Racial/Ethnic and Socioeconomic Disparities in Disordered Sleep and Obesity

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The Potential Role of Sleep in Obesity Prevention and Management: A Virtual Workshop

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Conceptual Framework: Racial/Ethnic Disparities in the Relationship between Sleep and Weight gain/Obesity

**ENVIRONMENT (physical and social)**
- Socioeconomic status (income, education, occupation, wealth)
- Built (inopportune light exposure, noise, temperature, food deserts)
- Irritants (allergens, environmental pollutants, tobacco)
- Social (toxic stress; neighborhood disorder, crime, trauma, culture)
- Access to healthy lifestyles (food quality, physical activity, smoking)
- Access to & utilization of healthcare & treatments (medication use)

**EPIGENETICS**

**GENETICS**
- Diversity within race (African ancestry and SWS)

**Race**

**Suboptimal Sleep Duration/Quality/Timing**

**Biological mechanisms:**
- Melatonin
- Cortisol
- Leptin/Ghrelin
- hs-CRP
- PYY
- Growth hormone
- Insulin sensitivity
- Free fatty acids

**Behaviors:**
- Appetite/Eating
- Physical activity

**Existing conditions:**
- Diabetes

**Social problems**
- Discrimination
- Mental health disorders

**Weight Gain/Obesity**
Disparities in Sleep and Obesity
**Socioeconomic Disparities in Sleep and Sleep Disorders**

**Lower-SES individuals experience higher rates of**
- Extreme sleep durations
- Low sleep quality
- Some sleep disorders (e.g. obstructive sleep apnea)

**Potential mechanisms -**

*Stressors:*
- Neighborhood; Housing; Occupational (e.g. shift work); Psychosocial

*Environmental hazards:*
- Tobacco, allergens and pollutants
# Racial/Ethnic Disparities in Sleep and Sleep Disorders

## Sleep Duration
- Short sleep (<7 hours) –
  - Blacks ~2x as likely to report short sleep at ~31%
- Long sleep (≥9 hours) –
  - Blacks >60% more likely to report long sleep (14%)

## Sleep Quality
- Blacks experience less deep, more light sleep, take longer to fall asleep, and have less efficient sleep

## Obstructive Sleep Apnea
- Blacks (14%)
  - 4–6 times higher in black children (6 to 8%) than in white children
  - More severe health consequences
- Whites (6%)
- Asians (4%) – may be particularly susceptible

## Insomnia
- Whites (10%)
- Asians (4%)
- Blacks (3%)
- Methodological issues
  - Differing definitions of insomnia; reliance on self-reports; diagnosis

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Chen et al. Sleep Medicine. 2016; Chen et al. SLEEP. 2015
Prevalence of Obesity by Race and Sex

**Both Genders**

- Asian: 12.6%
- Black: 48.4%
- Latino: 42.6%
- American Indian/Alaska Native: 42.3%
- White: 36.4%

**Men**

- Asian: 12.6%
- Black: 38.0%
- Latino: 37.9%
- White: 34.7%

- Asian: N/A
- Black: 57.2%
- Latino: 46.9%
- White: 38.2%

**Women**

- Asian: N/A
- Black: 16.8%
- Latino: 8.7%
- White: 9.7%

*Note: Obese and Extremely Obese categories.*
Smoothed Lines of Mean Body Mass Index for Black and White Men by Educational Attainment, 1997-2008

Jackson CL. et al. Journal of Obesity. 2013
Why do these disparities exist?
Conceptual Framework:
Determinants of Sleep and Disparate Cardiovascular Health
Social Conditions and Policies
- Poverty, socioeconomic status, public policy, culture, norms, discrimination and prejudice (e.g. employment, education, housing)

Institutional Context
- The health care system, the family, organized religion, the economic system, the legal system, the media, and the political system

Physical Context
- Housing and work building quality, pollution, business & transit access, noise, graffiti, cleanliness, open space, parks, neighborhood stability

Social Context
- Collective efficacy, social capital, social cohesion, poverty level, racial/ethnic integration, social/economic gradient

Social Relationships
- Social networks, social support, social isolation, social influence, social engagement, religious participation, civic engagement, employment

Individual Demographics
- Age, sex, socioeconomic status (income, education, occupation), health status, race/ethnicity, acculturation, sleep environment characteristics

Individual Risk Behaviors
- Tobacco use, alcohol use, caffeine use, technology use, diet, physical activity, sleep, sexual behavior, loneliness, stress coping, trust in health care system

Biological Responses
- Stress/anxiety, depression, obesity, hypertension, high cholesterol, previous illness, chronic lung disease, alcoholism

Biologic/Genetic Pathways
- Allostatic load, biologic processes, craniofacial characteristics, genetic ancestry, genetic mechanisms

Fundamental Causes

Social and Physical Context

Individual Demographic And CVD Risk Factors

Biologic Responses and Pathways

Disparate CVD Health Outcomes
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- Poverty, socioeconomic status, public policy, culture, norms, discrimination and prejudice (e.g., employment, education, housing)

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Fundamental Causes
- Distal Determinants
- Intermediate Determinants
- Proximal Determinants

Social and Physical Context
- Individual Demographic and CVD Risk Factors
- Biologic Responses and Pathways

Disparate CVD Health Outcomes
- Conception
- Death
Proximal Factors: Individual Risk Behaviors Influence Sleep Duration/Quality and Obesity

• Health behaviors
  – Sleep hygiene (e.g. bedtime routine; appropriate technology use)
  – Diet/Nutrition
  – Physical activity
  – Sexual activity
  – Stress coping approach
  – Substance use (alcohol, caffeine, tobacco, medications)

• Vary by demographics
  – Age
  – Sex
  – Race/ethnicity
  – Socioeconomic status
  – Existing health status

Sleep restriction

- ↓ leptin
- ↑ inflammatory cytokines (IL-6, TNF-α)
- ↑ ghrelin
- ↓ insulin sensitivity
- ↓ PYY
- ↓ satiety
- ↑ hunger
- ↑ sympathetic tonus
- ↑ GH
- ↑ cortisol
- ↑ cathecolamines
- ↑ Free Fatty Acids
- ↑ C-reactive protein

Insulin resistance

Weight gain

Obesity

Adapted from Zimberg et al. Cell Biochem Funct 2012
### Social Conditions and Policies
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### Individual Risk Behaviors
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### Biologic/Genetic Pathways
Allostatic load, biologic processes, craniofacial characteristics, genetic ancestry, genetic mechanisms

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**Fundamental Causes**

**Social and Physical Context**

**Distal Determinants**

**Intermediate Determinants**

**Proximal Determinants**

**Biologic-Environment Interactions**

**Disparate CVD Health Outcomes**

**Conception**

**Death**

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Intermediate Factors:
Physical Context—Built Environments
Influence Sleep Quality and Duration

• Neighborhood and housing disadvantages

  Sleep:
  • Inopportune light exposure
  • Environmental temperature
  • Noise
  • Allergens
  • Irritants (e.g. environmental tobacco; air pollution)
  • Neighborhood disorder

  Obesity:
  • Food environment (e.g. food deserts → lower food quality)
  • Walkability

# Age-Standardized Short Sleep Prevalence by Occupational Class within Industries among Blacks and Whites

<table>
<thead>
<tr>
<th>Industry</th>
<th>Black (n=24,941)</th>
<th>White (n=110,694)</th>
<th>Total (n=135,635)</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Health care and social services, n=17,878</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Professional/Management</td>
<td>43</td>
<td>26</td>
<td>27</td>
</tr>
<tr>
<td>Support Services</td>
<td>40</td>
<td>29</td>
<td>31</td>
</tr>
<tr>
<td>Laborers</td>
<td>35</td>
<td>28</td>
<td>30</td>
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<tr>
<td><strong>Accommodation and food, n=7,615</strong></td>
<td></td>
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<tr>
<td>Professional/Management</td>
<td>42</td>
<td>31</td>
<td>32</td>
</tr>
<tr>
<td>Support Services</td>
<td>30</td>
<td>29</td>
<td>29</td>
</tr>
<tr>
<td>Laborers</td>
<td>34</td>
<td>34</td>
<td>34</td>
</tr>
<tr>
<td><strong>Public Administration/Arts, n=16,905</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Professional/Management</td>
<td>42</td>
<td>26</td>
<td>28</td>
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<tr>
<td>Support Services</td>
<td>36</td>
<td>26</td>
<td>27</td>
</tr>
<tr>
<td>Laborers</td>
<td>37</td>
<td>30</td>
<td>31</td>
</tr>
<tr>
<td><strong>Education, n=13,763</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Professional/Management</td>
<td>45</td>
<td>26</td>
<td>28</td>
</tr>
<tr>
<td>Support Services</td>
<td>35</td>
<td>21</td>
<td>23</td>
</tr>
<tr>
<td>Laborers</td>
<td>38</td>
<td>31</td>
<td>33</td>
</tr>
</tbody>
</table>

Intermediate Factors: Social Relationships Influence Sleep Quality and Duration

Interpersonal relationship (e.g. family influences)
- Parenting styles (sleep & feeding routines/curfews; TVs in bedrooms)
- Family routines
- Family illness/accident
- Depressed parental mood
- Parental work schedules
- Intimate partner violence and other traumatic life events
- Adverse childhood study

Social Conditions and Policies
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Allostatic load, biologic processes, craniofacial characteristics, genetic ancestry, genetic mechanisms
Discrimination

Social Capital

Education

Transportation

Employment

Food Access

Socioeconomic Status

Environmental Exposure

Health Behaviors

Access to Health Services

Housing

Public Safety

Obesity

Adapted from Center for Health Equity and Social Justice
Racial Discrimination and Sleep

- **Racism-related vigilance**
  - ↑ Racism-related vigilance ↑ sleep difficulty
  - May lead to chronic psychosocial stress

- **Perceived day-to-day interpersonal racial discrimination**
  - ↑ perceived discrimination ↑ sleep disturbances and daytime fatigue
  - ↓ deep sleep

- **Potential biological mechanisms**
  - Accelerated vascular aging (as measured by telomere length)
  - Race → Discrimination → Sleep quality → Obesity → Allostatic load → CVD

Hicken MT. Race and Social Problems. 2013
Lewis TT. American Psychological Association. 2013
Owens SL. Psychosom Med. 2017
Slopen N. Sleep. 2014
Liu SY. Public Health Rep. 2017
Tomfohr LM. Health Psychology. 2016
Future Research Directions
Future Research Directions

**Research methodology**
- Prospective studies
- Randomized controlled trials (when possible)
- Standardized, objective, repeated measures (e.g. motion biosensors)
- Incorporate:
  - sleep measures in existing laboratory, clinical, and epidemiologic studies
  - measures of social determinants of health
- Increase minority research participation and investigation
- Transdisciplinary approaches

**Research topics**
- Social determinants of sleep and obesity health
- Life course and critical periods (especially early life exposures)
- Racial differences in time use and daily stressors/hassles
- Place vs. Race
- Identify biomarkers for sleep
- Exposomics
- Public awareness of sleep - implementation/dissemination research
Policies and Structures Needed to Address Disparities
Policies and Structures Needed to Address Disparities in Sleep-Obesity Relationship

Policy, Systems, and Environmental Improvements:

• Incorporate health in all policies (e.g. health impact assessments)
• Incorporate equity in all policies (e.g. health equity impact assessments)
  – Address unequitable distribution of power/resources; discriminatory policies/practices
• Implement and evaluate structural and individual-level interventions that are culturally-relevant and place/community-based
  – Where people live, work, learn, play, and worship
  – e.g. Neighborhood, housing, and work quality; School start times
• Increase public awareness of the importance of sleep (e.g. impact on weight)
• Integrate sleep into medical training
• Increase sleep specialists in federally qualified health centers
Conclusion

- Disordered sleep and obesity disproportionately impact low socioeconomic status individuals and racial/ethnic minorities.

- Sleep and obesity are socially patterned and embedded in physical and social contexts that are influenced by upstream social conditions.

- Social determinants of health – major contributor to both sleep and obesity.

- Early life exposures/experiences appear particularly important.

- Racial/ethnic groups should not be studied as a monolith (when possible).
  - Socioeconomic variation exists.

- Sleep is modifiable and interacts with other health behaviors (+/-).
  - Could be considered 1st behavior in domino effect.

- Implement and evaluate place-based environmental interventions to improve health and address health disparities.
THANK YOU (AND SWEET DREAMS)!

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