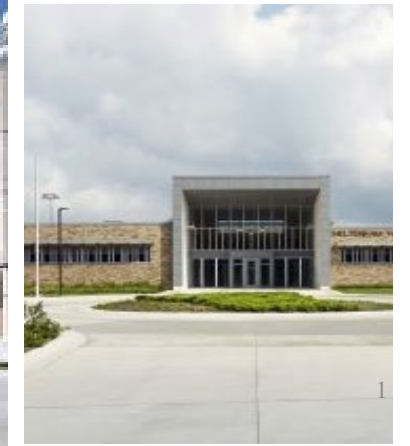




Perspectives on Sleep Health for Youth in Juvenile Justice System



Meeting with State of Maryland
Juvenile Services Education Program Board
April 6, 2022





Introductions



Amy R. Wolfson, PhD

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Associate Professor, Psychiatry & Behavioral Sciences

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Sleep Regulation: Changes During Puberty

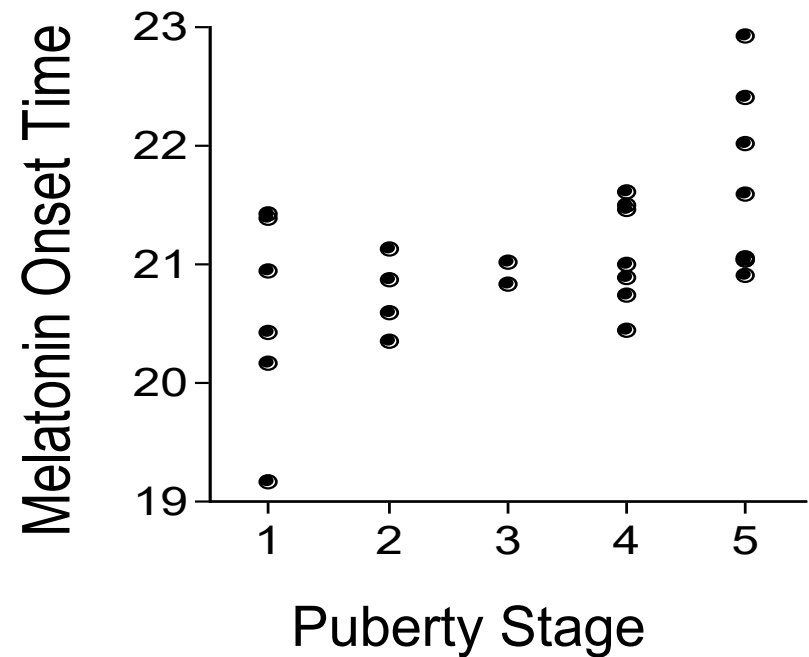
- Sleep Pressure System
 - Balances sleep and wake
 - **Pressure for sleep builds more slowly in older vs. younger student**

- Circadian (~24-hour) Biological Clock
 - Regulates timing of sleep and wake
 - **Clock signaling sleep runs later in older vs. younger students**



Circadian Clock Shifts Later

- Controlled conditions
- Circadian cue for sleep shifts later with puberty

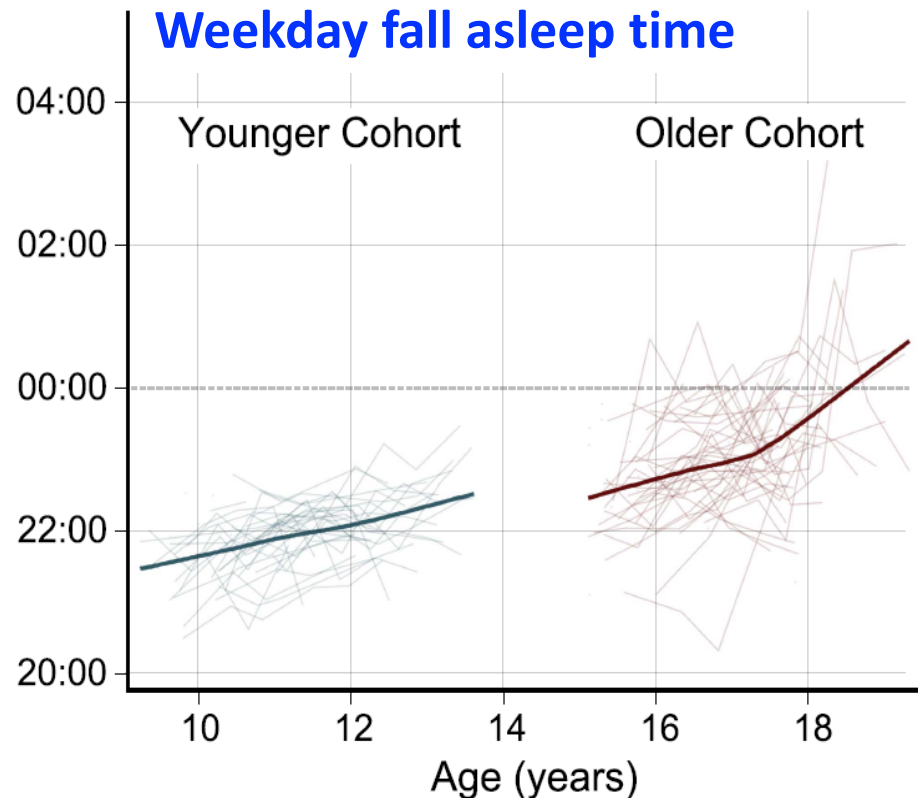


(Carskadon et al., Ann. N.Y. Acad. Sci., 2004)

Figure from M. Carskadon

Adolescent sleep timing shifts later

- Largely driven by sleep regulatory changes in the brain during puberty.
- Older adolescent who used to fall asleep at 9:00 PM will now not be able to fall asleep until 11:00PM or later.
- It also means waking 2 hours later in the morning.



*external factors

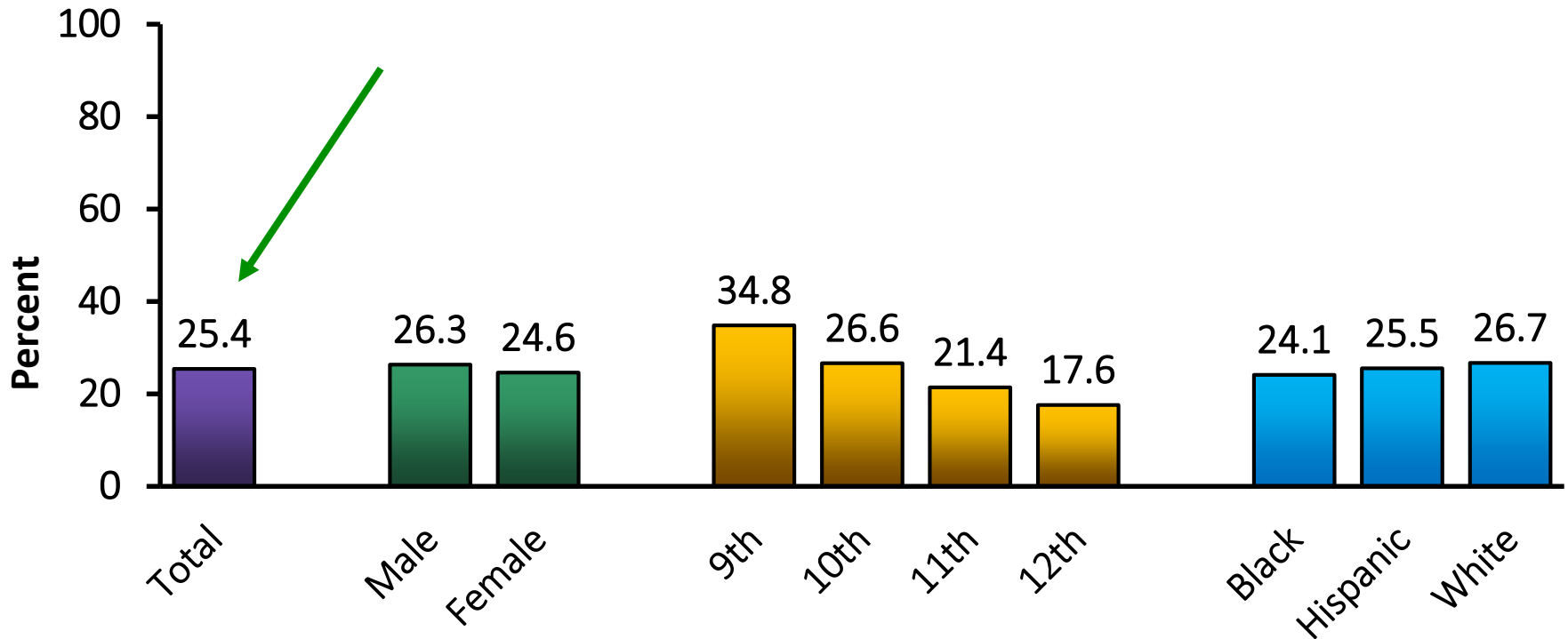
Insufficient School Night Sleep

- Biological factors contribute to late bedtimes.
- Early school start times force students awake on weekday mornings



Sleep Need: 8 – 10 hours/night

Percentage of High School Students Who Got 8 or More Hours of Sleep on Average School Night by Sex, Grade,[†] and Race/Ethnicity



[†]9th > 10th, 9th > 11th, 9th > 12th, 10th > 11th, 10th > 12th, 11th > 12th (Based on t-test analysis, $p < 0.05$.)

All Hispanic students are included in the Hispanic category. All other races are non-Hispanic.

Note: This graph contains weighted results.

Consequences of Insufficient & Mistimed Sleep

- Falling asleep in class
- Depression, anxiety, suicidal thoughts
- Behavior problems
 - Aggression
 - Hyperactivity
 - Poor impulse control
- Risk-taking behaviors
- Cognitive challenges
 - attention
 - memory
 - executive functioning
- Poor teachers' ratings
 - quality of work
 - percent work completed
 - difficulty recalling material
- Poor school grades



Wolfson & Carskadon (1998); Randazzo et al. (1998); Beebe et al. (2010); Beebe et al. (2013); Gruber, Wiebe et al. (2012); Gruber, Michaelsen et al. (2012); Sadeh et al. (2003); Fallone et al. (2001, 2005) Beebe (2011); Gruber et al. (2012); Owens et al. (2014)

Sleep Prepares for & Enhances Learning

Information acquisition



Consolidation/stabilization/strengthening/filtering

Information retrieval

I READ A RECENT
SCIENTIFIC STUDY
THAT SAID HIGH
SCHOOLS SHOULD
START AT A
LATER HOUR...

YA THINK?!





health, safety, and equity in education

Facts About School Start Times

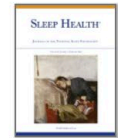
- The American Academy of Pediatrics recommends that middle and high schools start at 8:30 a.m. or later.
- Today, many middle and high schools begin much earlier, often around 7 a.m.
- Bus pick-ups starting between 5:15 and 6:30 a.m. require students to wake up hours before what is healthy, safe, and developmentally-appropriate for their still-growing brains and bodies.
- With such schedules, teenagers have to be in bed and asleep at 8 or 9 p.m. in order to get the amount of sleep they need. This just isn't possible — for both biological and logistical reasons.

Learn more about why it's time
to **Start School Later** ▶
... and what you can do to help.



Sleep Health

Volume 8, Issue 1, February 2022, Pages 11-22



Adolescent sleep health and school start times: Setting the research agenda for California and beyond. A research summit summary

Terra D. Ziporyn PhD ^{a, 2}, Judith A. Owens MD, MPH ^b, Kyla L. Wahlstrom PhD ^c, Amy R. Wolfson PhD ^d, Wendy M. Troxel PhD ^e, Jared M. Saletin PhD ^f, Sonia L. Rubens PhD ^g, Rafael Pelayo MD, FAASM ^h, Phyllis A. Payne MPH ³, Lauren Hale PhD ⁱ, Irena Keller PhD ^j, Mary A. Carskadon PhD ^f

Professional medical and public health organizations have reviewed all of the available sleep research on adolescent health. They have recommended a start time for all middle/high schools.



Recommend middle/high school start at
8:30am or later

American Academy of Child & Adolescent Psychiatry
American Academy of Pediatrics
American Academy of Sleep Medicine
American Medical Association
American Psychological Association
American Sleep Association
American Thoracic Society
Centers for Disease Control
Massachusetts Medical Society
National Association of School Nurses
National Institutes of Health
National Parent Teacher Association
National Sleep Foundation
Sleep Research Society
Society of Behavioral Medicine
Society of Pediatric Nurses

Recommend middle/high school start
before 8:30am

No organization has found that starting middle or high schools before 8:30am is safe or healthy for our children.



Masconomet Chapter | Massachusetts
health, safety and equity in education

Benefits of Later School Start Times

- Review of 38 studies (Wheaton et al, '16); Meta-analysis of 20 studies (Bowers & Moyer, '17); other studies:

- **Sleep**

- **Increased TST by 30-60 min**
- **later WTs**
- **consistent BTs**
- **fewer sleep problems**
- **easier time falling asleep**
- **decreased sleepiness**

- **Reduced tardiness (as much as 4X)**
- **Increased attendance**
- **Reduced drop-out rates**
- **Improved standardized test scores, particularly Math & Reading**
- **Improved GPAs**
- **Increased/stable engagement sports, extracurricular activities**
- **Improved time allocation**

- **Improved mood**
- **Improved behavior**
- **Improved mental health**
- **Decreased delinquent type behavior**
- **Decreased health center visits**
- **Improved family well-being (decreased family conflict)**
- **Decreased sleep-driver accidents**
- **Decreased substance abuse**



- **Economic benefits far exceed costs in real dollars by ratio of 6:1 as early as 2 years out**

Table 1

Adjusted odds ratios (95% CI) for each sleep duration category, comparing the odds of insufficient sleep to the odds of sufficient sleep, by school-night total sleep duration category.

| School-night total sleep duration (h) | Insufficient (<8 h TST) | Borderline (8-9 h TST) | Sufficient (≥9 h TST) |
|---------------------------------------|-------------------------|------------------------|-----------------------|
| 5-6 h | 1.00 (Reference) | 1.00 (Reference) | 1.00 (Reference) |
| 6-7 h | 1.21 (1.04, 1.40) | 1.00 (Reference) | 1.00 (Reference) |
| 7-8 h | 1.48 (1.28, 1.71) | 1.00 (Reference) | 1.00 (Reference) |
| 8-9 h | 1.81 (1.58, 2.08) | 1.00 (Reference) | 1.00 (Reference) |
| ≥9 h | 2.15 (1.87, 2.47) | 1.00 (Reference) | 1.00 (Reference) |

ADOLESCENT SLEEP NEEDS AND PATTERNS

Research Report
and Research Guide

Adolescents Living the 24/7 Lifestyle: The Influence of Caffeine and Technology on Sleep-Related Daytime Functioning

Christina L. Edwards, PhD, MEd, Theresa M. A. Barnes, MS, PhD, Jennifer L. Taylor, PhD, and Jennifer L. Taylor, PhD

BEHAVIORAL SLEEP MEDICINE

Journal of Clinical Sleep Medicine

Volume 7, Number 10, October 2012

ISSN: 1530-0417

Economics of Education Review

Journal homepage: www.elsevier.com/locate/econbase

Early to rise? The effect of daily start times on academic performance

Risley Edwards*

PEDIATRICS

Official journal of the American Academy of Pediatrics

Volume 130, Number 5, May 2012



Journal of Clinical Sleep Medicine

Volume 7, Number 10, October 2012

ISSN: 1530-0417

Driving Drowsy

Commentary

Dr. P. Phillip S. Adelman

CHILD DEVELOPMENT

Journal of Child Psychology and Psychiatry

Volume 53, Number 10, October 2012

REVIEW

Sedentary behavior and sleep: paradoxical effects in association with childhood obesity

A. Must and M. F. Pate

ADOLESCENT SLEEP NEEDS AND PATTERNS

Research Report

Adolescents Living the 24/7 Lifestyle: The Influence of Caffeine and Technology on Sleep-Related Daytime Functioning

Examining the Impact of Later High School Start Times on the Health and Academic Performance of High School Students: A Multi-Site Study

Final Report February 2014

Kyla L. Wahlstrom, Ph.D. Project Director/Lead Investigator

ARCHIVES OF PEDIATRICS & ADOLESCENT MEDICINE

Research Team/Report

Kyla L. Wahlstrom, PhD, Principal Investigator

Too Much Research to Review Today!

Summary of Findings

Does changing school schedules make a positive approach affect academic achievement, behavioral, and educational improvement (CARE) at the University of Minnesota that has studied these issues among both suburban and urban schools.

ARTICLE IN PRESS

The Effects of Acute Sleep Restriction on Adolescents' Performance in a Virtual Environment

Aaron L. Davis, PhD, Kristin T. Aul, PhD, and David C. Scheibel, PhD

ADOLESCENT SLEEP NEEDS AND PATTERNS

Research Report

Adolescents Living the 24/7 Lifestyle: The Influence of Caffeine and Technology on Sleep-Related Daytime Functioning

SD) values for sleep and daytime functioning parameters, and intelligence tasks as a function of adolescent's school nights

| | Insufficient (<8 h TST) | Borderline (8-9 h TST) | Sufficient (≥9 h TST) |
|--------|-------------------------|------------------------|-----------------------|
| (time) | 23.15 hours (121.77") | 22.15 hours (61.0") | 21.28 hours (63.7") |
| (time) | 68.3 (52.3") | 30.8 (22.8") | 21.18 (18.0") |
| (time) | 07.02 hours (51.2") | 07.10 hours (47.0") | 07.27 hours (48.6") |
| (time) | 07.15 hours (66.8") | 07.25 hours (59.7") | 07.35 hours (58.7") |

| | Insufficient (<8 h TST) | Borderline (8-9 h TST) | Sufficient (≥9 h TST) |
|--------|-------------------------|------------------------|-----------------------|
| (time) | 00.58 hours (174.1") | 23.52 hours (150.8) | 23.46 hours (169.0) |
| (time) | 44.3 (54.5") | 25.0 (29.8) | 20.2 (21.2) |
| (time) | 8.3 (2.2") | 9.2 (1.6) | 9.4 (1.5) |
| (time) | 10.01 hours (182.7") | 09.31 hours (146.3) | 09.27 hours (143.8) |
| (time) | 12.30 hours (174.9") | 09.57 hours (150.4) | 09.47 hours (157.1) |

Middle School Start Times: Night's Sleep

The neuroendocrine control of the circadian system: Adolescent chronotype

Megan Hastings Hagman, PhD, Theresa M. Lee, PhD

SLEEP AND BIOLOGICAL RHYTHMS

Journal of Child Psychology and Psychiatry

Volume 53, Number 10, October 2012

ADOLESCENT SLEEP NEEDS AND PATTERNS

Research Report

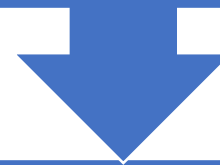
Adolescents Living the 24/7 Lifestyle: The Influence of Caffeine and Technology on Sleep-Related Daytime Functioning

Delaying School Start Times: Social Justice Solution!

- Strong evidence of racial/ethnic, socioeconomic disparities in adolescent sleep.
- Students from economically disadvantaged backgrounds experience greatest drawbacks from early SSTs (Marco, Wolfson et al., 2011, others).
- Early SSTs reduce performance among disadvantaged students by amount equivalent to having a highly ineffective teacher (Hamilton Report, 2011).
- Later middle SSTs associated with 2 percentile point gain in Math/Reading test scores, with larger gains at lower end of socioeconomic spectrum (Edwards, 2012).
- Delayed SSTs associated with increases in attendance & better graduation rates (McKeever & Clark, 2017).
- Therefore, later SSTs important & cost effective strategy to minimize achievement & health gaps for socioeconomically disadvantaged students.

Three Interlocking Studies

Phase 1: Sleep Environment
Observational Study of DJS
Facilities (Summer 2019)

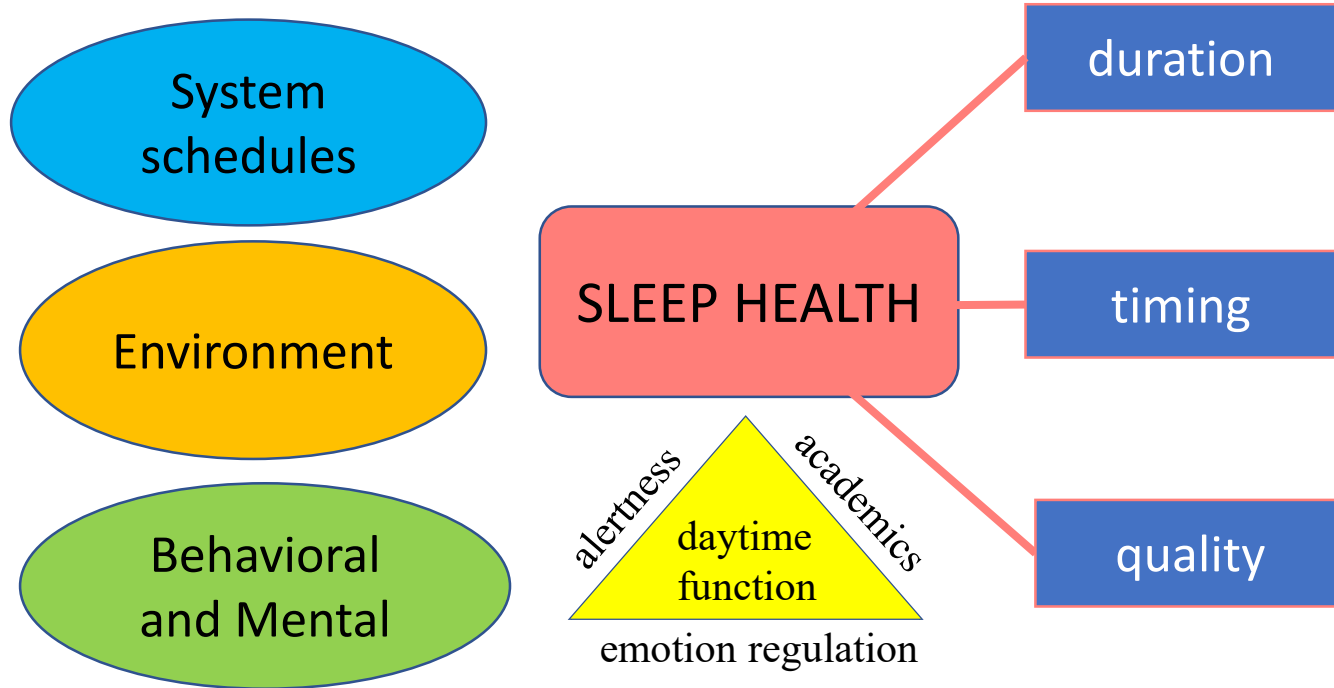


Phase 2: DJS Staff and
Administrator Interview Study
(Summer 2020)



Phase 3: Juveniles' Perceptions of
Sleep Quality and Environment
During Detention (2021)

Focus of Three Studies



Sleep Health in Juvenile Justice Systems

Studies' Overall Findings

- School-night sleep duration/time in bed close to recommended minimum of 8 hours
- Longer duration on weekends suggest some sleep restriction on school days.

duration

- Mismatch between lights out and readiness for sleep
- Waking up in morning challenging for ~ 60% of youth

timing

- ~2 awakenings per night reported on average
- Light at night was common theme from multiple reporters (youth and night staff)

quality

- Higher levels Depression/Anxiety symptoms associated with:
 - More night wakings
 - Increased daytime sleepiness
 - Earlier wake times

behavior/
mental health

DJS Sleep Health Changes and Initiatives

System/School
schedules

Shifting lights on/off times later

- Revised Schedule: 9pm to 6am
- **Need to delay school start time**

Environment

Dark at night & bright light during the day

- DJS creating ability to dim lights at night and/or changing type of night lighting
- Eyeshades for most youth to decrease light for sleep
- Increased time in daylight during day
- Optimal lighting during the day
- Decrease noise at night (e.g., TV)

Behavioral &
Mental health

Supplemental programs/initiatives

- Sleep/circadian disorder assessments & referral?
- Sleep health education programs for staff!

MULTI-PRONGED APPROACH

<http://www.startschoollater.net/>

Diverse players
(community advocates,
educators, health
professionals, sleep
health researchers,
policymakers)

National

- Legislation (e.g., ZZZs to As Act)
- Position Statements (e.g., AAP, CDC, APA, DOE, Educ Comm. Of the States)
- Litigation (?)
- Grassroots Activism
- Education

State

- Legislation
- Position Statements (e.g., state medical societies)
- Litigation (?)
- Grassroots Activism
- Education

Local

- Legislation
- Position Statements (e.g., local board of health)
- Grassroots Activism
- Education

