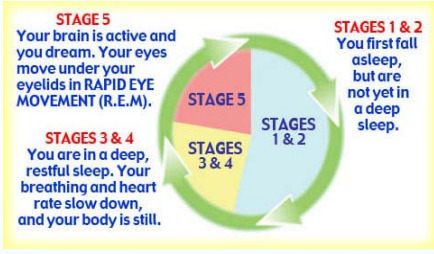
Stages of Sleep

One cycle through the stages lasts 60 minutes for a newborn and

increases to 90 minutes for 5 year old+:

- Stage 1 -10 minutes
- Stage 2 -25 minutes
- Stage 3 } → predominate in first
- Stage 4 } → half of night = deep sleep
- REM } → predominates in second
- } → half of night = dreaming





STAGE 5
Your brain is active and you dream. Your eyes move under your eyelids in RAPID EYE MOVEMENT (R.E.M).

STAGES 1 & 2
You first fall asleep, but are not yet in a deep sleep.

STAGES 3 & 4
You are in a deep, restful sleep. Your breathing and heart rate slow down, and your body is still.

Brief arousals or awakenings commonly occur when we transition from deeper to lighter stages of sleep –we are often not aware of these awakenings, but infants and children may “signal” to their caregivers

If awoken, we usually must go through the lighter stages of sleep before entering the deeper, restful stages.

Two-process model of Sleep Regulation (Borbely, 1982)

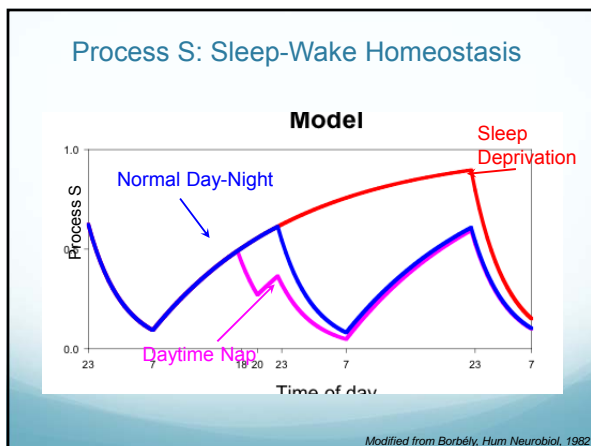
- Sleep is regulated by two simultaneous processes:

Process S

- Sleep propensity increases as waking accumulates and dissipates during Sleep
 - The longer you are awake, the more sleepy you become –“sleep drive”

Process C

- Sleep propensity oscillates with a Circadian variation
 - approximately 24-hours in humans



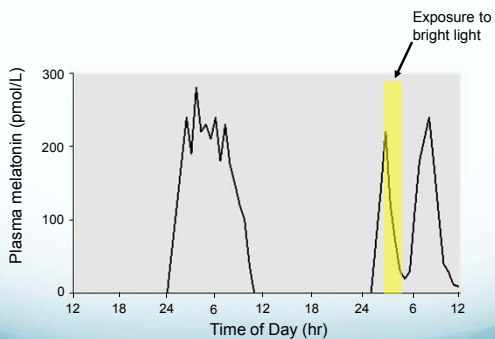
Process C: Circadian Rhythm

- A self-sustained biological rhythm that is normally synchronized to a 24-hour period
- Evidenced by regular physical and mental changes occurring in a day
- Regulated by the body's biological "clock"
- Affected by social and environmental cues

Biological Clock: SCN & Melatonin

- Suprachiasmatic nucleus (SCN) in the hypothalamus receives light input from the retinal hypothalamic tract
- Melatonin, a hormone that induces sleepiness, is produced in the pineal gland under the influence of the SCN
- Melatonin production is inhibited by light and permitted by darkness

Light during night suppresses Melatonin



Circadian Rhythm: Social & Environmental Cues

- Circadian rhythm affected by:
 - Regular nap and nighttime sleep times
 - Regular feeding times
 - Exposure to light and darkness
 - Temperature
 - Noise
 - Bedtime routines
 - Physical activity



Developmental Changes in Sleep

- **NEWBORNS** (0-2 months)
 - 3 sleep states: active, quiet, indeterminate
 - Total sleep is 10-19 hours/day
 - Sleep periods separated by 1-2 hours awake
 - No day/night pattern in the first few weeks

Developmental Changes in Sleep

- **INFANTS** (2-12 months)
 - Amount of active (aka REM sleep) decreases
 - Sleep cycles q50 minutes
 - Total sleep is 12-13 hours/day
 - Naps: 2-3 hours, decrease from 4 to 1
 - By 6 months no longer physiologically need a nocturnal feed
 - Achievement of motor milestones may interfere with sleep

Developmental Changes in Sleep

- **TODDLERS** (1-3 years)
 - REM sleep amounts continue to decline
 - Total sleep is 11-13 hours
 - Naps: 2-3 hours, decrease from 2 to 1, around 18 months
 - Developmental issues may interfere with sleep
 - separation anxiety/cognitive development which leads to nighttime fears
 - mastery of independent skills which leads to power struggles

Developmental Changes in Sleep

- **PRE-SCHOOLERS** (4-5 years)
 - Total sleep is 11-12 hours
 - Naps are usually eliminated by this age
 - By 3 years of age, 92% of children still nap
 - By 4 years of age, 57% of children still nap
 - And by 5 years of age, 27% of children still nap

How common are sleep concerns in children?

- 20-30% of children from infancy to adolescence have sleep problems that are considered significant by the family

Sleep Loss in Children

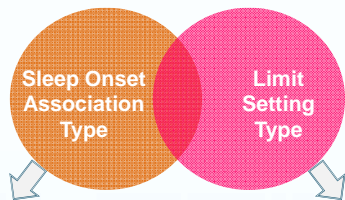
Insufficient sleep (sleep deprivation)

or

Fragmented Sleep (sleep disruption)

= Sleep Loss

Behavioral Insomnia of Childhood



- Conditions that are habitually presented at bed time and become required for infant/child to fall asleep
- Rocking/nursing to sleep
- Require parental intervention
- 25-50% of 6-12 month olds

- Inadequate enforcement or complete absence of bed time limits
- Bedtime resistance – 10-30% of toddlers
- 'Curtain calls' – drinks, kisses, stories

Behavioural Insomnia of Childhood

A Venn diagram with two overlapping circles. The left circle is orange and labeled 'Sleep Onset Association Type'. The right circle is pink and labeled 'Limit Setting Type'. The overlapping area is shaded red. Below the circles is a white arrow pointing down to a box containing a list of symptoms.

- Night-time awakenings
- Delayed sleep onset, fearful behaviours
- Difficulties at nap time
- Daytime behavioural problems
- Family Discord

Common Sleep Concerns in Infancy

- difficulty settling to sleep
- night awakenings
 - 25-50% of 6-12 month olds
 - 30% of 12 month olds
 - 15-20% of toddlers (1-3 year olds)

“Is your baby sleeping through the night?”

- Sleep regulation
 - infants start to learn how to fall asleep on their own at bedtime
 - they also learn to fall asleep on their own during the night if they wake = “self-soothers”
- Sleep association
 - Infant typically falls asleep under certain conditions (e.g. while feeding, being rocked)
 - May be avoided by using “Sleep-Feed-Activity-Repeat”

Evaluation of Sleep

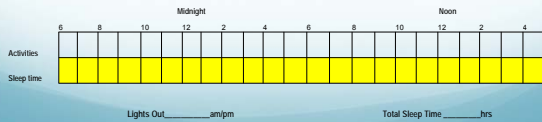
- BEARS Sleep Screening Algorithm for the most common sleep issues:
 - **B**edtime Problems -difficulty going to bed, falling asleep;
 - **E**xcessive Daytime Sleepiness –and other daytime behaviors;
 - **A**wakenings during the night –and parental response to wakes;
 - **R**egularity of sleep/wake cycles (bedtime, wake time) and average sleep duration, environmental cues;
 - **S**norning
- J.A. Owens, V. Datzellb. Sleep Medicine, 6 (2005) 63–69. Use of the 'BEARS' sleep screening tool in a pediatric residents' continuity clinic: a pilot study.

Sleep Diary

- Activities**
- D - each caffeinated drink (including coffee, tea, chocolate, coke)
 - P - prescription/non-prescription medication
 - M - meals/feedings
 - S - snacks
 - X - exercise or extra activities
 - T - use of toilet or diaper change during sleep
 - N - noises that disturb sleep
 - W - time of wake-up alarm/parent
 - C - crying

Sleep Time - including naps

mark with a "down" arrow each time child gets into bed
 mark with an "up" arrow each time child gets out of bed
 mark with a line the time sleep began and the time sleep ended,
 then join the lines to indicate sleep periods (see example below)



Sleep Management Basics

- Bedtime routine
 - Brief, enjoyable, relaxing
 - In the setting where sleep will occur
- Consistent bed and wake times (for naps too)
- Child is put to bed/goes to bed awake/drowsy
- Avoid caffeine, technology
- Bedroom = cool, dark, quiet
- Daytime exercise & sunlight
- Parental reassurance –night wakings are normal

Sleep Management Basics

- Consider:
 - Cultural differences
 - Family differences
 - Safe Sleep Practices (room vs bedsharing)
 - RNAO Best Practices Guidelines
 - Canadian Pediatric Society recommendations (see www.cps.ca and www.caringforkids.cps.ca)

Quick Tips for Newborns

- Observe the baby's sleep patterns and identify signs of sleepiness
- When possible, put baby in the crib when drowsy, but awake
- A quiet and dark room at a comfortable temperature is best for sleep
- Differentiate between day and night
- Begin a bedtime routine

Quick Tips for Infants (3-12 months)

- Put baby in the crib when drowsy, but awake
- Establish a brief (15-30 minutes), enjoyable bedtime routine, in the place where sleep will occur
- Establish consistency in sleep and wake times for nighttime sleep and daytime naps

Sleep In Toddlers & Preschoolers

- Frequent night wakings
 - Feeding at night
 - Parental involvement in falling asleep
- Developmental issues arise in toddlers in relation to sleep
 - Nighttime fears
 - Need for independence may lead to power struggles & need for limit setting

How does night feeding contribute to night waking?

- Sleep association develops, so that when infant awakens, needs to be fed to reinitiate sleep.
- Hunger cues occur at regular intervals and contribute to waking at night.
- Need to shift milk intake into daytime over a period of time.
- Process needs to occur gradually for infant and parent comfort!

How to reduce night feeding:

- Over a night or two, track the length and timing of feeds.
- Any feeding less than 2 minutes in length is not contributing much to total intake and can be eliminated right away.
- For other feeds, decrease length of feed by 2 minutes (or by 30 mL if bottle fed), every other night.
- Offer more/larger volume feeds during day to counter the shift from night.

How to reduce night feeding:

- When a feedings are gradually eliminated, hunger cues are also removed, so this results in fewer awakenings.
- For last feed before nighttime sleep will need to avoid being fed to sleep.
- For awakenings that continue, will need to settle the baby using other methods.
- Other methods can now be used to address the wakings that remain, e.g. graduated extinction.

Address parental beliefs, comfort with approaches to night wakes

- Ability to endure crying?
- Practical approaches –potential to disturb others?
- Fit with personal beliefs re: parenting?
- Different cultural practices?
- “I’ve already tried that and it doesn’t help”

Eliminating sleep associations

- Identification of associations and withdrawal of those associations
 - Reduction of night feeding, if appropriate
 - Reduction of volume/time
 - Dream feed
 - Parental involvement in infant falling asleep
 - Reduction of contact, time
- Extinction (cry it out)
- Graduated extinction (checking in)
- Extinction with parental presence (camping out)



Management of “Bedtime Resistance”

- Set an appropriate and consistent bedtime, with a routine and rules
 - Activity chart for routine
- Consistently return child to bed gently, but firmly if up after bedtime; intermittent reinforcement may be necessary
 - Bedtime pass
 - Door holding
 - Chair sitting

Management of “Bedtime Resistance”

- Use positive reinforcement for appropriate bedtime behaviour (e.g. sticker chart, pillow prizes)
- Bedtime fading
 - May need to advance bedtime until child is sleepy
 - Must wake up at regular time in morning

Management of “Early Risers”

- Environmental reasons
 - Room-darkening shades
 - White noise
- Wet diaper
 - Reduce night feedings
 - Double diapering
- Move bedtime earlier
- “Good Morning” light

PEDIATRIC SLEEP

Behavioral Treatment of Bedtime Problems and Night Wakings in Infants and Young Children

An American Academy of Sleep Medicine Review

Jodi A. Mindell, PhD¹; Brett Kahn, PhD²; Daniel S. Lewin, PhD³; Lisa J. Malow, PhD⁴; Avi Sadeh, PhD⁵

¹Department of Psychology, Saint Joseph's University, Philadelphia, PA; ²University of Nebraska Medical Center, Omaha, NE; ³Children's National Medical Center, George Washington University School of Medicine, Washington, DC; ⁴Children's Hospital of Pennsylvania, Philadelphia, PA; ⁵Department of Psychology, Tel Aviv University, Tel Aviv, Israel

- 94% of the studies report that behavioral interventions were efficacious
- Over 80% (n=2000) of the children had clinical improvement, sustained at 3-6mo
- Other solutions or preventive strategies are needed for early infancy (<6 months of age)

Make a Plan

- Is now a good time?
- Identify the final goal and intermediate steps
 - What is the first sleep association/limit that can change?

CONSISTENCY IS

Case 1, Liam 4 months old

- Chief complaint: Parents are tired from frequent night wakings and feedings and wonder if their baby is getting enough sleep.
- Baby is gaining weight appropriately and physical exam reveals nothing unusual.

Case 1, Liam 4 months old

- During day
 - Falls asleep in the stroller, swing or infant carrier during the day
- At night
 - Falls asleep while held by a parent while having dinner, watching tv, sometimes in Liam's room
- Wakes up to 5 times per night
 - Sometimes as little as 1 hour between awakenings, baby breastfeeds for 5 minutes and falls back asleep
 - Parents sometimes have Liam sleep with them in their bed due to frequent feedings

Liam, 4 months old

- What advice would you give Liam's parents?

Case 1, Liam 4 months old

- Bedtime Routine
 - Never too early to begin a short bedtime routine.
 - 15 to 30 minute series of predictable, enjoyable events.
- Have baby fall asleep in the same location, on the same sleep surface.
- Dream feed for longer stretch of sleep for mum
- Put baby down drowsy, but awake.

Case 1, Liam 4 months old

- Goal at this stage: creating conditions and activities to build self-soothing and routine into the infant's sleep behaviors. Requires consistency!
- Avoid falling asleep at the breast and "snacking"
- Implement "Sleep-Feed-Activity-Repeat"
- Reassurance, Parental sleep advice?

Case 2, Natalia 9 months old

Chief complaint:
Natalia wakes up at least 3x/night
Mum going back to work soon

Case 2, Natalia 9 months old

- Bedtime Routine
 - Starts at 5pm: dinner, bath, books, bottle
 - Leaves in crib at 7pm with bottle, falls asleep within 5-10 minutes
 - Wakes up few hours later, parent goes in and gives bottle
 - Now pulled to stand and can't get down and having to rock to sleep
- Naps: 2 hours in AM and PM, up by 3pm
- Medical Hx: Nothing of note

Natalia, 9 months old

- What advice would you give Natalia's parents?

Case 2, Natalia 9 months old

- Eliminate night feeds
 - Decrease the amount in the bottle
- Break the Sleep onset association
 - Graduated Extinction Method
- Developmental milestones
 - Work on the skill during the day

Case 3, Ruby 3 years old

- Chief complaint
 - Takes a long time to get Ruby to sleep
 - She often wakes in the night, ends up in parents' bed

Case 3, Ruby 3 years old

- Bedtime Routine
 - Dinner: 7pm
 - Bath: 8 pm
 - iPad: 8-9 pm
 - 9-10pm: glass of water, a story, potty, a hug
 - Parent lies with child, asleep by 10:10pm
 - Parents waking her at 6am

Case 3

- What advice would you give Ruby's parents?

Case 3, Ruby 3 years old

- Consistent, earlier bedtime
 - Avoid technology for 30-60 min before bed
 - Decrease length of bedtime routine
 - Bedtime fading
 - Rewards to deal with bedtime resistance
- Remove sleep association of parental presence for sleep
- Respond to night wakes by returning child to own bed

Adolescence: A Time of Transition



Sleep Needs Vary Over the Life Cycle

Newborns/Infants	10.5-18 hours
Toddlers/Children	10-13 hours
Adolescents	9.25 hours
Adults/Older Persons	7-8 hours

Teens Experience a Biological Shift to a Later Sleep-Wake Cycle

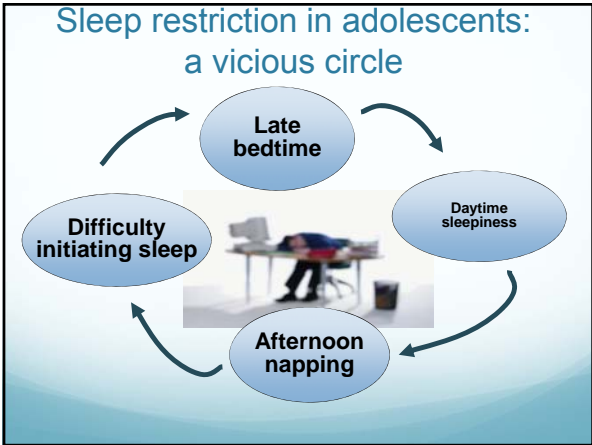
- The biological clock of children shifts during adolescence
- Gives adolescents the “ability” to stay up later
- Sleep needs don’t decrease, though, leading to a natural tendency to wake later
- Places teens’ sleep in conflict with school/work schedules



Adolescent Sleep: *the perfect storm*

- Psychological factors +
 - increased independence, anxiety, stress
- Environmental factors +
 - access to e-devices, caffeine, screen time
- Social factors +
 - increased importance of peers, more extracurricular activities, decreased parental involvement
- Social jet lag
 - irregular sleep-wake times across weekdays and weekends

= Sleep restriction in spite of an unreduced need for sleep



How much sleep do high school students achieve?

	Sleep during the week	Sleep on weekends
Average Grades 9-12	7.2	8.7
Grade 9	7.6	8.8
Grade 12	6.9	8.4

2006 National Sleep in America Poll

How much sleep do high school students achieve?

- 62% of adolescents in grades 9-12 were achieving less than 8 hours on weeknights
- 25% achieving 8-9 hours on weeknights
- Only 13% reaching an optimal 9 hours on weeknights

2006 Sleep in America Poll



Impact of Technology

- Increased use of computers, gaming, mobile devices, etc in adolescence
- 72% of children 6-17 have 1+ electronic device in the bedroom while asleep
- Teens who leave devices on at night get 30 minutes less sleep/night (2014 Sleep in America poll)

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Impact of Technology

- Numerous studies link use of technology with delayed bedtimes and shortened sleep durations
- What is the mechanism?
 - Using technology instead of sleeping
 - Exposure to light sends signal to the brain to wake up
 - Mental/Physical tasks related to use are alerting

70

Impact of Caffeine

- 75% of adolescents report drinking at least one caffeinated beverage/day
- 31% consume 2+/day
- Those that consume report less sleep time

71

Good sleep strategies

- Cool, dark, quiet bedroom
- Limit caffeine
- Limit screen time/device use
 - before bed and when in bed
- Exercise
 - not too close to bedtime

Good sleep strategies

- Relaxing activities before bed
 - Reading
 - Bath/shower
 - Download your brain:
 - To do list/write in journal
- Relaxation techniques to induce sleep
 - deep breathing, progressive muscle relaxation
 - 29% of Grade 9-12 students reported losing sleep because of worries, 'all the time' or 'often' (2011-2012 TDSB Student Survey)

Good sleep strategies



- Parental involvement in
 - making sleep a priority
 - setting bedtime
 - device use
 - caffeine consumption
 - awareness of drowsy driving
 - role modeling

Strategies for an earlier bedtime

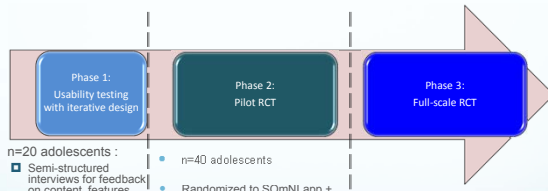
- Gradually move bedtime back
 - 5 minutes at a time on each weeknight
- No more than 1 hour difference in bed and wake times on weekdays vs weekend
 - Wake time is the most important to keep consistent
- Avoid naps
 - If taken, should be limited to 30 minutes and should not occur within 4 hours of bedtime
- Eat breakfast
- Early morning light exposure

SOMNI: Sleep Outcomes, mHealth, wearable sensors, and Nudging Intervention



- Intervention
 - wearable sensor and SOMNI app to facilitate behavioural changes to extend sleep
 - strategies to effect behaviour change, nudging, app features to promote intention formation, goal setting, provide feedback, guide problem-solving, social support

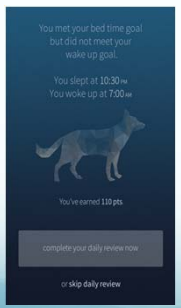



SOMNI Development

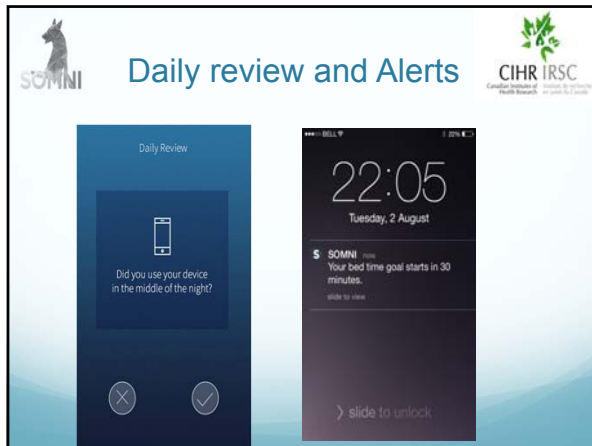


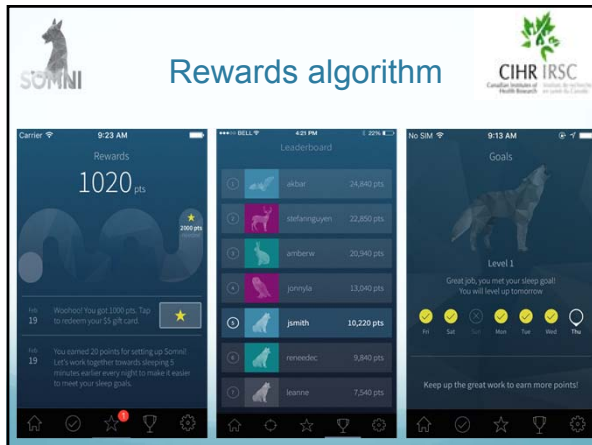
- n=20 adolescents :
 - Semi-structured interviews for feedback on content, features, messaging, formatting
 - Semi-structured interviews with focus on overall look and feel
 - 4-week use of the SOMNI app for testing of technical feasibility, compliance, acceptability
- n=40 adolescents
 - Randomized to SOMNI app + wearable sensor x 4 weeks OR wearable sensor only
 - Feasibility
 - Compliance
 - Sleep (actigraphy) & Health outcomes

Sleep trends within goals








Summary



- Mobile health, user-friendly, low-intensity interventions with wearable sleep sensors and tailored feedback may help adolescents to increase the amount of sleep they achieve
- Does not require health care provider involvement
- Could lead to widespread use as a public health tool to reduce the burden of sleep debt across all and populations
- Recruiting in March 2017





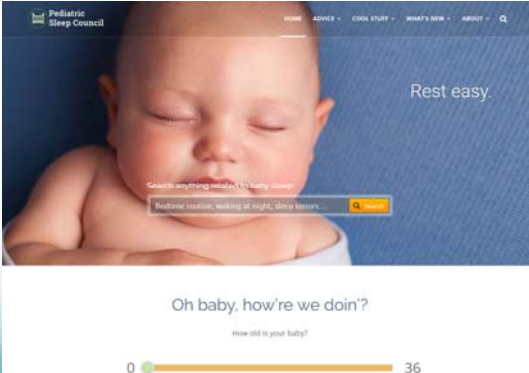
Contents lists available at [ScienceDirect](#)
Sleep Medicine Reviews
Journal homepage: www.elsevier.com/locate/smrv

CLINICAL REVIEW
Delayed school start times and adolescent sleep: A systematic review of the experimental evidence
Karl E. Minges^a, Nancy S. Bedeker^a
^aSan Francisco State University, USA

- 6 studies
- School start times delayed 25-60 min, and sleep time increased from 25 to 77 min per weeknight
- Reduced daytime sleepiness, depression, caffeine use, tardiness to class, and trouble staying awake
- Overall, evidence supports calls for policy that advocates for delayed school start time
- Need for rigorous randomized study designs

Online resources

- Canadian Sleep Society (patient handouts)
 - <http://css-scs.ca/>
- National Sleep Foundation (+++ materials –US-based)
 - www.sleepfoundation.org
- Better Nights, Better Days
 - www.betternightsbetterdays.ca
- Pediatric Sleep Council
 - www.babysleep.com



Pediatric Sleep Council

HOME - ADVICE - COUNSEL - WHAT'S NEW - ABOUT - Q

Rest easy.

Search anything related to baby sleep
Restless routine, waking at night, sleep terror...

Oh baby, how're we doin'?

How old is your baby?

0 36

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Questions? Thank you!



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