POVERTY AND SLEEP IN LATER LIFE

Jen-Hao Chen
Department of Health Sciences
Harry S Truman School of Public Affairs
University of Missouri
The Frailty Process

- Dysregulation of Homeostasis
- Physical & Cognitive Function
Aging Process and Frailty of Sleep

Source: National Sleep Foundation (2013)
High Prevalence of Poor Sleep in Old Age

- Insufficient sleep
  - One-fourth of older adults have less than 6 hours of sleep (Liu et al., 2014)

- Insomnia symptoms
  - Nearly half of older adults have at least one insomnia symptom (Foley et al., 1995)
  - 40% of older adults have trouble falling asleep (Lauderdale et al., 2014)
Poor Sleep as a Risk Factor

Poor Sleep

- Chronic Diseases
- Excess Mortality
Causes of Frailty of Sleep in Old Age

Vulnerability of Biological System → Sleep Problems

Social Factors
Economic Hardship and Sleep in Old Age

- Economic well-being is an influential factor for healthy aging (Bowling, 2004; Schoeni, Martin, Andreski, & Freedman, 2005)
  - Older adults have a higher risk of becoming poor
  - Transitions in later life are associated with changes in economic status
How Economic Hardship Can Affect Sleep?

• Negotiation of sleep
  • Economic constraints
  • Social roles and social structures

• Stress process
  • Poverty as a stressor
  • Stress proliferation process
  • Stress, hormones, and physiological processes
Panel Study of Income Dynamics-Disability and Use of Time Supplement (DUST)

- Panel Study of Income Dynamics (PSID)
  - Started with a nationally representative sample of about 5000 families in 1968
  - Annually before 1997 and biennially after

- 2013 Disability and Use of Time Supplement (DUST)
  - Either household head or spouse 60 or older as of Dec 31, 2012 (included single older adults)
  - N=1,693
Panel Study of Income Dynamics-Disability and Use of Time Supplement (DUST)

- DUST time-use data
  - Each older adult was asked to complete two (one weekday, one weekend day) 24-hour time diary
  - Started from 4am of the selected day
  - Used same codes from the American Time Use Survey for activities
Indicators of Sleep Problems

- Insufficient sleep (<6 hours)
  - Each adult was asked to complete two (one weekday, one weekend day) 24-hour time diary
  - Focus on longest sleep episode
- Difficulty falling asleep
  - When reported sleep in time diary, respondent was asked “Did it take you more than half an hour to fall asleep? (yes/no)”
Measures of Economic Hardship

- Linked DUST to the core PSID
- Current poverty (2013, DUST survey year)
  - Federal poverty line, adjusting for family size
  - 133% FPL
  - Approximately ~ 16%
- Long-term poverty (2009-2013)
  - Five years or more
  - Approximately ~ 8%
Analytical Strategy

• Multilevel models

\[ Y_{ij} = \alpha + \beta T_{ij} + \gamma X_{ij} + \delta Z_{ij} + \varepsilon \cdots \cdots (1) \]

\[ Y_{ij} = \alpha + \beta T D_{ijt} + \gamma X H_{jt} + \delta Z H_{ijt} + \varepsilon \cdots \cdots (2) \]

• T: poverty status
• X: family-level covariates
• Z: individual-level covariates
• TD: duration of the exposure to poverty
• XH: history of family-level covariates
• ZH: history of individual-level covariates
Analytical Strategy (Cont.)

• Counterfactual models
  • Inverse probability treatment weight (IPTW)
  • Marginal structural model
    • $2 \times 2 \times 2 = 8$ pathways

$$IPTW_{ijt} = \prod_{t=1}^{T} \frac{P(T_t = t_{it} \mid T_{it-1}, X_{i1})}{P(T_t = t_{it} \mid T_{it-1}, X_{it-1})}$$
Analytical Strategy (Cont.)

- Use classification and regression tree (CART) for estimating propensity score
  - Machine learning approach
  - Recursively partitioning the data space and fitting a simple prediction model within each partition.
  - The partitioning can be represented graphically as a decision tree
  - Non-parametric
- Stabilized weights
  - Do not increase or decrease bias, but can increase precision
## Current Poverty and Sleep Problems

<table>
<thead>
<tr>
<th></th>
<th>Insufficient Sleep</th>
<th>Difficulty Falling Asleep</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Log odds ratio (SE)</td>
<td>Log odds ratio (SE)</td>
</tr>
<tr>
<td><strong>A. Weekday Diary</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Unadjusted model</td>
<td>0.360 (0.161)*</td>
<td>0.755 (0.164)**</td>
</tr>
<tr>
<td>Regression-adjusted model</td>
<td>0.131 (0.202)</td>
<td>0.528 (0.208)*</td>
</tr>
<tr>
<td>IPTW model</td>
<td>0.206 (0.222)†</td>
<td>0.392 (0.224)†</td>
</tr>
</tbody>
</table>

| **B. Weekend Diary**|                    |                           |
| Unadjusted model    | 0.297 (0.175)      | 0.847 (0.172)**           |
| Regression-adjusted model | -.001 (0.219)     | 0.447 (0.221)*            |
| IPTW model          | -0.117 (0.241)     | 0.412 (0.235)*            |

*Note. † P<.1; * P<.05; ** P<.01; *** P<.001*
## Long-Term Poverty and Sleep Problems

<table>
<thead>
<tr>
<th></th>
<th>Insufficient Sleep</th>
<th>Difficulty Falling Asleep</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Log odds ratio (SE)</td>
<td>Log odds ratio (SE)</td>
</tr>
</tbody>
</table>

### A. Weekday Diary

- **Unadjusted model**: 0.418 (0.213)*  
  0.991 (0.212)***
- **Regression-adjusted model**: -0.016 (0.269)  
  0.695 (0.276)*
- **IPTW model**: 0.140 (0.313)  
  0.558 (0.310) †

### B. Weekend Diary

- **Unadjusted model**: 0.445 (0.230)  
  0.829 (0.231)***
- **Regression-adjusted model**: 0.033 (0.289)  
  0.445 (0.294)
- **IPTW model**: 0.129 (0.324)  
  0.546 (0.324)

*Note. † P<.1; * P<.05; ** P<.01; *** P<.001*
Effects of Poverty on Difficulty Falling Asleep (IPT Weighted)

- Current Poverty
  - Difficulty Falling Asleep (Weekday)
  - Difficulty Falling Asleep (Weekend)

- Long-Term Poverty
  - Difficulty Falling Asleep (Weekday)
  - Difficulty Falling Asleep (Weekend)
Discussion

• Consistent patterns for weekdays and weekends

• Non-effect of insufficient sleep
  • Coping: older adults strive to maintain normal sleep hours in the face of economic hardship
  • Additional analysis on sleep duration showed small positive effect
  • Coping may be less successful for sleep initiation
Limitations

- Not a nationally representative sample of older adults
- Income and poverty information not available between the two interview years
- Measurement error of sleep indicators
- Ignorability assumption
Conclusion

• This study adds to the understanding of determinants of sleep problems in old age
  • Sleep health is consequential for older adults’ health and well-being

• Poverty has no effect on insufficient sleep

• Poverty can reduce older adults’ abilities to initiate sleep
  • Effects for both current and long-term poverty
  • Effects for both weekdays and weekend days
Implications: A More Comprehensive Way to Promote Sleep Health of Elderly

Sleep Health

Biomedical & Neuropsychological Perspective

Social & Health Policy Perspective

Social World

Sleep
Acknowledgement

• This project received funding from the National Institute on Aging P01 AG029409

Thank you!