Social determinants of sleep and circadian health

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Sleep Health

- Satisfaction
- Alertness
- Timing
- Efficiency
- Duration
- Regularity

Socioecological model

**Nation:** laws, policies, culture, infrastructure

**Neighborhood:** safety, violence, noise, air quality

**Family:** bedpartners, work/school schedules, finances

**Individual:** genetics, attitudes, behaviors
Environment conducive to sleep

• Physical environment
  • Homelessness, housing quality
  • Light – devices, neighborhood, detention facilities
  • Temperature – heating/air conditioning
  • Noise – family members, traffic
  • Air pollution – sleep apnea
  • Pests – bedbugs, cockroaches

• Safe environment
  • Physical violence – homeless, prison, domestic abuse
  • Property loss – slums, homeless shelter, neighborhood crime
Geography and sleep

Data from 1990 National Health Interview Survey of 32,749 US adults

<table>
<thead>
<tr>
<th>Location</th>
<th>Short sleep duration (≤ 6hrs)</th>
<th>Long sleep duration (≥ 9 hrs)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Rural (Non-MSA)</td>
<td>1.00</td>
<td>1.00</td>
</tr>
<tr>
<td>MSA, central-city &gt; 1 million</td>
<td>1.43</td>
<td>0.84</td>
</tr>
</tbody>
</table>

Adjusted for age, gender, race, marital status, education, household income, household size, employment, stress, smoking, exercise, activity limitation, alcohol, weight, number of disability days in past year, residence type, region of US.

Hale L and Do D. Sleep 2007; 30:1096-103.
Effect of a Housing Intervention on Sleep

Buenos Aires slums

Baseline 1 month 6 months

Pittsburgh Sleep Quality Index

Qualitative Themes:
• Increased security from weather
• Decreased worry about loss of property
• Decreased worry about violence
• Increased hopefulness

Simonelli G et al. Sleep 2013; 36:1669-76.
Neighborhood and sleep

2156 middle-aged participants undergoing actigraphy in Hispanic Community Health Study

Analyses adjusted for age and sex.

Traffic noise and sleep

- Acutely, noise during the sleep period interrupts sleep but there is habituation over time.
- However, habituation is incomplete.

Polysomnographic field studies of sleep continuity in long time residents near airports and railroad lines in Germany.

<table>
<thead>
<tr>
<th></th>
<th>Road traffic</th>
<th>Air traffic</th>
<th>Rail traffic</th>
</tr>
</thead>
<tbody>
<tr>
<td>OR for sleep stage</td>
<td>1.32</td>
<td>1.32</td>
<td>1.34</td>
</tr>
<tr>
<td>transition per 10 dBA</td>
<td>(1.15-1.50)</td>
<td>(1.19-1.47)</td>
<td>(1.19-1.51)</td>
</tr>
</tbody>
</table>

Odds ratio for transition to wake or N1 adjusting for age, sex, day of week, and time from sleep onset.

Social environment and sleep

- Others in home / Household density
  - Dyssynchronous rhythms
  - Sleeping in living spaces

- Others in bed
  - Partner – reassurance / nuisance (e.g., snoring)
  - Child/sibling
  - Pet

- Caregiving responsibilities
  - Infant
  - Family member with chronic disease
Caregiving and sleep

Meta-analysis of sleep duration and quality in caregivers of patients with dementia
Household chaos and sleep

26 black 11-12 year-olds tracking sleep for 2 weeks. Analyses adjusted for school/off night.

Stress and sleep

Social stressors
• Financial stress
• Job stress
• Discrimination stress
• Acculturative stress

Resiliency factors
• Social support
Stress sources and sleep

5313 Hispanic adults participating in the Hispanic Community Health Study

Analyses adjusted for age, sex, site, study site, background, nativity, income, education, BMI, hypertension, heart disease, lung disease, diabetes, alcohol, smoking, sleep apnea, depression, and other stresses.
Work and sleep

• Work factors associated with sleep
  • Work hours
  • Work shift
  • Work autonomy
  • Work stress

• Unemployment associated with:
  • Longer sleep duration
  • Delayed timing
  • Decreased social jetlag (weekend/weekday variability)
Work hours and incident sleep disturbances

Whitehall II cohort of 900-1600 individuals with no prevalent sleep disturbance followed over 5 years for incident sleep problems.

<table>
<thead>
<tr>
<th>Work hours</th>
<th>Short sleep (&lt; 7 hrs)</th>
<th>Difficulty falling asleep</th>
<th>Early waking</th>
<th>Unrefreshing sleep</th>
</tr>
</thead>
<tbody>
<tr>
<td>35-40</td>
<td>1.00</td>
<td>1.00</td>
<td>1.00</td>
<td>1.00</td>
</tr>
<tr>
<td>41-55</td>
<td>1.02</td>
<td>1.69</td>
<td>1.01</td>
<td>1.09</td>
</tr>
<tr>
<td>&gt;55</td>
<td>1.76</td>
<td>4.12</td>
<td>1.44</td>
<td>1.82</td>
</tr>
</tbody>
</table>

Adjusted for age, sex, marital status, occupational grade, education, chronic illness, physical activity, body mass index, smoking, alcohol, and job demands.

Time use surveys

Data from 24-hour recalls of 23,325 participants of American Time Use Survey 2003-2005 with analyses adjusted for age, sex, race, education, income, bedpartner, children.

Income, work and sleep

Effect of retirement on sleep

Changes in self-reported sleep 1 year after retirement in 993 participants of Retirement and Sleep Trajectories (REST) cohort.

Adjusted for age, sex, health status, and circadian preference.

### Shiftwork and actigraphic sleep measures

1253 working adults undergoing actigraphy in the Hispanic Community Health Study

<table>
<thead>
<tr>
<th></th>
<th>Day (n=806)</th>
<th>Afternoon (n=128)</th>
<th>Night (n=74)</th>
<th>Split (n=68)</th>
<th>Irregular (n=130)</th>
<th>Rotating (n=47)</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Sleep duration</strong></td>
<td>6.7 hrs</td>
<td>6.7 hrs</td>
<td>6.1 hrs</td>
<td>6.7 hrs</td>
<td>6.5 hrs</td>
<td>6.6 hrs</td>
</tr>
<tr>
<td><strong>Sleep midpoint</strong></td>
<td>3:23 AM</td>
<td>4:34 AM</td>
<td>5:53 AM</td>
<td>4:17 AM</td>
<td>4:04 AM</td>
<td>4:19 AM</td>
</tr>
<tr>
<td><strong>Interday stability</strong></td>
<td>0.55</td>
<td>0.53</td>
<td>0.45</td>
<td>0.56</td>
<td>0.53</td>
<td>0.50</td>
</tr>
<tr>
<td><strong>Napping</strong></td>
<td>9 min</td>
<td>11 min</td>
<td>21 min</td>
<td>7 min</td>
<td>17 min</td>
<td>7 min</td>
</tr>
</tbody>
</table>

Analyses adjusted for age and sex.

Reid KJ et al. Sleep 2018; 41:zsy131.
Work commute and sleep

760 non-shift working adults undergoing actigraphy in the Hispanic Community Health Study

Analyses adjusted for age and sex.

## Access to sleep health care

<table>
<thead>
<tr>
<th>Disease</th>
<th>Care plan</th>
<th>Barriers</th>
<th>Solutions</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sleep Apnea</td>
<td>Sleep study</td>
<td>Sleeping in center</td>
<td>Home testing and therapy</td>
</tr>
<tr>
<td></td>
<td>CPAP titration study</td>
<td>Insurance coverage</td>
<td></td>
</tr>
<tr>
<td></td>
<td>CPAP therapy</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Insomnia</td>
<td>Cognitive behavioral therapy (CBT-I) by psychologist</td>
<td>Provider shortage</td>
<td>Internet-based treatment</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Insurance coverage</td>
<td></td>
</tr>
</tbody>
</table>
Race and sleep duration

2014 Behavioral Risk Factor Surveillance System

Prevalence of Short Sleep (%)

- Whites
- Blacks
- Hispanics
- Asians
- Native Americans
- Pacific Islanders
- Other/Multi-racial

https://www.cdc.gov/sleep/data_statistics.html
Black – white differences in sleep

Social conditions and policies
- Public policy, culture, discrimination, prejudice

Institutional context
- Healthcare system, legal system, economic system

Social context
- Racial integration, neighborhood crime/safety

Social relationships
- Social isolation, family needs, caregiving

Physical context
- Housing stock, commuting time, noise, pollution

Individual demographics
- Employment status, education, acculturation

Individual risk behaviors
- Regular sleep schedule, TV in bedroom, caffeine/nicotine use

Biological/genetic pathways
- Genetic and epigenetic mechanisms

Race

Poor Sleep
Structural racism

- “A system in which public policies, institutional practices, cultural representations and other norms work in various, often reinforcing ways to perpetuate racial group inequity.”

- Perpetuation of past inequities even if current policies and policy makers do not intend to be racist.

https://www.aspeninstitute.org/blog-posts/structural-racism-definition/
Sleep as a potential mediator of health disparities