#95  Sleep and the College Student: Problems and Pathways to Successful Intervention Programs

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Outline

• Brief introduction to sleep in emerging adults
  — Sleep Timing
  — Sleep Deprivation

• Large Survey of College Student Sleep
  — Measures
  — Outcomes
  — Regression analyses

• Intervention Strategies
  — What's been done
  — Breakfast Club Program
  — Faculty/Student Research Projects

Sleep is an acquired habit. Cells don't sleep. Fish swim in the water all night. Even a horse doesn't sleep. A man doesn't need any sleep.

-Thomas Edison
Objectives

1. Describe “typical” sleep for college students.
2. Identify factors that disturb sleep in college students.
3. Describe the effectiveness of intervention programs designed to improve sleep.

Sleep timing is controlled by multiple internal and external factors.

Circadian Rhythms
Sleep Homeostat
Zeitgebers
Pharmaceuticals
“Lark” or “Owl” Chronotypes change during childhood and adolescence.

By the age of 25 your time of day preference is well established, but most 18 – 21 year olds are undifferentiated.

Sleep in Emerging Adulthood – A Perfect Storm

Sleep Deprivation: Cognitive Effects

- Microsleep
- Poor decision making
- Slowed reaction time
- Difficulty communicating
- Forgetfulness
- Fixation
- Lethargy
- Bad mood
- Paranoia


Sleep Deprivation & Cognition

Dawson, D.; Reid, K. 1997
Sleep Deprivation & Psychiatric Illness

- 35 – 50% of people with chronic sleep problems have mood disorders.
- Most patients with mood disorders experience disrupted sleep.


Sleep Deprivation enhances night time cortisol secretion.

Sleep & Immune System

- Sleep deprivation is correlated with a significant reduction in cellular immunity (reductions in T-cells) (Lange, & Born, 2011)
- Men who received just four hours of sleep a night for four straight nights after receiving a flu shot produced half the antibodies as the control group (Weintraub, 2004)
- In lab rats, total sleep deprivation for four weeks can cause death by infection (Stapleton, 2001)

Sleep & Cardiovascular System

- Sleep deprivation increases concentrations of cytokines & C-reactive proteins in the body
- This inflammation can damage the inner walls of the arteries, leading to possible stroke or heart disease
- Blood pressure and heart rate are higher following sleep deprived nights
- Men who sleep 5 hours or less a night have 2x as many heart attacks as men who sleep 8 hours or more (Voelker, 1999)
Sleep Deprivation & Fat Homeostasis

• Healthy young men were forced to sleep 4 hours a night or 9 hours a night for 4 days straight.

• Short sleepers had a 18% drop in leptin, the fat satiety signal (equivalent drop to subtracting 1100 calorie a day diet).

• 25% Increase in hunger, 45% in appetite for junk foods

Van Cauter, 2004

Sleep Deprivation & Pre-Diabetes

• Chronic sleep deprivation leads to insulin resistance

• This resistance can result in high blood glucose concentrations, leading to diabetes

• Men who sleep 4 hours a night for 6 straight nights lose 30% of their ability to respond to insulin

Gottlieb et al., 2005

Sleep Deprivation is epidemic on college campuses

How many of the past 7 days did you get enough sleep so that you felt rested when you woke up in the morning?

Sleep Debt: 8 hrs.

A typical student’s sleep schedule
Another example of college sleep

Only 30% - 40% of Lost Sleep Can be restored

Design

- Email request sent to all undergraduate students
- 1125 respondents (18% response rate)
- Survey included:
  - Profile of Mood States
  - Epworth Sleepiness Scale
  - Subjective Units of Distress Scale
  - Horne-Ostberg MEQ
  - Pittsburgh Sleep Quality Index
  - Questions about Drug/Alcohol use
  - Sleep Hygiene

Epworth Sleepiness Scale

0 – 21 scale
Scores greater than 5 are considered poor quality.

0 = would never doze or sleep
1 = slight chance of dozing or sleeping
2 = moderate chance of dozing
3 = high chance of dozing or sleeping

0 – 24 scale
Scores of 10 or greater are indicative of excessive daytime sleepiness.
**Morningness Eveningness Scale**

- *Approximately* what time would you get up if you were entirely free to plan your day?
- How easy do you find it to get up in the morning (when you are not awakened unexpectedly)?
- You want to be at your peak performance for a test that you know is going to be mentally exhausting and will last two hours. You are entirely free to plan your day. Considering only your internal "clock," which one of the four testing times would you choose?

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**RESULTS: Evidence of chronic, restricted sleep**

- Mean total sleep time was 7.02 hours
- Only 11.6% got >8hrs sleep a night
- 20% pulled all-nighters at least once in the last month
- 35% stayed up until 3AM at least once a week
- 25% excessive daytime sleepiness (ESS >10)
- 15% fell asleep in class >1x/week

Only 37% of male students and 33% of female students met the criteria for healthy sleep on the PSQI.

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The first year in college is associated with an abrupt shift in sleep schedule.
Despite similar TST, females have higher daytime sleepiness.

Students are stressed, especially the women.

Students are fatigued, especially the women.
These data are consistent with national trends in college student mental health.

**CIRP Freshman Survey 2010**
- Administered at
  - 420 colleges and universities
  - 261,511 students

John H. Pryor
Higher Education Research Institute at UCLA

Those with poor sleep quality have worse moods.

<table>
<thead>
<tr>
<th>Stress and Mood</th>
<th>(d.f.)</th>
<th>F</th>
<th>p</th>
<th>Post hoc</th>
<th>Optimal &gt;6</th>
<th>Border line 6-7</th>
<th>Poor 7&lt;</th>
</tr>
</thead>
<tbody>
<tr>
<td>Anger</td>
<td>2,897</td>
<td>66.8</td>
<td>&lt;.001</td>
<td>O&gt;B&gt;P</td>
<td>7.48</td>
<td>9</td>
<td>10.61</td>
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<tr>
<td>Confusion</td>
<td>2,897</td>
<td>32.2</td>
<td>&lt;.001</td>
<td>O&gt;B&gt;P</td>
<td>8.6</td>
<td>9.56</td>
<td>10.31</td>
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<tr>
<td>Depression</td>
<td>2,897</td>
<td>71.2</td>
<td>&lt;.001</td>
<td>O&gt;B&gt;P</td>
<td>7.01</td>
<td>8.76</td>
<td>10.66</td>
</tr>
<tr>
<td>Fatigue</td>
<td>2,897</td>
<td>146.2</td>
<td>&lt;.001</td>
<td>O&gt;B&gt;P</td>
<td>9.44</td>
<td>12.09</td>
<td>14.92</td>
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<td>Tension</td>
<td>2,897</td>
<td>81.1</td>
<td>&lt;.001</td>
<td>O&gt;B&gt;P</td>
<td>8.29</td>
<td>9.96</td>
<td>11.82</td>
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<tr>
<td>Vigor</td>
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<td>28.4</td>
<td>&lt;.001</td>
<td>O&gt;B&gt;P</td>
<td>14.29</td>
<td>13.38</td>
<td>12.09</td>
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<tr>
<td>Distress (SUDS)</td>
<td>2,916</td>
<td>72.4</td>
<td>&lt;.001</td>
<td>O&gt;B&gt;P</td>
<td>49.9</td>
<td>59.9</td>
<td>70.7</td>
</tr>
</tbody>
</table>
Sleep & Mood

What’s responsible for the poor sleep quality?

Perhaps Inadequate Sleep Hygiene Disorder?
Insomnia for at least one month + presence of at least one of the following:

- Frequent daytime napping
- Highly variable bedtimes or rising times
- Routine use of nicotine, alcohol or caffeine
- Mentally stimulating, physically activating, or emotionally disturbing activities in bed
- Spending excessive amounts of time in bed and/or using bed for non-sleep/sex purposes

Perhaps psychoactive substance use/abuse?

<table>
<thead>
<tr>
<th>Motivation for taking substance</th>
<th>Alcohol</th>
<th>Caffeine</th>
<th>Marijuana</th>
<th>Nicotine</th>
</tr>
</thead>
<tbody>
<tr>
<td>Intoxication</td>
<td>67%</td>
<td>1%</td>
<td>88%</td>
<td>37%</td>
</tr>
<tr>
<td>Relaxation</td>
<td>58%</td>
<td>8%</td>
<td>74%</td>
<td>74%</td>
</tr>
<tr>
<td>To be social</td>
<td>93%</td>
<td>10%</td>
<td>74%</td>
<td>79%</td>
</tr>
<tr>
<td>Enhance meals</td>
<td>22%</td>
<td>66%</td>
<td>5%</td>
<td>21%</td>
</tr>
<tr>
<td>Alertness</td>
<td>1%</td>
<td>65%</td>
<td>7%</td>
<td>11%</td>
</tr>
<tr>
<td>Sleep</td>
<td>9%</td>
<td>0%</td>
<td>42%</td>
<td>5%</td>
</tr>
<tr>
<td>Wakefulness</td>
<td>3%</td>
<td>74%</td>
<td>5%</td>
<td>5%</td>
</tr>
</tbody>
</table>
Depressants suppress REM sleep

Stimulants increase sleep latency & reduce deep slow wave sleep

Substance abusers are more likely to be evening types and have lower quality sleep.

Students who drink alcohol to induce sleepiness consume significantly more alcohol and caffeine than those who use drink for social reasons.

Undiagnosed Sleep Problems can morph into substance abuse!
However, for most students, stress, but not drugs, influences sleep.

<table>
<thead>
<tr>
<th>Dependent Variable</th>
<th>Independent Variables</th>
<th>β</th>
<th>SEM</th>
<th>t</th>
<th>p-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sleep Quality (PSQI)</td>
<td>Stress &amp; Negative Mood (SUDS, POMS)</td>
<td>.434</td>
<td>.007</td>
<td>7.87</td>
<td>&lt;.001***</td>
</tr>
<tr>
<td></td>
<td>Morningsness/Eveningness (MEQ)</td>
<td>-.252</td>
<td>.020</td>
<td>4.52</td>
<td>&lt;.001***</td>
</tr>
<tr>
<td></td>
<td>Alcohol weekly consumption</td>
<td>.030</td>
<td>.028</td>
<td>1.53</td>
<td>.127</td>
</tr>
<tr>
<td></td>
<td>Caffeine weekly consumption</td>
<td>-.032</td>
<td>.021</td>
<td>-.15</td>
<td>.878</td>
</tr>
</tbody>
</table>

Predictors of PSQI score in Males (n = 333)

**Model Summary**

<table>
<thead>
<tr>
<th>Model</th>
<th>R</th>
<th>R Square</th>
<th>Adjusted R Square</th>
<th>Std. Error of the Estimate</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Tension</td>
<td>.443</td>
<td>.197</td>
<td>.194</td>
<td>2.807</td>
</tr>
<tr>
<td>2. Tension, MEQ</td>
<td>.508</td>
<td>.258</td>
<td>.253</td>
<td>2.702</td>
</tr>
<tr>
<td>3. Tension, MEQ, SUDS</td>
<td>.542</td>
<td>.294</td>
<td>.287</td>
<td>2.648</td>
</tr>
</tbody>
</table>

Excluded variables: alcohol, caffeine, TV/Video game time, exercise duration, bedtime & risetime delay, depression, anger, confusion.

Predictors of PSQI score in Females (n = 550)

**Model Summary**

<table>
<thead>
<tr>
<th>Model</th>
<th>R</th>
<th>R Square</th>
<th>Adjusted R Square</th>
<th>Std. Error of the Estimate</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Depression</td>
<td>.471</td>
<td>.222</td>
<td>.221</td>
<td>2.815</td>
</tr>
<tr>
<td>2. Depression, SUDS</td>
<td>.521</td>
<td>.272</td>
<td>.268</td>
<td>2.726</td>
</tr>
<tr>
<td>3. Depression, SUDS, MEQ</td>
<td>.537</td>
<td>.298</td>
<td>.294</td>
<td>2.698</td>
</tr>
<tr>
<td>4. Depression, SUDS, MEQ, Anger</td>
<td>.547</td>
<td>.299</td>
<td>.294</td>
<td>2.680</td>
</tr>
</tbody>
</table>

Excluded variables: alcohol, caffeine, TV/Video game time, exercise duration, bedtime & risetime delay, tension, confusion.

Major Findings from Lund 2010 study:

- Evidence of chronic restricted sleep in college students.
- Poor sleepers have more problems with depression, anxiety and anger (and vice versa)
- Stress & negative moods seem to be the strongest predictors of poor quality sleep.
- In general, college women show more stress and mood induced sleep disturbances than men do.
Major Findings from Lund 2010 study, cartoon format

- Because insufficient sleep exacerbates mood, anxiety and substance abuse disorders, health care providers should work toward managing the distinct psychological factors that disrupt sleep in young women and men.

- Determine what treatment/education programs would increase sleep quality.

Next Steps: Interventions

Thinking about improving sleep...

Theoretical Approaches to Making Change

Structure ➔ Agency
“Within the last 12 months, have any of the following been traumatic or very difficult for you to handle?”

3 Week Intervention Program

- Open to first year full-time students
  - 200 invited
  - 13 filled out pre-survey
  - 9 completed the program
  - 7 completed the post-survey

- Students received free breakfast, health and wellness information, prizes and a drawing for $500 bookstore gift card

- Students had to commit to 5 of 6 breakfasts per week

- Students were not aware that this was a sleep study.

“Serve the People, Body and Soul.”
**Breakfast Club Schedule**

**Weekday morning**
- Students arrive at an on-campus private dining room at 8:15 AM
- Eat and find out the topic of the day or activity
- Presentation & Discussion
- Program over by 9:15

**Weekend Morning**
Meet at 9AM to walk 15 – 30 minutes to a local restaurant for breakfast.

**Topics Covered**
- Nutrition: Dietician & Health Professor
- Sleep: Psychology Professor
- Friendships: Communications Professors
- Romantic Relationships: Psychology Professor
- Finances: Business Office & Financial Aid Rep
- Alcohol: Wellness Educator
- Emotions: Clinical Psychologist & UST Counselor
- Academic Resources: Enhancement Services
- Drugs: Psychology Professor
- Stress Relief Activities: Bowling, piano concert, walks

**E-delivery comparison group**
- Received same information, but just over daily emails.
- 17 people (of 200 invited) filled out the pre-survey.
- 12 of those filled out the post-survey.
Why didn’t you choose to participate in the Breakfast Club?

- Didn’t want to wake up that early: 55%
- Other: 20%
- Too much of a time commitment: 15%
- Didn’t know about it: 5%
- Not interested in health: 5%

E-delivery comparison group

Outcome Measures

- Clinical Measures: PSQI, ESS, SUDS
- Self-Reported Behaviors
- Motivations to Change
- Program Assessment
- Interviews (Breakfast club only)

Schedule

- Fall Semester: Schedule Speakers, reserve rooms, approve IRB
- February 1 – 20: Recruit students
- February 21-25: Pre-surveys (30 minutes)
- February 26- March 16: Breakfast Club Meetings
- March 17 – 26: Spring Break
- April 16 – 20: Post-Surveys (20 minutes)

Total Sleep Time

- Pre
- Post
Breakfast Club E delivery

Pittsburgh Sleep Quality Index

Mean

Breakfast Club E delivery

Epworth Sleepiness Scale

Mean

Breakfast Club E delivery

Sleep Latency

Minutes

Breakfast Club E delivery

... used an energy drink or caffeine pill to keep you alert

Days per week

Breakfast Club E delivery
**Stages of Change: Sleep**

<table>
<thead>
<tr>
<th></th>
<th>Pre</th>
<th>Post</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pre-contemplation</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>Contemplation</td>
<td>2</td>
<td>2</td>
</tr>
<tr>
<td>Preparation</td>
<td>3</td>
<td>3</td>
</tr>
<tr>
<td>Action</td>
<td>4</td>
<td>4</td>
</tr>
<tr>
<td>Maintenance</td>
<td>5</td>
<td>5</td>
</tr>
</tbody>
</table>

**Breakfast Club**

**E delivery**

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**What about Stress Management?**

- Felt confident in your ability to handle personal problems
  - Pre: 6, Post: 5
  - **Breakfast Club**
  - E delivery

- Dealt successfully with day-to-day problems
  - Pre: 5, Post: 4
  - **Breakfast Club**
  - E delivery
... created a to-do list & prioritized tasks

... made a schedule and stuck to it

SUDS: Distress Scale

Stages of Change: Stress
Next Steps

- Meet once a semester with original breakfast club crew
- Do a sophomore assessment to see if gains made continue
- Share data with administrators
- Incorporate into Freshman Orientation?
- Look for funding

Other Interventions/Programs at UST

- adjUST – 10 week project designed to improve student sleep, nutrition, and physical activity. Collaboration between Videography class and wellness center.

- Independent student research projects- 6 week laboratory projects on sleep-related topics in neuroscience & psychology courses

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Student Assessment

<table>
<thead>
<tr>
<th>Statement</th>
<th>1 SD</th>
<th>5 SA</th>
</tr>
</thead>
<tbody>
<tr>
<td>I enjoyed this program.</td>
<td>5.0</td>
<td>3.8</td>
</tr>
<tr>
<td>I would recommend this program to another student.</td>
<td>5.0</td>
<td>3.6</td>
</tr>
<tr>
<td>I learned more about resources UST offers its students.</td>
<td>4.4</td>
<td>3.7</td>
</tr>
<tr>
<td>I prefer to get this information by email rather than in group meetings.</td>
<td>1.6</td>
<td>4.5</td>
</tr>
<tr>
<td>My sleep has improved as a result of this program.</td>
<td>4.3</td>
<td>2.9</td>
</tr>
<tr>
<td>My stress management has improved as a result of this program.</td>
<td>3.4</td>
<td>3.2</td>
</tr>
<tr>
<td>My health and fitness have improved as a result of this program.</td>
<td>4.1</td>
<td>2.3</td>
</tr>
<tr>
<td>My overall wellness has improved as a result of this program.</td>
<td>4.3</td>
<td>3.4</td>
</tr>
<tr>
<td>I feel a sense of kinship/camaraderie with the students who completed this program.</td>
<td>4.7</td>
<td>2.3</td>
</tr>
</tbody>
</table>

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Breakfast Club | E delivery

- Days per week

3 4 5 6 7

Breakfast Club | E delivery

Pre | Post
Experimental Ways to Measure Sleep

- Cortisol ELISA Assay
- Sleep Apps
- Temperature Tracking

Student Project: Cortisol Levels Reflect Student Reported Psychological Stress

Student Project: Circadian Temperature Rhythms in Structured vs. Unstructured Schedules
Higher levels of CRP are correlated with mental stress in patients with stable coronary artery disease (Burg, et al., 2006).

Other Student Research Projects on Sleep

- Digital Phantoms: The effects of electronic media on sleep quality
- Effects of short-term sleep deprivation on specific prefrontal cortex dependent abilities

"Being enrolled in ROTC in college presents a conflict between staying up late to study or get some sleep so you can be well rested for the same wake-up call that occurs almost everyday of the week. Taking this class and learning about the vital need for quality sleep has changed my perception of sleep, making it a big priority. Freshmen year brought multiple sleepless nights for me as I crammed for exams which lead to multiple severe illnesses that kept me out of important track meets and hindered optimal retention of class material during lectures. After making sleep more of a priority, I have found class material easier to learn and remember as well as a significantly stronger immune system."

"I also didn’t realize how complex sleep mechanisms were, or how devastating lack of sleep can be. Again, I put sleep off because who has time to sleep when I should be studying. The lack of sleep mimics increased cortisol levels which again surprised me at how damaging neural and chemical interactions can be. These are things I can only control or alter by changing my habits..."
Acknowledgements

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