Disparities in Energy Product Use, Sleep, and Health Outcomes

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Conflicts of Interest

• None.
Outline

• What are health disparities?
  – Why think of social/behavioral pathways?

• What are sleep disparities?
  – And why might they play a role in health?
  – And the possible role of energy drinks

• Social patterns of energy drink use

• Potential pathways linking energy drink use, sleep, and health disparities
Prevalence of metabolic syndrome

Beltran-Sanchez, Harhay, Harhay, and McElligott, 2013

- Non-Hispanic White
- Black/African-American
- Mexican-American

Prevalence

15% - 35%
Prevalence of hypertension

Egan, Zhao, and Axon, 2010
Cardiovascular death before age 75

- CHD Death
- Stroke Death

Keenan and Shaw, 2011
Overall health by education

Braveman, Cubbin, Egerter, Williams, and Pamuk, 2010
Why do these disparities exist?

• Genetic factors

• Gene-environment interactions

• Life course factors

• Social and behavioral factors
When we sleep, where we sleep, and with whom we sleep are all important markers or indicators of social status, privilege, and prevailing power relations.

-Simon J. Williams (2005)
What is the question?

- Difficulty Falling Asleep
  - Black/African-American: 0.67
  - Mexican-American: 0.53
  - Other Hispanic/Latino: 0.72
  - Asian/Other: 0.82

- Sleep Latency >30mins
  - Black/African-American: 2.01
  - Mexican-American: 1.15
  - Other Hispanic/Latino: 1.72
  - Asian/Other: 0.98

Grandner, Ruiter-Petrov, Jackson, Rattanaumpawan, and Patel, In Press
Sleep duration and race/ethnicity

Adjusted for: age; age-squared; gender; marital status; education; family income; family size; employment status; stress level; smoking status; exercise participation; activity limitation; alcohol consumption; weight; number of bed-days per year; urban environment variables; residence type; and region
Sleep duration and race/ethnicity

Adjusted for: age, sex, marital status, immigrant status, language spoken at home, income, education, access to health insurance, home ownership, food security

Whinnery, Jackson, Rattanaumpawan, and Grandner, In Press
Poverty, race/ethnicity, and sleep

<table>
<thead>
<tr>
<th>Race/Ethnicity</th>
<th>OR for Poor Sleep</th>
</tr>
</thead>
<tbody>
<tr>
<td>White / Caucasian</td>
<td>4.20</td>
</tr>
<tr>
<td>Black / African-American</td>
<td>2.72</td>
</tr>
<tr>
<td>Hispanic / Latino</td>
<td>2.57</td>
</tr>
<tr>
<td>Other</td>
<td>1.57</td>
</tr>
</tbody>
</table>

Patel, Grandner, Xie, Branas, & Gooneratne, 2010
Sleep duration and income

Mean Family Income

<table>
<thead>
<tr>
<th>Sleep Duration</th>
<th>Mean Income</th>
</tr>
</thead>
<tbody>
<tr>
<td>≤5 hours</td>
<td>$36,819</td>
</tr>
<tr>
<td>6 hours</td>
<td>$43,869</td>
</tr>
<tr>
<td>7 hours</td>
<td>$48,065</td>
</tr>
<tr>
<td>8 hours</td>
<td>$42,907</td>
</tr>
<tr>
<td>9+ hours</td>
<td>$34,883</td>
</tr>
</tbody>
</table>

Krueger & Friedman, 2009
Sleep duration and income

OR for Short Sleep

1st Quintile: 1.54
2nd Quintile: 1.29
3rd Quintile: 1.11
4th Quintile: 1.03
5th Quintile: 1.00

Stamatakis, Kaplan, & Roberts, 2007
Education

Odds Ratio

Less than High School
Some High School
High School Graduate
Some College

<5 Hours
5-6 Hours
7-8 Hours
9+ Hours

Whinnery, Jackson, Rattanaumpawan, and Grandner, In Press
Education

Adjusted for: Age, Sex, Marital Status, Race/Ethnicity, Immigration, Language, Income, Insurance, Home Ownership, Food Insecurity, and Overall Health

Whinnery, Jackson, Rattanaumpawan, and Grandner, In Press
Food Security & Sleep Symptoms

- **Sleep Latency >30min**
- **Trouble Falling Asleep**
- **Frequent Awakenings**
- **Early Morning Awakenings**
- **Daytime Sleepiness**

**Odds Ratio for Insomnia Sxs**

- Marginal
- Low
- Very Low

Grandner, Ruiter-Petrov, Jackson, Rattanaumpawan, and Patel, In Press
Food Security & Sleep Duration

Odds Ratio for Insomnia Sxs

- Very Short (<5 hours)
- Short (5-6 hours)
- Long (9+ hours)

Whinnery, Jackson, Rattanaumpawan, and Grandner, In Press
Childhood SES and poor sleep

Childhood SES = parental education. Adjusted for age, gender, BMI and race (black/white).

Tomfohr, Ancoli-Israel & Dimsdale, 2011
## Sleep and health disparities

<table>
<thead>
<tr>
<th>Group</th>
<th>Sleep Duration</th>
<th>5-year ΔSBP</th>
<th>5-year ΔDBP</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>Not adjusted for sleep duration</td>
<td>Adjusted for sleep duration</td>
</tr>
<tr>
<td>Black Men</td>
<td>5.2 (1.1)</td>
<td>+4.45</td>
<td>+2.87</td>
</tr>
<tr>
<td>Black Women</td>
<td>5.9 (0.8)</td>
<td>+1.25</td>
<td>+0.36</td>
</tr>
<tr>
<td>White Men</td>
<td>6.1 (0.9)</td>
<td>+2.85</td>
<td>+2.26</td>
</tr>
<tr>
<td>White Women</td>
<td>6.7 (0.8)</td>
<td>Reference</td>
<td>Reference</td>
</tr>
</tbody>
</table>

Knutson, Van Cauter, Rathouz, Yan, Hulley, Liu, and Lauderdale 2007
Insufficient or Excessive Sleep Duration and/or Inadequate Sleep Quality

Societal Level
Public Policy, Globalization, Technology, Economics, Environment

Social Level
Neighborhood, Social Groups, Religion, Culture

Individual Level
Genetics, Behavior, Psychology, Health, Environment

Work / School
Family / Home

Adverse Health Outcomes
- Cardiovascular Disease
- Metabolic Dysregulation
- Immune Dysfunction
- Performance Deficits
- Psychological Disturbance
- Cancer
- Stress

Energy Drink Use?
Why would SES patterns exist?

• Energy drinks can be purchased with EBT/SNAP
  – Sugary drinks account for 48-58% of beverage budget
    (Andreyava et al., 2012)

• Energy drink use associated with overall energy-dense dietary pattern positively associated with poverty (Park et al., 2011)

• Adjusted OR for caffeine use in shift workers is 3.29
  (Walia et al., 2012)
Why would racial patterns exist?

• Energy drink ads are targeted to minorities in 2010
  – Black children saw 161% more ads than white children
    • Especially 5-hour energy (2.70:1) and Red Bull (2.52:1)
  – Black teens saw 106% more ads than white teens
    • Especially 5-hour energy (2.14:1) and Red Bull (1.83:1)
  – Of only 8 sugary drink brands advertised on Spanish language TV, two were 5-Hour Energy and Red Bull
  – Fewer ads for sugary drinks overall on Spanish-language radio but 22% more ads for energy drinks

Even if patterns are not seen, they may eventually emerge.

Harris, Schwartz, Brownell et al., 2011
Patterns of use

• Data on social patterning of energy drinks use is scarce

• However, there are a few very clear patterns:
  – This is an emerging phenomenon
  – Common in adolescents, less in adults (age is strongest predictor)
  – More use in men
  – Commonly used in the context of alcohol
    • Unlike other caffeinated drinks

• And there are many unclear patterns
  – Patterns of use by race/ethnicity and socioeconomic status?

Toblin, Clarke-Walper, Kok, and Sipos, 2012
When do adolescents start?

• Study of middle schoolers in Italy
  – Use generally starts in middle school
    • 17.8% in 6th grade
    • 56.2% in 8th grade
  – Frequent use in boys (>1/week)
    • 6.2% in 6th grade
    • 16.5% in 8th grade
  – Predictors were smoking and alcohol use

Gallimberti, Buja, Chindamo, Vinelli, Lazzarin, Terraneo, Scafato, and Baldo, 2013
Socioeconomic patterns

• Studying alcohol use patterns in Brazilian college students
  – Frequency of use of energy drinks mixed with alcohol varied by SES category

![](image)

Locatelli, Sanchez, Opaleyee, Carlini, and Noto, 2012
Socioeconomic patterns?

- Study of college students in Puerto Rico
- More common in younger students
  - (26.3% in age 21-30 vs 9.4% in 31-53)
- More common in men
  - (35.6% vs 18.9%)
- No differences by SES

Rios, Betancourt, Pagan, Fabian, Cruz, Gonzalez, Gonzalez, Rivera-Soto, and Palacios, 2013
Socioeconomic patterns?

- Random sample of the population of Milwaukee, WI
- Energy drink use more common in men (OR=3.74)
- Energy drink use more common in young
  - OR=8.83 in 18-29 vs 55+
  - OR=3.55 in 30-54 vs 55+
- No differences according to education level
- No differences according to employment status
- No differences according to reported household income
- Energy drink use more common in city vs surrounding area (OR=1.99)
- Some differences according to race
  - No difference in Black vs White
  - “Other” more likely than White (OR=2.26)
    - 45% White, 37% Black 12% Hispanic, 3% Asian, 3% Multiracial
Socioeconomic patterns?

- Data from 2010 NHIS on “Sports and Energy Drinks”
  - Nationally-representative sample
  - Includes Gatorade, VitaminWater, etc.

![Bar chart showing socioeconomic patterns for sports and energy drinks consumption. The chart illustrates the prevalence of consumption by income level, with odds ratios (OR) provided for different income brackets.]

Berger, Fendrich, Chen, Arria and Cisler, 2011
Race/Ethnicity patterns?

- Data from 2010 NHIS on “Sports and Energy Drinks”
  - Nationally-representative sample
  - Includes Gatorade, VitaminWater, etc.

Berger, Fendrich, Chen, Arria and Cisler, 2011
Demographic predictors (NYC)

- More common in men (36.9% vs 29.8%)
  - Also more likely to combine with alcohol (19.6% vs 14.3%)

Wells, Kelly, Pawson, LeClair, Parsons, and Golub, 2013
Implications

• Are there differences in energy drink (and supplement) use?

• How might patterns of energy drink use be related to differential experiences of sleep?

• How might patterns of energy drink use play a role in sleep disparities?
Insufficient or Excessive Sleep Duration and/or Inadequate Sleep Quality

Adverse Health Outcomes

- Obesity / Weight Gain
- Cardiovascular Disease
- Metabolic Dysregulation
- Immune Dysfunction
- Performance Deficits
- Psychological Disturbance
- Cancer
- Stress

Energy Drink Use?

Grandner, Hale, Moore & Patel, 2010
Energy drinks and risky behavior

• In all subjects
  – Serious physical fight
  – Seatbelt omission
  – Risk on dare

• In White only
  – Cigarette use
  – Alcohol use
  – Alcohol problems
  – Prescription drug use

Miller, 2008
Role of sleep duration
**Energy shots and blood pressure**

• Newer, high-caffeine energy shots associated with short-term increases in blood pressure

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**Figure 1.** Mean ± SE changes in systolic blood pressure (SBP) between the caffeinated arm and the decaffeinated arm at 1, 3, and 5 hours after energy shot consumption compared with baseline values.

**Figure 2.** Mean ± SE changes in diastolic blood pressure (DBP) between the caffeinated arm and the decaffeinated arm at 1, 3, and 5 hours after energy shot consumption compared with baseline values.

Sleep attitudes

• Black/white differences in the following (among older women):
  – I am motivated to make sure that I have enough time to sleep
  – My sleep is important to my health
  – Boredom makes you sleep even if you slept enough the night before
  – Lying in bed with your eyes shut is as good as sleeping
  – Opening the car window is a good way to wake me up if I am drowsy while driving
  – Turning up the volume of the radio or music is a good way to wake me up if I am drowsy while driving
  – Getting enough sleep is important for me to be able to enjoy the daytime
  – People who fall asleep at work or at school are lazy or have bad habits*
  – Not enough sleep can lead to serious consequences*
  – Poor sleep affects the quality of my life*
  – Dozing while driving a vehicle is serious

Grandner, Patel, Jean-Louis, Gehrman, Perlis and Gooneratne, 2013
Drowsy Driving

**Complete Sample**

<table>
<thead>
<tr>
<th>Hours</th>
<th>Odds Ratio of Drowsy Driving</th>
</tr>
</thead>
<tbody>
<tr>
<td>≤5</td>
<td>Unadjusted</td>
</tr>
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<td>6</td>
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<td>7</td>
<td>Unadjusted</td>
</tr>
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</tr>
<tr>
<td>9</td>
<td>Unadjusted</td>
</tr>
<tr>
<td>≥10</td>
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**Never Insufficient**

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</tr>
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Maia, Grandner, Findley, and Gurubhagavatula et al., In Press
Other pathways

• Differential genetic risk
  – Example: CYP1A2 gene important in caffeine metabolism, associated with race/ethnicity (Gines and Dahl, 2008)

• Differential blood glucose effects
  – Example: adding caffeine to sugary drinks alters glucose metabolism profile (Keast et al., 2011)

• Moderating effect of culture
  – Endorsement of traditional masculinity and conforming to masculine norms predict energy drinks (Wimer & Levant, 2013)
Many social/behavioral questions

• What are the sociodemographic and socioeconomic patterns of energy product use?
  – Relative to coffee?
  – And what could they be a proxy for?

• What is the role in the growth of energy drink use in beliefs and attitudes about healthy sleep?
  – Are people trying to replace sleep?
  – Are there better alternatives?
  – How can we improve sleep beliefs and practices in the general population?
Many social/behavioral questions

• Are there certain groups that are at particular risk to the effects of energy drinks?
  – Genetic and physiologic moderators of risk?
  – Social/demographic moderators of risk?

• What are the harmful effects of energy products in how (and in whom) they are used?
  – What are the cognitive and functional outcomes?
  – Do these change across the life course?
  – Are there issues being masked (e.g., shift work)?
Thanks.

Other Mentors & Active Collaborators:

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Nick Jackson MPH (USC)

Girardin Jean-Louis PhD (NYU)
Jackie Kloss PhD (Drexel)

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Daniel Kripke MD (UCSD)
Muredach Reilly MD (Penn CVI)
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Ray Townsend MD (Penn CVI)
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