The Observable Burden in The US

• 5000 deaths due to *injury* in the workplace annually

• 5,000,000 *injuries* in the workplace, recorded annually, resulting in $50-100B loss in direct costs and productivity

• With resultant early exit from the labor force, *injuries* likely result in 2% or more loss of GDP

• Contribution to *disease* burden remains subject to debate
Fig. 5  CHD mortality among total population by year of follow-up.
Age-Adjusted, Annual Incidence Rate for Males by Job Grade (1996-2003)
But is work the cause? Our Dilemma:

• The way we live, and the work we do (or don’t!) are not randomly assigned.

• We can’t do experiments, so must rely on observing “life”

• The ability to tease out the effects of psycho-social factors- in life and work-- are “confounded” by the presence of physical/chemical exposures in life and work

• The ability to study physical environment is confounded by highly inter-correlated social stresses, behaviors and differences in health care
Figure 2  County Map of S70, White Males, 2000
Theoretical Explanations for the Observed Gradients in Health Across the Life-Cycle:

- Genetic differences
- Early life environment
- Differential school experience
- Health care differentials
- Behavior differences (e.g. tobacco, diet, BMI)
- Physical environment (e.g. noise, pollution, climate)
- Social environment (e.g. stress, social relations)
- Work environment
Potential Pathways by which Work may Contribute to the Health Gradient

- More dangerous jobs
- More hazardous exposures on the job
- Less control over work shift
- Higher stress
- Lower pay
- Lower status
- Less job security, especially during recession
- Work-Job tension (especially for women)
- Less ability to work from home (COVID-19)
Theoretical Explanations for the Observed Gradients in Health Across the Life-Cycle:

- Is status important per se?
- What’s the role of job stress?
- How about those physical and chemical factors?
- What’s happening to women as they enter the traditional male world of work?
- What role do changes in the culture of work play?
- Has COVID-19 changed the conversation?
OR of Hypertension by Continuous Job Grade (v. hourly lowest)
Answer Questions using the following scale and according to what the job requires:

<table>
<thead>
<tr>
<th>Often</th>
<th>Sometimes</th>
<th>Seldom</th>
<th>Never</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
</tr>
<tr>
<td>5</td>
<td>6</td>
<td>7</td>
<td>8</td>
</tr>
<tr>
<td>9</td>
<td>10</td>
<td>11</td>
<td>12</td>
</tr>
</tbody>
</table>

Q13  How often does the job require working fast?
Q14  How often is it extremely important to do the work without mistakes?

Q15  How often does the job demand simultaneous or consecutive completion of tasks that are difficult to combine (i.e. conflicting demands)?

Q16  How often does the job permit complete discretion and independence in determining how the work is to be done?

Q17  How often does the job permit complete discretion and independence in determining when the work is done?
Karasek Strain Model

<table>
<thead>
<tr>
<th>Demand</th>
<th>Control</th>
</tr>
</thead>
<tbody>
<tr>
<td>Low</td>
<td>Low</td>
</tr>
<tr>
<td></td>
<td>High</td>
</tr>
<tr>
<td>Low</td>
<td>Low</td>
</tr>
<tr>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Do Chemical and Physical Exposures at Work Contribute to the Gradient?

- 25-50% still exposed to major hazards
- Strong inverse relationship between education and hazard, though less with income
- The unanswered question is: what hazards remain that might explain excess risk for lower SES individuals
Exposure from:

**Second hand cigarette smoke:**
Stars, from 2006 Surgeon General Report
and INTERHEART study

**And air pollution:**
Hex, from Women’s Health Initiative cohort
Diamonds, from ACS cohort
Triangles, Harvard Six Cities cohort

Exposure from smoking
≤3, 4-7, 8-12, 13-17, 18-22, and 23+ cigarettes/day
Results for PM2.5 (mg/day)* and All-IHD incidence (log scale)

PM2.5 concentration transformation: mg/m^3 x 10 = mg/day
## Risk Factors for Injury: Gender

<table>
<thead>
<tr>
<th></th>
<th>Injury Rate (95% CI)</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>All Jobs (n=58)</strong></td>
<td></td>
</tr>
<tr>
<td>All Employees</td>
<td>14.2 (13.8-14.6)</td>
</tr>
<tr>
<td>Males</td>
<td>14.3 (14.0-14.7)</td>
</tr>
<tr>
<td>Females</td>
<td>22.4 (20.8-24.0)</td>
</tr>
<tr>
<td>RR</td>
<td>1.6 (1.4-1.7)</td>
</tr>
<tr>
<td><strong>Selected Jobs (n=14)</strong></td>
<td></td>
</tr>
<tr>
<td>All Employees</td>
<td>14.2 (13.8-14.6)</td>
</tr>
<tr>
<td>Males</td>
<td>13.6 (13.2-14.0)</td>
</tr>
<tr>
<td>Females</td>
<td>21.6 (19.9-23.5)</td>
</tr>
<tr>
<td>RR</td>
<td>1.6 (1.5-1.7)</td>
</tr>
</tbody>
</table>

- Injury rates for women are significantly higher.
- Relative risk (RR) shows women are 1.6 x more likely to be injured than men in comparable jobs.
Risk Factors for Injury: **Gender**

Injury Rates for Males and Females by Standardized Job Title
Potential Contribution of Work Organization

- Unemployment/underemployment
- Recessions/ work insecurity
- Shift work/overtime
- The “new” work contract
What we have learned from COVID-19

• Not enough empirical work yet, but:
  • Essential work appears to be a critical risk factor for disease incidence.
  • While certain occupations have presented major clusters, the degree to which the ethnic, racial and geographic disparities can be explained by work remains uncertain.
Occupation*
Specific Occupations

![Bar Chart showing frequency of specific occupations among COVID-19 patients compared to the total population.](chart.png)

- **Educator**: 27 patients, 22 in the general population.
- **FT Student**: 53 patients, 32 in the general population.
- **Other Medical**: 36 patients, 23 in the general population.
- **Physician**: 3 patients, 1 in the general population.
Approaches for further study

- Modeling, using features from O*NET
- Linkages of occupational data with health data
Questions?