Improving Teen Sleep to Prevent Suicide:
Promising Strategy or Impossible Dream?

Tina Goldstein PhD
Western Psychiatric Hospital, University of Pittsburgh Medical Center

STAR Annual Conference
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Disclosures

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<td>National Institute of Mental Health</td>
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<td>The American Foundation for Suicide Prevention</td>
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Agenda

1. Update on Adolescent Suicide
2. Why Sleep?
3. The Sleep-Suicide Association
4. Implications for:
   • Assessment
   • Treatment
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Suicide Rates Among Youth Are Steadily Increasing

Suicide Rates by Age from 2000 to 2017

- Adolescents (15-24)
  - Suicide 22%
  - Unintentional Injuries 49%
  - Other Causes 13%
  - Homicide 17%

- Children (10-14)
  - Suicide 21%
  - Unintentional Injuries 34%
  - Other Causes 11%
  - Homicide 7%
  - Homicide 17%

CDC National Center for Injury Prevention and Control 2017

Suicide is Currently the 2nd Leading Cause Of Death Among Youth In The US

National Center for Injury Prevention and Control 2017
Multiple Domains Contribute to Suicide Risk

Characteristics of suicidality
- Psychological characteristics:
  - Impulsivity
  - Hopelessness
- Family & environmental factors:
  - Abuse
  - Loss
  - Family history
  - Stress
  - Bullying
  - Medical problems
- Medical problems
- Intent
- Planning
- Prior suicidal behavior

Cash & Bridge 2009; Bridge et al 2006

Improved Understanding of Proximal Risk Factors Is Critical for Suicide Prevention Efforts

**WHO? Distal Risk Factors**
For example:
- Psychiatric disorders
- Family history

**WHEN? Proximal Risk Factors**
For example:
- Recent loss
- Recent hospital discharge

Cash & Bridge 2009; Bridge et al 2006

Optimal Targets for Suicide Prevention are:

1) Proximal

Rudd et al 2006
Optimal Targets for Suicide Prevention are:

1) Proximal
2) Dynamic
3) Modifiable

...LIKE SLEEP?!
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Pediatric Sleep Guidelines
American Academy of Sleep Medicine

<table>
<thead>
<tr>
<th>Age</th>
<th>Recommended Sleep Hours per 24 hour period</th>
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<tbody>
<tr>
<td>Infants: 4-12 months</td>
<td>12 to 16 hours (including naps)</td>
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<tr>
<td>Toddlers: 1-2 years</td>
<td>11 to 14 hours (including naps)</td>
</tr>
<tr>
<td>Preschoolers: 3-5 years</td>
<td>10 to 13 hours (including naps)</td>
</tr>
<tr>
<td>Grade-schoolers: 6 to 12 years</td>
<td>9 to 12 hours</td>
</tr>
<tr>
<td>Teens: 13-18 years</td>
<td>8 to 10 hours</td>
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Epidemic of Sleep Deprivation in Teens

Insufficient sleep - 73%
The Rate of US Adolescents Reporting Insufficient Sleep Is Increasing

<table>
<thead>
<tr>
<th>Year</th>
<th>% getting less than 7 hours of sleep most nights</th>
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<tbody>
<tr>
<td>1991</td>
<td>45</td>
</tr>
<tr>
<td>1993</td>
<td>40</td>
</tr>
<tr>
<td>1995</td>
<td>35</td>
</tr>
<tr>
<td>1997</td>
<td>30</td>
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<td>1999</td>
<td>25</td>
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<td>2001</td>
<td>20</td>
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<td>2003</td>
<td>15</td>
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<td>2005</td>
<td>10</td>
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<tr>
<td>2007</td>
<td>5</td>
</tr>
<tr>
<td>2009</td>
<td>0</td>
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Twenge et al 2017
n=369,595
Youth Risk Behavior Survey & Monitoring the Future Survey

Why is Short Sleep So Common In Teens? Biological Changes In Sleep at Puberty

Sleep becomes lighter
Sleepiness increases

Circadian rhythms shift later (delayed melatonin onset, DLMO) prefer later bed and wake times
- DLMO: Preschool ~ 7:30 PM
- DLMO: Prepubertal ~ 8:30 PM
- DLMO: Mature adolescents ~ 9:30 PM

Whyte et al 2010; Johnson et al 2016; Roenneberg et al 2004

Insomnia Increases During Adolescence

- Lifetime prevalence = 11%
- 53% comorbid with a psychiatric disorder
- Menses onset associated with 3x increased risk

Johnson et al 2006
n=1,014
Why is Short Sleep So Common In Teens?

**Social & Environmental Changes in Sleep at Puberty**

- Decrease in parental control
- Homework & after school activities
- Use of social media (& exposure to light)
- Early school start times

Keyes et al. 2015; Johnson et al. 2016; Roenneberg et al. 2004

The More Time Youth Spend Using Electronics, the Less Likely They Are to Report Adequate Sleep

![Graph showing the correlation between hours of electronic device use and sleep duration.](image)

Twenge et al. 2017
National Longitudinal Youth Risk Behavior Survey & Monitoring the Future Survey
Data from 2009-2015

Biological + Social Influences During Adolescence = Chronic Sleep Deprivation

- Biological: Circadian and preferred sleep timing shift later in adolescence
- Social/Environmental: Early school start times, after school activities, homework, etc...

![Chart showing sleep patterns on different days of the week.](image)

Slide courtesy of Brant Hasler PhD
Consequences of Insufficient Sleep in Adolescents

This is your teen…

Cognitive
- Lower grades/achievement test scores
- Concentration
- Judgment
- Problem-solving

Emotional
- More depressive symptoms
- Emotional reactivity
- More negative/less positive affect
- Difficulty regulating emotions

Behavioral
- Impulsivity
- Irritability
- Sleepiness
- Delayed puberty
- Substance use

Physical
- Weight gain/obesity
- Diabetes
- Preference for high-fat, high-carb foods
- Acne
- Perceived as less attractive
- Elevated pro-inflammatory cytokines

Neurological
- Impaired prefrontal cortical functioning
- Blunted reward circuitry (nucleus accumbens)
- Reduced hippocampal connectivity (frontal/limbic)
- Decreased serotonin activity
- HPA axis alterations

Less Sleep = Greater Risk for Teen Substance Use

Note: Each hour less of sleep is associated with a significant increase in odds of use

Winsler et al 2015

N=27,939
Sleep and Youth Psychiatric Disorders

Sleep is disturbed in youth with psychiatric disorders
- depression
- anxiety
- ADHD
- substance use disorders

Sleep problems are:
- a risk factor for developing psychiatric disorders
- symptoms of psychiatric disorders
- associated with worse outcomes in patients with psychiatric disorders

Adolescence: A period of vulnerability to psychiatric disorders that may be further exacerbated by sleep loss

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This is Your Teen's Suicide Risk on Insufficient Sleep…

The Sleep-Suicide Association: What Do We Know?

Risk of Suicide Attempt Nearly 3x Greater Among Teens Who Sleep Less than 8 Hours/Night
Risk of Suicide Attempt 2.5x Greater Among Teens Who Report Frequent Nightmares

The Association Between Total Sleep Time and Suicidal Ideation, Plans and Attempts in US Adolescents (n=16,410)

Just 1 Hour Less of Weekday Sleep is Associated with Increase in Risk for Suicidal Ideation and Attempt in HS Students
Greater Rates of Sleep Disturbance in the Preceding Week Among Youth who Died by Suicide vs. Controls

Goldstein et al 2008

Sleep Onset Variability Predicts Subsequent Increases in Suicidal Ideation

Bernert et al 2017

Distal Risk Factors
- eg psychopathology, early trauma, family history of suicide

Proximal Risk Factors
- eg interpersonal conflict, loss, bullying, substance use

Sleep & Circadian Disturbances
- short sleep, long sleep, insomnia, hypersomnia, circadian reverse, nightmares, poor sleep quality, weekend catch-up

Psychosocial Developmental Processes

Biological Developmental Processes

Impulsivity
- Impaired problem solving
- Decreased capacity to regulate emotions
- Acute substance use

Neurobiological dysfunction
- Decreased serotonin activity
- HPA axis alterations

Suicidality
The Sleep-Suicide Association: What Else Do We Need to Know to Prevent Teen Suicide?

- Understanding of specific sleep disturbances
  - objective & subjective measures
- Temporal associations
  - prospective studies with high risk samples
- Developmental differences?
- Identification of underlying mechanisms
  - psychological
  - neurobiological

Liu & Buysse 2005
Pigeon et al 2012

Examining the prospective association between sleep health and suicidality in adolescents and college students at ultra-high risk for suicide

**S.P.O.T. Study**

Sleep Predicting Outcomes in Teens

**STAR**
What Time of Day is Suicidal Ideation Most Common?

<table>
<thead>
<tr>
<th>Time of Day</th>
<th>% of Days</th>
</tr>
</thead>
<tbody>
<tr>
<td>1AM-3AM (2AM-4AM)</td>
<td>20</td>
</tr>
<tr>
<td>4AM-6AM (5AM-7AM)</td>
<td>30</td>
</tr>
<tr>
<td>7AM-9AM (8AM-10AM)</td>
<td>40</td>
</tr>
<tr>
<td>10AM-12PM (11AM-1PM)</td>
<td>10</td>
</tr>
<tr>
<td>1PM-3PM (2PM-4PM)</td>
<td>10</td>
</tr>
<tr>
<td>4PM-6PM (5PM-7PM)</td>
<td>20</td>
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<tr>
<td>7PM-9PM (8PM-10PM)</td>
<td>30</td>
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<td>10PM-12AM (11PM-1AM)</td>
<td>20</td>
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</tbody>
</table>

How Are the Youth in SPOT Sleeping?

- Total sleep time (hours) = 7.0 (Range 5.5–8.7)
- Sleep efficiency (%) = 82% (Range 69%–96%)
- Sleep onset latency (minutes) = 18 (Range 6–60)
- Nightmares = 38% (Range 3–100%)
- Sleep quality (1-100 scale) = 51 (Range 21 – 70)
Does Last Night’s Sleep Predict Suicidality Today?

Promising Strategy for Suicide Prevention…?

Real-time detection of high-risk sleep profile

Alert providers, parents

Prompt teen to use skills and safety plan

Future Directions:

Monthly Neuroimaging (fMRI) Neurobiological mechanisms

Suicidal ideation
Passive death wish

Standardized Effect: Odds Ratio

Alert providers, parents

Prompt teen to use skills and safety plan

Related risk factors eg, substance use

Objective sleep health

Suicidal ideation / behavior
Subjective sleep

Related risk factors eg, substance use

Baseline
1-month
2-month
3-month

Clinical Assessment
Baseline Related risk factors

Daily Actigraphy

Daily Cellphone Ratings

Weekly Clinical Ratings

Neuroimaging (fMRI)

Neurobiological mechanisms

Suicidal ideation
Passive death wish

Standardized Effect: Odds Ratio
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Implications For Assessment

Include assessment of sleep problems in standard suicide risk assessment

How to Assess for Sleep Problems in Teens

Ask about a “recent typical night”

• Be specific
• Get overview of preceding day
• Wind down period
• Pre-sleep period: from ‘in bed’ to ‘lights out’
• Identify thoughts, feelings, behaviors

Look for:
• Regularity of bedtime and waketime
• Time to fall asleep
• Nighttime awakenings
• Nightmares

Harvey & Buysse 2017
The Utility of a Sleep Diary

- Clarifies patterns
- Informs intervention/goals
- Monitor progress

Things to consider tracking:
- sleep timing
- awakenings
- nightmares
- caffeine
- sleep quality
- sleep quantity
- physical activity
- daytime sleepiness

Free downloadable sleep diary templates:
American Academy of Sleep Medicine: www.yoursleep.aasmnet.org
National Sleep Foundation: www.sleepfoundation.org

Free apps to track sleep:
Sleep Better
Sleep Tracker + Mood Diary

Cognitive Behavioral Therapy for Insomnia (CBT-I)

Associated with improvements in sleep, functioning and substance use in adolescents

Suicidal ideation in adults

Components:
- Psychoeducation
- Sleep hygiene
- Restriction of time in bed
- Stimulus control
- Cognitive therapy
- Relaxation techniques

Tested in group and online

Evidence-Based Treatment for Nightmares

Psychosocial: Evidence supports nightmare-specific CBT
eg, Image Rehearsal Therapy (IRT)
- Brief (3-4 sessions)
- “Nightmare rescripting” Learn ways to re-write the dream
- Practice imagining the new dream during the daytime

Pharmacological: Prazosin has most support; RCTS needed

Transdiagnostic Intervention for Sleep and Circadian Dysfunction (TranS-C)

<table>
<thead>
<tr>
<th>Cross-Cutting Modules</th>
<th>Common Transdiagnostic Sleep-Circadian Problems</th>
<th>Treatment Module</th>
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<tbody>
<tr>
<td>Core Formulation</td>
<td>Establishing regular sleep-wake times</td>
<td>Core Module 1</td>
</tr>
<tr>
<td>Education</td>
<td>Learning a wind-down routine</td>
<td>Core Module 1</td>
</tr>
<tr>
<td>Behavioral Change &amp; Maintenance Goal Setting</td>
<td>Improving daytime functioning</td>
<td>Core Module 2</td>
</tr>
<tr>
<td></td>
<td>Correcting shift/chronic sleep-related</td>
<td>Core Module 3</td>
</tr>
<tr>
<td></td>
<td>Improving sleep efficiency</td>
<td>Optional Module 1</td>
</tr>
<tr>
<td></td>
<td>Reducing sleep latency</td>
<td>Optional Module 2</td>
</tr>
<tr>
<td></td>
<td>Dealing with delayed or advanced phase</td>
<td>Optional Module 3</td>
</tr>
<tr>
<td></td>
<td>Reducing sleep-related worries/irritability</td>
<td>Optional Module 4</td>
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<td>Maintenance of behavior change</td>
<td>Core Module 4</td>
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Preliminary support:
- Youth age 10-18 (n = 176; Harvey et al in press)
- Adults with serious mental illness in community settings (n = 92; Harvey et al 2016)

Triple Chronotherapy

1) Total sleep deprivation
2) Sleep phase advancement
3) Bright light therapy

- Effective for depression
- Preliminary data in adults for suicidality
- Needs further study

Mean Total Score

Suicidality (CISDSC)
Depression (HAM-D17)

Delayed Sleep Phase

Shift bedtime earlier 30 minutes per week

Current bedtime: 2 am

Goal: 11 pm
The case for later school start times

Later school start times associated with improved:

• Attendance
• Tardiness
• Drop-out rates
• Standardized test scores
• Grades

• No impact on bedtimes
• Increase in sleep time: 25 – 77 mins/weekday, ~5 hrs per week
• Extracurricular activity involvement remains the same or increases

Organizations increasingly recommend school start time 8:30 or later!

American Academy of Pediatrics (AAP)
American Medical Association (AMA)
Centers for Disease Control (CDC)
The Sleep Research Society (SRS)

For reviews see: Wheaton et al 2016; Minges & Redeker 2016

The National Association of School Nurses
Society for Behavioral Sleep Medicine (SBSM)
The National Education Association (NEA)
National Parent Teacher Association (PTA)

General Guidelines for Improving Sleep in Teens

• Minimal fluctuation in the sleep-wake schedule across the week:
  Bedtime + 1 hour, WakeTime + 2 hours

• "Wind-down" period (30-60 mins) same time every night:
  Relaxing activities
  Reduce light (esp from technology)

• Wake-Up:
  Make it brisk
  No snoozing
  Get sunlight
  Get moving

• Bed is only for sleeping
• Avoid naps

Harvey & Buysse 2017

General Guidelines for Improving Sleep in Teens

Build commitment

Small changes
• Even 1 more hour of sleep can make a big difference!
  (Wintner et al 2015)

Engage parents as developmentally appropriate
  (Stuewig et al 2010)

Problem solve all that gets in the way...
• Time management
• Technology
• "Catch-up" sleep

Harvey & Buysse 2017
Conclusions

- Adolescence is a period of increased vulnerability that may be further exacerbated by sleep changes and difficulties
- Strong association between teen sleep and suicidality
- Promising strategy for teen suicide prevention
- More to come…!

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