Alleviating Chronic Sleep Debt in Early Adolescence – Can a School-Based Intervention Make a Difference?

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Adolescent Sleep

- Assumption: Sleep is a fundamental necessity for health.

Assumptions:

- Youth ages 10-17 require ~9 hours of nightly sleep (National Institutes of Health; National Sleep Foundation)
- Studies across various geographic and cultural settings report 54 to 92% of teens obtain insufficient sleep most school nights.

Why be concerned about chronic sleep debt in adolescents?

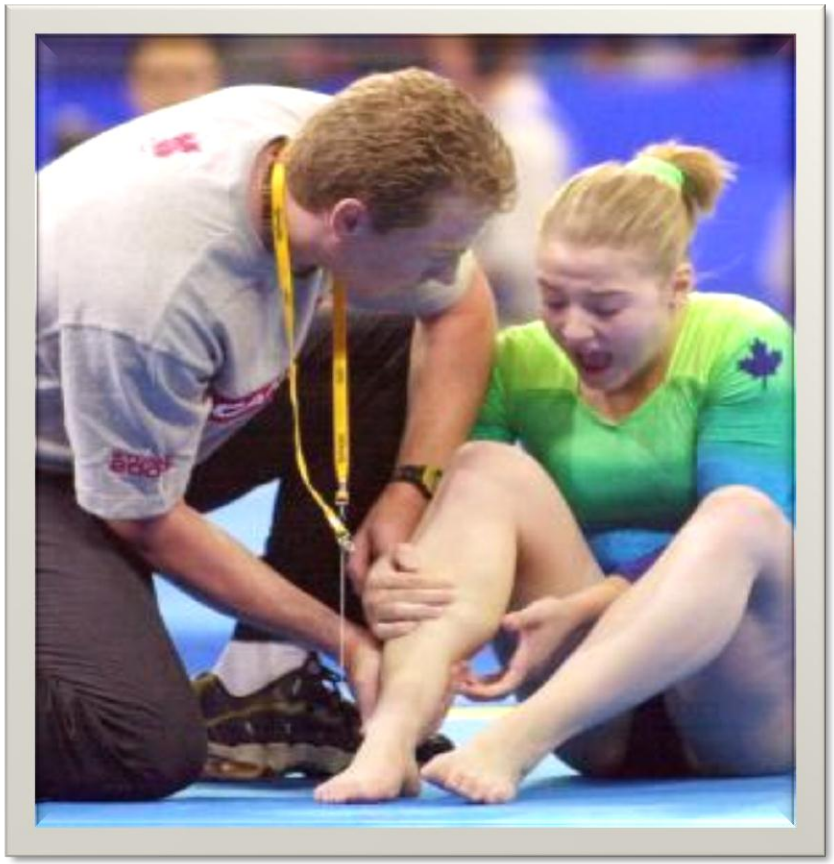
Obesity

Hypertension

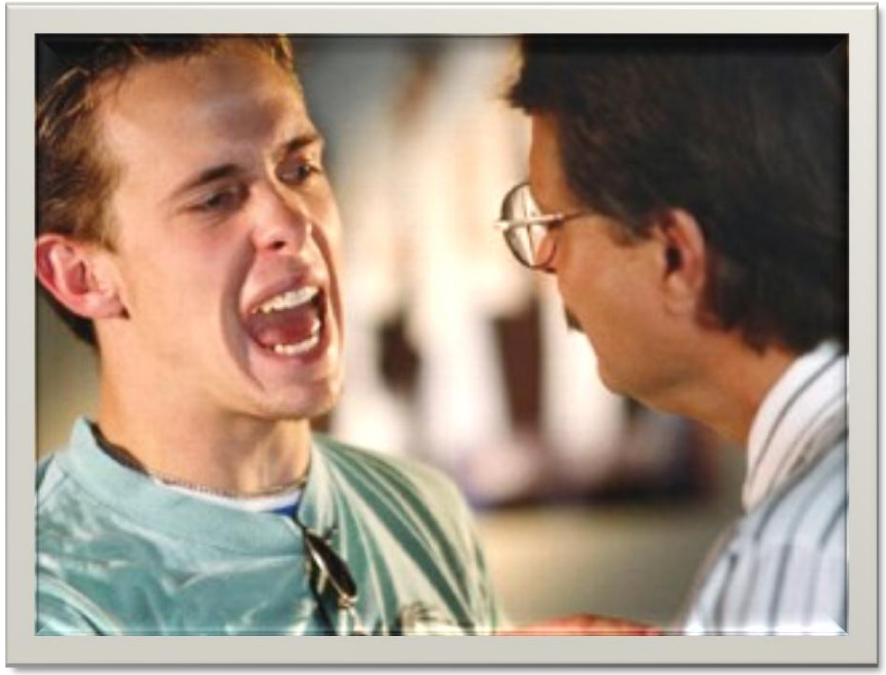
Poor academic performance

Symptoms of depression

Unintentional injuries



Behavior Problems



Substance abuse

Common causes of chronic sleep debt in teens

- Behavioral factors (school, work, social, cultural practices)
- Physiological factors (circadian rhythm changes, sleep disorders)
- Environmental factors (technology, noise)

Background / Significance

- Adolescence is a time when significant social, emotional, physical, and intellectual development occurs
- Behavior patterns established in teen years have long lasting consequences

Rationale

- Key to addressing chronic sleep debt is to prevent occurrence in the first place
- Middle school years are a good time to establish positive health-related behaviors

Purpose

- The purpose of this study was to test a curriculum designed to inform 12 to 14-year old teens about the importance of sleep and motivate them to increase nightly sleep towards a target goal of 9 hours per night.

Specific Aims

1. Examine the relationship between total sleep time (TST) and self-reported daytime sleepiness (DS)
2. Create, implement and evaluate the *Sleep For Your Health* curriculum
3. Determine the impact of a school-based sleep curriculum on TST and DS in early adolescence

Theoretical Framework

- Bronfenbrenner -Bio-ecological Systems Theory - predicts most effective health promotion programs must involve coordinated interventions at multiple levels.
- Jerome Bruner -Discovery Learning Theory - students learn best through process of self discovery.

Design and Methods

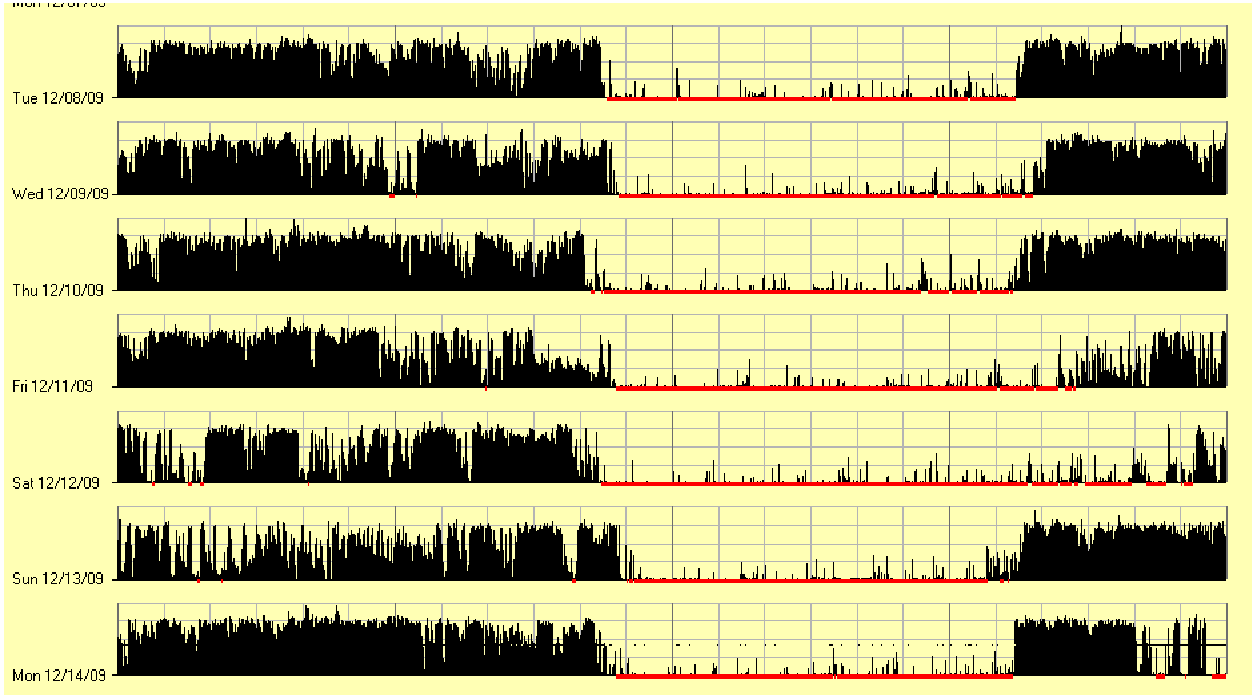
- Design: X--------O--------X

  Pre-test / sleep intervention / post-test
- IRB approval
- Site selection
- Power analysis (n=40)
- Sample / recruitment

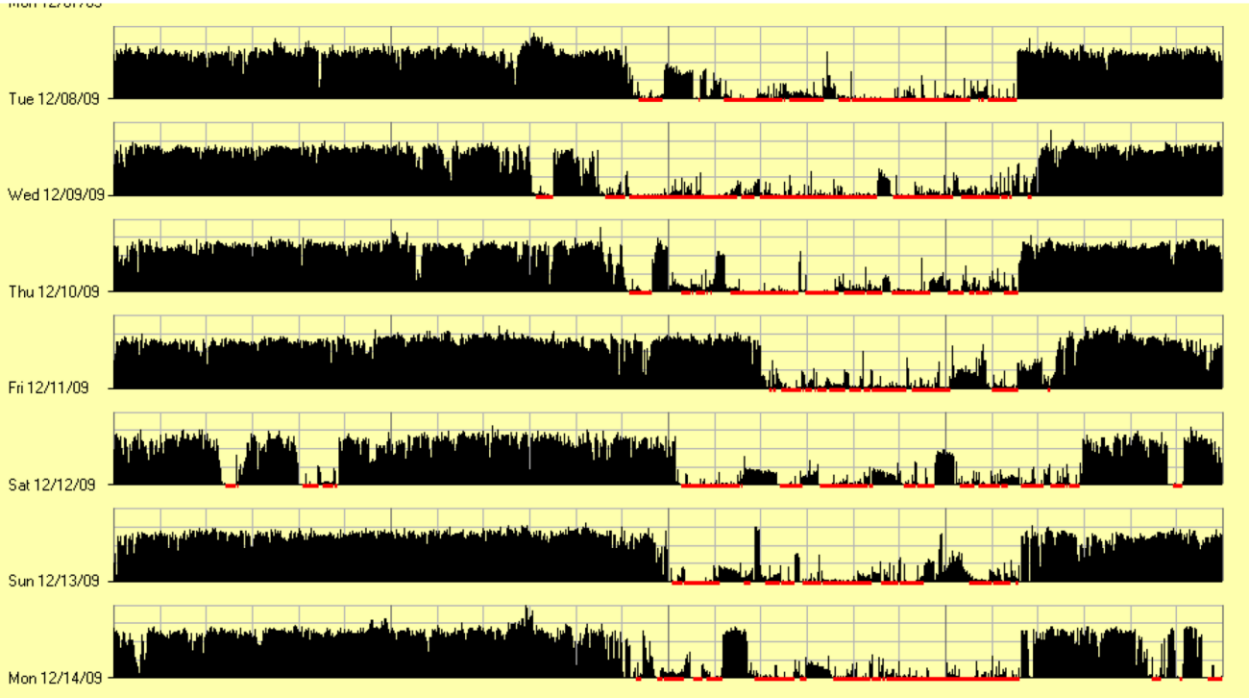
Instruments: Actigraphy

- Wrist actigraph contains a highly sensitive accelerometer that records integrated measures of activity - analyzed in 1 minute epochs to identify periods of sleep

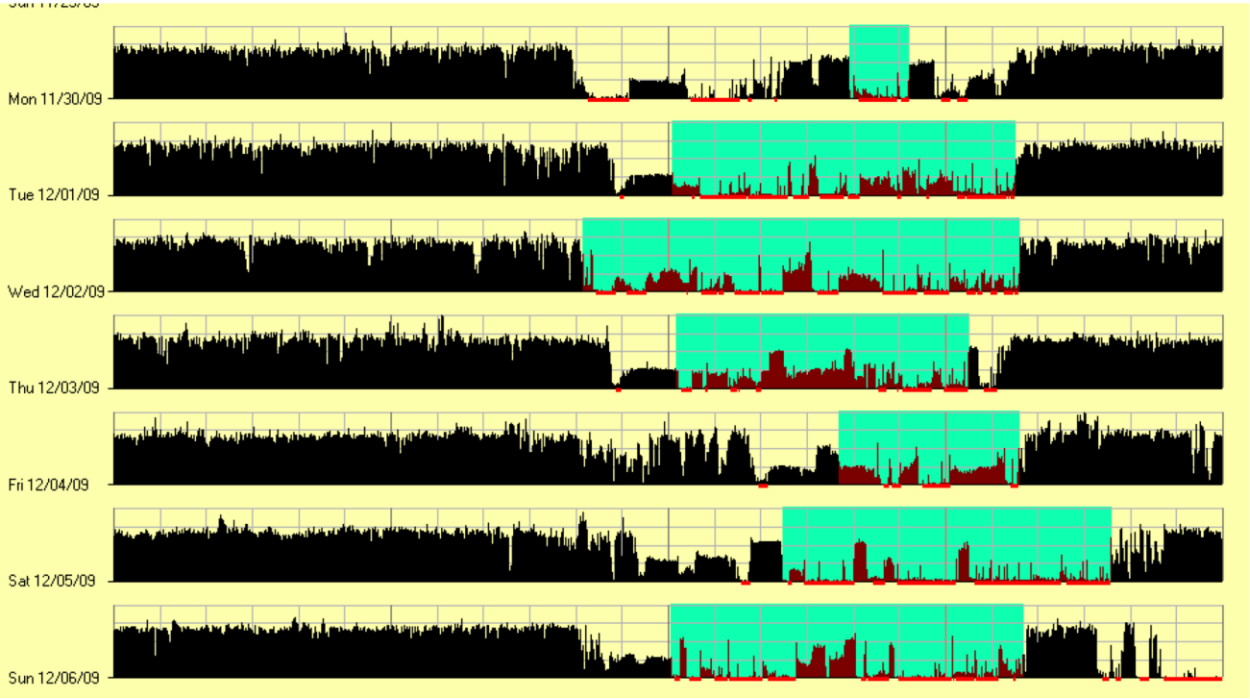
Example of actigraph demonstrating typical adolescent sleep pattern with extended sleep on weekend nights.



Actigraph demonstrating varible times for sleep onset and frequent night awakenings.



Actigraph demonstrating extremely variable times for sleep onset with numerous and prolonged night awakenings (insufficient amount and poor quality sleep).



CASQ-Daytime Sleepiness

- Cleveland Adolescent Sleepiness Questionnaire (Spilsbury et. al., 2007)
- 16 question survey
- Construction of CASQ demonstrated content validity and reliability
- In original study, negative correlation between CASQ and *self-reported* TST

CASQ

Cleveland Adolescent Sleepiness Questionnaire

Today's Date: (fill in) __ __ / __ __ / __ __

What is your age? (fill in years) _____ **What is your sex? (check one)** 1. Female 2. Male

We would like to know about when you might feel sleepy during a usual week. For each statement, mark the circle under the response that best fits with how often it applies to you. It's important to answer them yourself – don't have people help you. There are no right or wrong answers. For example, if we asked "I sleep with a pillow," and the response that best fit how often you sleep with a pillow was "often," you would mark the item as follows:

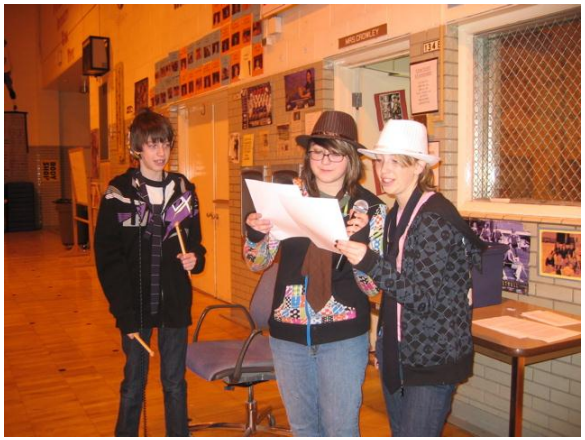
EXAMPLE	Never (0 times per month)	Rarely (less than 3 times per month)	Sometimes (1-2 times per week)	Often (3-4 times per week)	Almost every day (5 or more times per week)
I sleep with a pillow	○	○	○	⊗	●

Sleepiness Questions

	Never (0 times per month)	Rarely (less than 3 times per month)	Sometimes (1-2 times per week)	Often (3-4 times per week)	Almost every day (5 or more times per week)
1. I fall asleep during my morning classes	○	○	○	○	○
2. I go through the whole school day without feeling tired	○	○	○	○	○
3. I fall asleep during the last class of the day	○	○	○	○	○
4. I feel drowsy if I ride in a car for longer than five minutes	○	○	○	○	○
5. I feel wide-awake the whole day	○	○	○	○	○
6. I fall asleep at school in my afternoon classes	○	○	○	○	○

Sleep For Your Health Curriculum

- Grade level appropriate
- Sequential
- Interactive learning strategies
- Small groups - peer led activities
- Reinforced at home and school

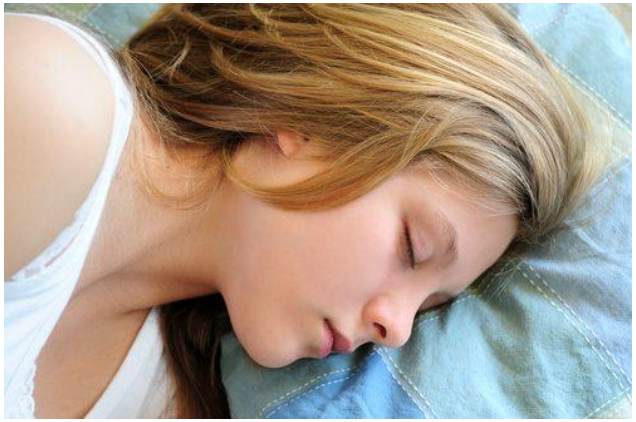


6 Sessions

15 minutes per week

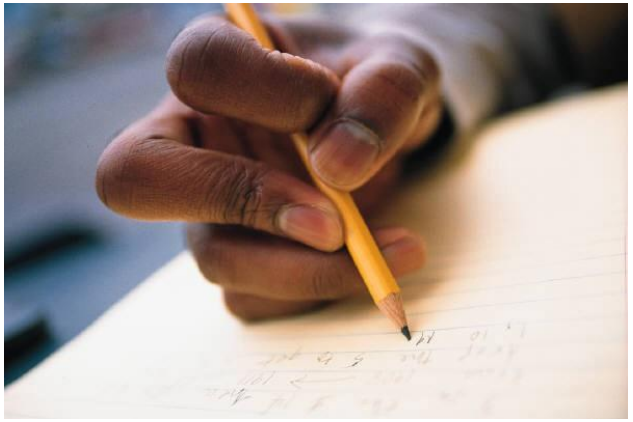
- What does sleep do for you?
- Sleep – Are you in debt? (Sleepy, Dopey, and Grumpy)
- Chronobiology – You've got rhythm!
- Sleep Hygiene – Just do it!
- Common sleep disorders – Are you sleeping?
- Everything you wanted to know about sleep but were afraid to ask.

Data Collection



- Pre- and post-intervention…
- Students wore wrist actigraphs; concurrently kept sleep diary for 1 week
- Completed CASQ on day acti-watches were returned

Post-intervention: Knowledge assessment and curriculum evaluation



- Students & parents were given a 10 question T/F quiz
- 2 checked response questions
- 3 open-ended evaluation questions

Results: Descriptive Statistics

- n = 48 enrolled
- Comparison (control) group = 26, Experimental group = 22
- 52% male
- Mean age = 159 months (13.26 years)
- 83% white

Findings: Total Sleep Time

N=pre/post	Mean TST pre-intervention	Mean TST post-intervention	Change
Total 47	441 minutes ± 66 (7.35 hours)		
Control group 26/24	438 minutes ± 75 (7.3 hours)	447 minutes ± 67 (7.45 hours)	9 minutes
Experiment Group 21/21	445 minutes ± 55 (7.42 hours)	467 minutes ± 75 (7.78 hours)	22 minutes

Findings: CASQ / Daytime Sleepiness

N	Mean CASQ score pre-intervention (sd)	Mean CASQ post-intervention (sd)
Total 48	31 ± 9	
Control group 26	31 ± 9	32 ± 7
Experimental group 22	30 ± 10 [Possible score range 16-80]	31 ± 11

Specific Aim 1. Data Analysis

Examine the relationship between total sleep time (TST) and self-reported daytime sleepiness (DS) in 12 to 14-year old adolescents.

Pre-test r = .014, (*p*=.463)

Post-test control group *r* = -.149

(*p*=.244)

Experimental group *r* = -.024 (*p*=.459)

Age & Sleep Duration

- r = -.618 (p=.003)
- The older the adolescent, the less their average sleep time

Specific Aim 2. Assessment of Sleep Content Comprehension

- 10 question T/F quiz
- Student score mean = 8.29 (*sd* = 1.5)
- Parent score mean = 9.6 (*sd* = 0.5)

Data Analysis / Evaluation Survey

- 63.2% of students stated they learned “quite a bit” or “way more than expected”
- 77.8% responded they were trying to get closer to 9 hours of nightly sleep

Data Analysis / Evaluation Survey

- Parent responses (25%)
- 80% learned “a few helpful things” or “quite a bit”
- 80% said they were likely to encourage 9 hours of nightly sleep

Key Findings:

- Mean TST in control group increased 9 minutes / night
- Mean TST in experimental group increased by 22 minutes / night
- 55% experimental group increased sleep by average of 65 minutes / night
- 45% experimental group decreased sleep by average of 49 minutes / night

Limitations

- Not sufficient power to detect a moderate effect size with 48 subjects; most likely due to wide variation in sleep habits.
- Lack of diversity in participants
- Instruments – wrist actigraphs, CASQ, sleep knowledge questionnaire

Limitations

- Low return rate of parental responses
- Did not measure baseline sleep knowledge
- Curriculum not delivered as planned
- Insufficient time to emphasize goal setting each week

Implications: Total Sleep Time

- TST in both groups increased from October to December
- Further research on seasonal variations in sleep patterns

CASQ

- Sleepiness is difficult to measure
- No significant correlation between DS, TST or sleep quality as measured by actigraphy
- Highly reliable. ? validity
- Suggest further testing with larger and more diverse samples

Summary

Study confirms 12-14 year olds not getting sufficient sleep most nights.

Raises the question whether teens recognize feelings of sleep deprivation.

Approach was acceptable / encourage adoption of sleep information in middle school health curricula.