The economic burden of occupational illness

Rene Pana-Cryan, PhD

The findings and conclusions in this report are those of the author(s) and do not necessarily represent the views of the National Institute for Occupational Safety and Health
Burden definition and purpose

• Burden estimates encompass the broad consequences of worker injury and illness on society overall

• Exposure/Hazard $\rightarrow$ Injury/Illness $\rightarrow$ Disability/Severity/Cost

• Estimates of the magnitude and distribution of the burden
  • inform prevention decisions
  • reveal trends that help us
    • understand the determinants of the burden
    • evaluate the actual effect of prevention efforts
  • improve management of limited resources
NIOSH-sponsored burden estimates

• Most recently published national estimates: Leigh 2011

• Studies completed but not yet published, to obtain:
  • Updated estimates of injury burden by sector (Leigh)
  • Detailed injury burden in Manufacturing (Ray) and Wholesale and retail trade (Bhattacharya)
  • Updated estimates of rates and cases of selected chronic illnesses by sector (Groenewold et al.)
Surveillance and economic burden components

Health outcome information
• Incidence-based
  • Rate
  • Number of new cases due to work (100% for injury as used by Leigh 2011)
• Prevalence-based (as used by Leigh 2011 for selected chronic conditions)

Economic information
• Builds on the health outcome method (incidence- or prevalence-based)
  • Both methods consider future health outcomes and associated economic metrics by bringing them to one year (present value)
Available surveillance sources

• Fatalities: Timely and reliable national estimates are available from the Bureau of Labor Statistics (BLS), Census of Fatal Occupational Injuries (CFOI)

• Nonfatal injuries and “acute illnesses:” Incidence-based estimates are available from BLS Survey of Occupational Injuries and Illnesses (SOII) but need adjustments for undercounting (see Leigh 2011)

• Mortality and morbidity from chronic occupational illnesses are more difficult to estimate, and most morbidity estimates are prevalence-based

• No national surveillance system captures cases of occupational illness reliably and comprehensively

• Standardizing methods is a challenge!
Recent NIOSH efforts to improve estimates of chronic illnesses

- Incidence rate and number of cases
  - All USA
  - By sector
- Attributable Fraction (AF)
  - Determine exposure prevalence and relative risk
- Incidence rate due to work
  - Apply AF to incidence rate
- Number of cases due to work
- Economic burden
Three sets of approaches to estimate economic burden

<table>
<thead>
<tr>
<th>Approach</th>
<th>Comments</th>
<th>Decision makers</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Medical Costs and Productivity Losses</strong></td>
<td>Used by Leigh (2011, 2016) for NIOSH-sponsored estimates of the societal costs of occupational injuries and illnesses</td>
<td>Public health community</td>
</tr>
<tr>
<td></td>
<td>Used for employer level analyses</td>
<td>Employers</td>
</tr>
<tr>
<td><strong>Risk-Money Tradeoffs</strong></td>
<td>Include mandated approaches to estimate the impact of regulations by federal agencies</td>
<td>Regulatory community</td>
</tr>
<tr>
<td><strong>Reductions in Quality of Life</strong></td>
<td>Include WHO-sponsored assessments of the global burden of disease (GBD) that use Disability-adjusted Life Years (DALYs)</td>
<td>Public health community</td>
</tr>
</tbody>
</table>
# Lung cancer (and bronchus) age 30+

<table>
<thead>
<tr>
<th></th>
<th>Population 2012</th>
<th>Incidence rate (per 100,000)</th>
<th>Estimated number of cases</th>
<th>Estimated % exposed</th>
<th>Relative Risk (RR)</th>
<th>Attributable Fraction (AF) %</th>
<th>Incidence rate due to occupational exposures (per 100,000)</th>
<th>Estimated number of cases due to occupational exposures</th>
</tr>
</thead>
<tbody>
<tr>
<td>All U.S.</td>
<td>185,775,911</td>
<td>113</td>
<td>210,577</td>
<td>0.1-10</td>
<td>1.1-2.7</td>
<td>5 - 10</td>
<td>6-11</td>
<td>11,371 - 20,236</td>
</tr>
<tr>
<td>PSS</td>
<td>2,788,900</td>
<td>106</td>
<td>2,953</td>
<td>2-38</td>
<td>15 - 35</td>
<td>15 – 37*</td>
<td>432 – 1,039</td>
<td>1,938 – 2,920*</td>
</tr>
<tr>
<td>SRV</td>
<td>68,251,200</td>
<td>80</td>
<td>54,580</td>
<td>0.1-8</td>
<td>4 - 5</td>
<td>3 – 4</td>
<td>1,938 – 2,920*</td>
<td></td>
</tr>
</tbody>
</table>

*highest incidence rate or number of cases
Lung cancer projected deaths

• Determined the number of lung cancer patients who would die each year following diagnosis *from lung cancer*
  • based on information collected by the Surveillance, Epidemiology, and End Results (SEER) Program of the National Cancer Institute
  • all races, males and females
  • adjusted for non-cancer deaths

<table>
<thead>
<tr>
<th>Cases diagnosed in all sectors</th>
<th>Deaths</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Year 2</td>
</tr>
<tr>
<td>Low estimate</td>
<td>7,268</td>
</tr>
<tr>
<td>High estimate</td>
<td>13,448</td>
</tr>
</tbody>
</table>

Department of Health and Human Services
Centers for Disease Control and Prevention
National Institute for Occupational Safety and Health
Lung cancer medical costs

<table>
<thead>
<tr>
<th>Disease</th>
<th>Initial year</th>
<th>Each continuing year</th>
<th>Last year of life</th>
</tr>
</thead>
<tbody>
<tr>
<td>Lung cancer</td>
<td>$76,679</td>
<td>$8,771</td>
<td>$136,028</td>
</tr>
<tr>
<td>Melanoma</td>
<td>$6,793</td>
<td>$2,093</td>
<td>$88,445</td>
</tr>
<tr>
<td>Leukemia</td>
<td>$44,981</td>
<td>$11,507</td>
<td>$190,211</td>
</tr>
</tbody>
</table>

Projected lung cancer medical costs by sector – low estimate (million $)

<table>
<thead>
<tr>
<th>Sector</th>
<th>Cost</th>
</tr>
</thead>
<tbody>
<tr>
<td>AFF</td>
<td>$9.5</td>
</tr>
<tr>
<td>CON</td>
<td>$164.0</td>
</tr>
<tr>
<td>HAS</td>
<td>$49.9</td>
</tr>
<tr>
<td>MNF</td>
<td>$303.8</td>
</tr>
<tr>
<td>MIN</td>
<td>$5.5</td>
</tr>
<tr>
<td>OGE</td>
<td>$13.9</td>
</tr>
<tr>
<td>PSS</td>
<td>$74.3</td>
</tr>
<tr>
<td>SRV</td>
<td>$159.1</td>
</tr>
<tr>
<td>TWU</td>
<td>$136.5</td>
</tr>
<tr>
<td>WRT</td>
<td></td>
</tr>
</tbody>
</table>

Department of Health and Human Services
Centers for Disease Control and Prevention
National Institute for Occupational Safety and Health
Years Lived with Disability (YLD) and Years of Life Lost (YLL) by condition: Global Burden of Disease (GBD) 2013

<table>
<thead>
<tr>
<th>Condition</th>
<th>YLD/case</th>
<th>YLL/death</th>
</tr>
</thead>
<tbody>
<tr>
<td>Asthma</td>
<td>0.044</td>
<td>25.2</td>
</tr>
<tr>
<td>COPD</td>
<td>0.077</td>
<td>13.4</td>
</tr>
<tr>
<td>TB</td>
<td>0.300</td>
<td>20.1</td>
</tr>
<tr>
<td><strong>Lung cancer</strong></td>
<td>0.122</td>
<td>19.0</td>
</tr>
<tr>
<td>Mesothelioma</td>
<td>0.224</td>
<td>17.7</td>
</tr>
<tr>
<td>Bladder cancer</td>
<td>0.070</td>
<td>14.2</td>
</tr>
<tr>
<td>Leukemia</td>
<td>0.012</td>
<td>19.8</td>
</tr>
<tr>
<td>Melanoma</td>
<td>0.056</td>
<td>23.2</td>
</tr>
<tr>
<td>Sinonasal and nasopharynx cancer</td>
<td>0.091</td>
<td>26.1</td>
</tr>
</tbody>
</table>
Top ten low estimates: Lung cancer, Melanoma, and Leukemia by sector

<table>
<thead>
<tr>
<th>Cases</th>
<th>Deaths</th>
<th>Medical costs</th>
<th>YLL</th>
</tr>
</thead>
<tbody>
<tr>
<td>SRV Lung</td>
<td>1,938</td>
<td>SRV Lung 1,921</td>
<td>SRV Lung $333,232,355</td>
</tr>
<tr>
<td>MNF Lung</td>
<td>1,767</td>
<td>MNF Lung 1,751</td>
<td>MNF Lung $303,829,500</td>
</tr>
<tr>
<td>CON Lung</td>
<td>954</td>
<td>CON Lung 945</td>
<td>CON Lung $164,036,980</td>
</tr>
<tr>
<td>TWU Lung</td>
<td>925</td>
<td>TWU Lung 917</td>
<td>TWU Lung $159,050,531</td>
</tr>
<tr>
<td>CON Mel</td>
<td>870</td>
<td>WRT Lung 787</td>
<td>WRT Lung $136,525,537</td>
</tr>
<tr>
<td>WRT Lung</td>
<td>794</td>
<td>PSS Lung 428</td>
<td>PSS Lung $74,280,897</td>
</tr>
<tr>
<td>SRV Mel</td>
<td>787</td>
<td>CON Mel 402</td>
<td>HSA Lung $49,864,491</td>
</tr>
<tr>
<td>AFF Mel</td>
<td>543</td>
<td>SRV Mel 364</td>
<td>CON Mel $48,521,042</td>
</tr>
<tr>
<td>PSS Lung</td>
<td>432</td>
<td>HSA Lung 287</td>
<td>SRV Mel $43,892,023</td>
</tr>
<tr>
<td>HSA Lung</td>
<td>290</td>
<td>AFF Mel 251</td>
<td>PSS Leu $31,446,198</td>
</tr>
</tbody>
</table>
Top ten high estimates:
Lung cancer, Melanoma, and Leukemia by sector

<table>
<thead>
<tr>
<th>Cases</th>
<th>Deaths</th>
<th>Medical costs</th>
<th>YLL</th>
</tr>
</thead>
<tbody>
<tr>
<td>TWU Lung</td>
<td>3,292</td>
<td>TWU Lung 3,263</td>
<td>TWU Lung 61,997</td>
</tr>
<tr>
<td>SRV Lung</td>
<td>2,920</td>
<td>SRV Lung 2,894</td>
<td>SRV Lung 54,986</td>
</tr>
<tr>
<td>MNF Lung</td>
<td>2,538</td>
<td>MNF Lung 2,515</td>
<td>MNF Lung 47,785</td>
</tr>
<tr>
<td>SRV Mel</td>
<td>2,467</td>
<td>CON Lung 1,721</td>
<td>CON Lung 32,699</td>
</tr>
<tr>
<td>CON Mel</td>
<td>2,335</td>
<td>WRT Lung 1,226</td>
<td>SRV Mel 26,471</td>
</tr>
<tr>
<td>CON Lung</td>
<td>1,737</td>
<td>SRV Mel 1,141</td>
<td>CON Mel 25,056</td>
</tr>
<tr>
<td>AFF Mel</td>
<td>1,271</td>
<td>CON Mel 1,080</td>
<td>WRT Lung 23,294</td>
</tr>
<tr>
<td>WRT Lung</td>
<td>1,237</td>
<td>PSS Lung 1,030</td>
<td>CON Mel 19,570</td>
</tr>
<tr>
<td>PSS Lung</td>
<td>1,039</td>
<td>AFF Mel 588</td>
<td>AFF Mel 13,642</td>
</tr>
<tr>
<td>PSS Mel</td>
<td>816</td>
<td>PSS Mel 378</td>
<td>PSS Mel 8,770</td>
</tr>
</tbody>
</table>
Average ranking by deaths, medical costs, and YLL

<table>
<thead>
<tr>
<th>Low estimates</th>
<th>High estimates</th>
</tr>
</thead>
<tbody>
<tr>
<td>SRV Lung</td>
<td>TWU Lung</td>
</tr>
<tr>
<td>MNF Lung</td>
<td>SRV Lung</td>
</tr>
<tr>
<td>CON Lung</td>
<td>MNF Lung</td>
</tr>
<tr>
<td>TWU Lung</td>
<td>CON Lung</td>
</tr>
<tr>
<td>WRT Lung</td>
<td>WRT Lung</td>
</tr>
<tr>
<td>PSS Lung</td>
<td>SRV Mel</td>
</tr>
<tr>
<td>CON Mel</td>
<td>CON Mel</td>
</tr>
<tr>
<td>SRV Mel</td>
<td>PSS Lung</td>
</tr>
<tr>
<td><strong>HSA Lung</strong></td>
<td><strong>AFF Mel</strong></td>
</tr>
<tr>
<td><strong>AFF Mel</strong></td>
<td><strong>PSS Mel</strong></td>
</tr>
</tbody>
</table>
Medical cost estimates comparison

• Leigh 2011 prevalence-based medical cost estimates for 2007, adjusted to 2015 dollars:
  • Lung cancer $1.59 billion
  • No melanoma
  • Leukemia $0.16 billion

• Our incidence-based medical cost estimates for 2013, adjusted for 2015 dollars:
  • Lung cancer min $1.25 billion, max $2.31 billion
  • Melanoma min $0.17 billion, max $0.49 billion
  • Leukemia $0.14 billion
Conclusions and next steps

• We presented estimates based on the same number of new cases diagnosed in one year but capturing different aspects of the burden and resulting in different ranking of illnesses

• Incidence-based estimates are informative --this is the first time we were able to use such estimates by illness and sector

• AF estimates can be useful for both incidence- and prevalence-based metrics

• Both incidence- and prevalence-based estimates are needed
Conclusions and next steps

• GBD estimates are prevalence-based, are being produced more frequently in recent years, and are a good source for prevalence-based and other burden information

• Traditional surveillance metrics and economic metrics derived by different methods, when considered together, provide a richer understanding of burden

• There are many ways to combine these metrics in indexes, as well as use them separately but as a group, i.e., a dashboard
The Impact of Non-standard Employment on Earnings and Benefits: Evidence from the 2010 and 2015 National Health Interview Survey

Abay Asfaw, Regina Pana-Cryan, and Toni Alterman

Disclaimer: The findings and conclusions in this presentation are those of the authors and do not necessarily represent the views of NIOSH.
Background

• Technological change, continuing pressure to increase profitability, and workers’ desire for flexible work schedules are some of the factors affecting changes in the types and prevalence of ‘non-standard’ employment arrangements.

• Workers in non-standard arrangements include independent contractors, on-call workers, and workers hired by staffing agencies.

• Depending on the definition and data source used, the size of the contingent workforce ranges from less than 5% to over one third of the total employed labor force (GAO, 2015).
Background (cont.)

• Non-standard employment arrangements have eroded:
  o the conventional employer-employee relationship, and
  o the traditional role of employers to provide fringe benefits such as group health insurance and pension plans, and paid leave.

• Due to lack of data, little is known about the demographics, working conditions, and the health, safety, and well-being of the millions of workers in non-standard employment arrangements.
Objectives

• The major objectives of this study were to examine the impact of non-standard employment on:
  
  o individual earnings,
  o family poverty status, and
  o access to employer sponsored benefits

at two points in time and across employment arrangements.
Data

• We used the NIOSH supplement of the 2010 & 2015 National Health Interview (NHIS). These data have information on types of employment arrangements.

• DEPENDENT VARIABLES:

1. Annual personal income (in 2015 dollars):
   We used the imputed values for missing and incomplete income observations provided by the National Center for Health Statistics. See https://www.cdc.gov/nchs/data/nhis/tecdoc15.pdf for the details.

2. Family poverty status (based on the Federal Poverty Level (FPL))
   • Poor or near-poor: Family income below 200% of the FPL

3. Access to employer sponsored health insurance (ESHI)
4. Access to paid sick leave (PSL)
Data (cont.)

- **EXPLANATORY VARIABLE**: Type of employment arrangement

The NIOSH supplement of the NHIS in 2010 and 2015 included questions on types of employment arrangements:

1. **Independent contractor**: Independent contractor, consultant, or freelance worker
   - Two types: self-employed and employed

2. **Temporary or contract**: employment by a temporary agency, work for a contractor who provides workers and services to others

3. **Standard**: regular permanent employee

4. **Other**: some other employment arrangement
Data (cont.)

- **COVARIATES:**
  - Sex
  - Age
  - Education (4 categories)
  - Marital status (4 categories)
  - Race/ethnicity (4 categories)
  - Number of adults working in the family
  - Overall health status
  - Number of hours worked per year
  - Industry (8 categories)
  - Firm size (3 categories)
  - Geographic region (4 categories)
**Method (cont.)**

<table>
<thead>
<tr>
<th>Dependent variable</th>
<th>Method</th>
</tr>
</thead>
<tbody>
<tr>
<td>Annual personal income</td>
<td>Multiple imputation regression</td>
</tr>
<tr>
<td>Family income to poverty status ratio (poor or near-poor vs. not-poor)</td>
<td>Multiple imputation logistic regression</td>
</tr>
<tr>
<td>Access to ESHI and PSL</td>
<td>Logistic regression</td>
</tr>
</tbody>
</table>

- To make the results representative of the U.S. non-institutionalized population, we used the weights provided by the NCHS.
- We expressed income variables in 2015 dollars throughout.
Results

Difference between self-employed and employed independent contractors

• We tested for differences in earnings and family poverty status between self-employed and employed independent contractors, and there was no difference; therefore we considered independent contractors as one group for these analyses.

• However, we found significant differences in access to ESHI and PSL between these groups; therefore, we considered self-employed and employed independent contractors as two separate groups for the analyses of ESHI and PSL.
1. Annual real personal earnings

Univariate

Earnings of workers by employment arrangement

<table>
<thead>
<tr>
<th>Employment Arrangement</th>
<th>2010</th>
<th>2015</th>
</tr>
</thead>
<tbody>
<tr>
<td>Other</td>
<td>$27,155</td>
<td>$32,313</td>
</tr>
<tr>
<td>Temporary or contract</td>
<td>$31,329</td>
<td>$34,567</td>
</tr>
<tr>
<td>Independent contractor</td>
<td>$38,212</td>
<td>$41,273</td>
</tr>
<tr>
<td>Standard</td>
<td>$43,798</td>
<td>$47,542</td>
</tr>
</tbody>
</table>

Changes:
- Other: -35%
- Temporary or contract: -28%
- Independent contractor: -13%
- Standard: Ref.
1. Annual real personal earnings

Univariate (cont.)

Difference in earnings between workers in standard vs. non-standard employment arrangements

<table>
<thead>
<tr>
<th>Employment Arrangement</th>
<th>2010</th>
<th>2015</th>
</tr>
</thead>
<tbody>
<tr>
<td>Other</td>
<td>-$16,643</td>
<td>-$15,229</td>
</tr>
<tr>
<td>Temporary or contract</td>
<td>-$12,469</td>
<td>-$12,975</td>
</tr>
<tr>
<td>Independent contractor</td>
<td>-$5,586</td>
<td>-$6,269</td>
</tr>
</tbody>
</table>
1. Annual real personal earnings (cont.)

**Multivariable**

- Differences in earnings in the univariate analyses may not be due to employment arrangement.

- The average number of hours worked per year was 1,840 for workers in standard arrangements, 1,650 for independent contractors, and 1,550 for temporary or contract workers.

- There was significant variation in race/ethnicity, education, and sex across different types of employment arrangements.

- We used multivariable analysis to control for covariates.
1. Annual real personal earnings (cont.)

Multivariable (cont.)

Difference in earnings between workers in standard vs. non-standard employment arrangements, controlling for covariates

<table>
<thead>
<tr>
<th></th>
<th>2010</th>
<th>2015</th>
</tr>
</thead>
<tbody>
<tr>
<td>Other</td>
<td>-$6,755</td>
<td>-$5,839</td>
</tr>
<tr>
<td>Independent contractor</td>
<td>-$5,534</td>
<td>-$2,889</td>
</tr>
<tr>
<td>Temporary or contract</td>
<td>-$2,635</td>
<td>-$3,013</td>
</tr>
</tbody>
</table>

Controlling for sex, age, education, marital status, race/ethnicity, number of adults working in the family, overall health status, number of hours worked per year, industry, firm size, and geographic region.
2. Family poverty status

Univariate

Workers living in poor or near-poor families by employment arrangement (%)

- Temporary or contract: 34.2 (2010) vs 28.9 (2015)
## 2. Family poverty status (cont.)

### Multivariable

Multiple-imputation logistic regression results, controlling for covariates

<table>
<thead>
<tr>
<th></th>
<th>Odds Ratios of workers living in poor or near-poor families [95% confidence intervals]</th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>2010</td>
<td>2015</td>
</tr>
<tr>
<td>Independent contractor</td>
<td>1.40 [1.16 – 1.69]</td>
<td>1.40</td>
<td>1.40</td>
</tr>
<tr>
<td>Temporary or contractor</td>
<td>1.25 [0.89 – 1.75]</td>
<td>1.39</td>
<td>1.39</td>
</tr>
<tr>
<td>Other</td>
<td>1.65 [1.26 – 2.15]</td>
<td>1.40</td>
<td>1.40</td>
</tr>
<tr>
<td>Standard Reference</td>
<td></td>
<td>Reference</td>
<td></td>
</tr>
<tr>
<td>Number of observations</td>
<td></td>
<td>13,848</td>
<td>17,379</td>
</tr>
</tbody>
</table>

Controlling for sex, age, education, marital status, race/ethnicity, number of adults working in the family, overall health status, number of hours worked per year, industry, firm size, and geographic region.
3. Access to ESHI

Univariate

Workers with access to ESHI (%)

<table>
<thead>
<tr>
<th></th>
<th>2010</th>
<th>2015</th>
</tr>
</thead>
<tbody>
<tr>
<td>Self-employed</td>
<td>10</td>
<td>12</td>
</tr>
<tr>
<td>Employed</td>
<td>37</td>
<td>36</td>
</tr>
<tr>
<td>Independent contractor</td>
<td>27</td>
<td>28</td>
</tr>
<tr>
<td>Other</td>
<td>47</td>
<td>48</td>
</tr>
<tr>
<td>Temporary or contract</td>
<td>77</td>
<td>76</td>
</tr>
<tr>
<td>Standard</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
### 3. Access to ESHI (cont.)

#### Multivariable

Logistic regression results, controlling for covariates

<table>
<thead>
<tr>
<th>Employment Status</th>
<th>Odds Ratio of having access to ESHI [95% confidence intervals]</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>2010</td>
</tr>
<tr>
<td>Self-employed Independent Contractor</td>
<td>0.02 [0.02 – 0.03]</td>
</tr>
<tr>
<td>Employed Independent Contractor</td>
<td>0.16 [0.13 – 0.21]</td>
</tr>
<tr>
<td>Temporary or Contract</td>
<td>0.35 [0.25 – 0.48]</td>
</tr>
<tr>
<td>Other</td>
<td>0.11 [0.09 – 0.15]</td>
</tr>
</tbody>
</table>

Standard Reference

| Number of observations                   | 13,848                                                   | 17,379                                                  |

*Controlling for sex, age, education, marital status, race/ethnicity, number of adults working in the family, overall health status, number of hours worked per year, industry, firm size, and geographic region.*
4. Access to PSL

Univariate

Workers with access to PSL (%)

<table>
<thead>
<tr>
<th></th>
<th>2010</th>
<th>2015</th>
</tr>
</thead>
<tbody>
<tr>
<td>Self-employed</td>
<td>3</td>
<td>5</td>
</tr>
<tr>
<td>Employed</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Independent contractor</td>
<td>23</td>
<td>26</td>
</tr>
<tr>
<td>Other</td>
<td>13</td>
<td>16</td>
</tr>
<tr>
<td>Temporary or contract</td>
<td>22</td>
<td>26</td>
</tr>
<tr>
<td>Standard</td>
<td>66</td>
<td>68</td>
</tr>
</tbody>
</table>
### 4. Access to PSL (cont.)

**Multivariable**

Logistic regression results, controlling for covariates

<table>
<thead>
<tr>
<th></th>
<th>Odds Ratio of having access to PSL [95% confidence intervals]</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>2010</td>
</tr>
<tr>
<td>Self-employed Independent Contractor</td>
<td>0.01 [0.00 – 0.02]</td>
</tr>
<tr>
<td>Employed Independent Contractor</td>
<td>0.15 [0.11 – 0.20]</td>
</tr>
<tr>
<td>Temporary or Contract</td>
<td>0.18 [0.13 – 0.26]</td>
</tr>
<tr>
<td>Other</td>
<td>0.07 [0.05 – 0.10]</td>
</tr>
<tr>
<td>Standard Reference</td>
<td></td>
</tr>
<tr>
<td>Number of observations</td>
<td>13,848</td>
</tr>
</tbody>
</table>

*Controlling for sex, age, education, marital status, race/ethnicity, number of adults working in the family, overall health status, number of hours worked per year, industry, firm size, and geographic region.*
Limitations

• Because the NHIS data are cross sectional, we could not establish causality among employment arrangements and the other variables of interest.

• Better definitional clarity is needed to distinguish among the increasing varieties of non-standard employment arrangements; due to data limitations, we examined only 4 or 5 broad categories of employment arrangements.
Conclusions

• Workers in non-standard employment arrangements were paid less than their regular counterparts.
• Workers in non-standard arrangements were more likely to live in families with income below or near the FPL.
• We found large gaps in access to ESHI and PSL between workers in standard and non-standard arrangements and within the non-standard group.
• We found no significant difference in earnings or family poverty status between self-employed and employed independent contractors, but there were differences among these groups in terms of access to ESHI and PSL.
• The gaps in income and access to employer sponsored benefits slightly declined from 2010 to 2015.
Future research

• Future research should examine the implications of our findings for worker financial stress, adverse health outcomes, and overall well-being.

• Future studies should include additional information on whether non-standard employment arrangements are chosen by workers, or are the result of their difficulty to obtain employment in standard arrangements.

• Future research is needed on the taxonomy of employment arrangements and to further explore the economic impact of these arrangements on workers and their families.
Thank you!
Using WC Systems to Improve Safety through Partnerships

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Ibraheem Al-Tarawneh, Ohio Bureau of Workers’ Compensation
Alysha Meyers, NIOSH
Tim Bushnell, NIOSH
Mike Lampi, Ohio Bureau of Workers’ Compensation
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Xiangyi Duan, NIOSH

“The findings and conclusions in this report/presentation have not been formally disseminated by the National Institute for Occupational Safety and Health and should not be construed to represent any agency determination or policy.”
Presentation Outline

- WC System Potential
- Studies
  - Claims Data
  - Risk Control
  - Outreach
- Partnership Opportunities
Maximize the use of WC data and systems to improve safety and health
WC System Potential

Claims Data

Employer Data

Outreach to Workers
Using State WC Data for Prevention Purposes

- **FROI**
  - First report of injury
- **SROI**
  - Subsequent report of injury
- Medical reports
- Disputed claims information

Focus on the FROI/SROI to start
- Claims narrative
- Codes for cause, industry, occupation

Limitations
- No information on company size (employee count)
- Codes for cause, industry, occupation may be inaccurate or missing
Using State WC Data for Prevention Purposes

- **FROI**
  - First report of injury
- **SROI**
  - Subsequent report of injury
- Medical reports
- Disputed claims information

**Focus on the FROI/SROI to start**
- Claims narrative
- Codes for cause, industry, occupation

**Solutions**
- Link to data on company size (employee count)
- Auto-coders for cause, industry, occupation
Model and Proof of Concept

• Washington Labor and Industries
  • WC data already has personnel hours and industry
  • Produce detailed reports on injury counts and rates by cause and industry
    http://www.lni.wa.gov/Safety/Research/Files/bd_3F.pdf

• Ohio Bureau of Workers Comp
  • Linked WC to unemployment insurance (UI) data on industry and employee count at employer level via FEIN
  • Developed counts and rates of injury by cause and industry
    – Benchmarking data for employers
    – Focus research and prevention
State WC Claims Data Studies

- NIOSH $5M grant for WC surveillance
  - Develop collaboration between state WC bureaus and departments of health
  - Trend data by industry and cause
  - CA, MA, OH, TN, MI now funded

- Additional states may be funded next year

- Many other states are also conducting WC related analyses

- Ideal time to formally encourage funded states and others interested in WC analyses to share best practices and methods via webinars and Listservs
WC Claims Auto-Coding

Cause

• Adaptable to any narrative data and code set

  • Basic Cause

  • Detailed Cause

Industry/Occupation

• Being adapted for WC
  • https://wwwn.cdc.gov/niosh-nioccs/
Data-Visualization

- Interactive
- Accessible
- Easy to Use
- Fast
- Adaptable
WC Data-Visualization

http://www.cdc.gov/niosh/topics/workercomp/cwcs/dashboard.html
WorkSafe BC Example

- Model for engaging dashboards for safety/health data
  
  Fully accessible public dashboards:

  - https://public.tableau.com/profile/worksafebc#!/vizhome/SeriousInjuryDashboard/SeriousInjuriesatWork
WC System Potential Cont’d

Claims Data

Employer Data

Outreach to Workers
Insurers collect exposure data in many industries

Opportunity to improve usability of data within insurers and for research

CWCS conducting a number of studies
Insurer Risk Control Study

- CWCS conducting interview study to understand the risk control (RC) process used in a variety of WC insurers
  
  • Understand the potential impact of RC systems on workplace safety/health
  
  • Evaluate types of data being collected and formats
  
  • Encourage researchers to work more with insurers to evaluate risks/controls and disseminate best safety/health practices
CWCS Standardized IH Forms Project

• Create standardized forms for air and noise sampling

• Focus groups with insurers and other IH experts

• Identify IH data fields of required data and suggest formats for data collection

• Develop pilot template and collect feedback from insurer IH consultants on usability and suggested improvements
CWCS Standardized IH Forms Project

- Received forms from:
  - 3 state WC insurance funds
  - 2 private WC and multi-line carriers
  - 1 private company that conducts internal IH and safety inspections
  - 4 federal government agencies

- Each participant sent noise sampling forms and most also included basic air sampling

- Compare to AIHA suggested template

- Peer-reviewed pub planned as deliverable
Future Exposure Assessment

- Centralized, searchable databases
- New big data technology

- Wearables
  - Smart glasses/vests, contacts, fabrics, patches
  - Near field chips, proximity monitors to hazards, posture monitors
  - Heat, HR, respiration, pupil tracking
  - Real-time fatigue monitoring
  - Dash-cams, helmet-cams, vests
  - Google glass- use in risk control surveys
  - GPS enabled, smart factories

- CWCS connecting public health researchers to insurers to encourage further research
Outreach Examples

Connect insurer & public health communities

• CWCS and other NIOSH Webinar Series
  - https://www.cdc.gov/niosh/topics/workerc omp/cwcs/publications.html

• Develop/disseminate NIOSH hazard alerts, apps

NIOSH Ladder App

http://www.cdc.gov/niosh/topics/falls/mobileapp.html
Prevention Effectiveness Studies

• Ohio Bureau of Workers’ Compensation (OHBWC) provides matching funds to employers to implement safety/health engineering controls
  
  – Compared 468 employers before/after intervention from 2003-2009

  – All workers’ compensation outcomes for affected employees decreased significantly with interventions

  – Most were ergonomic and safety controls
  – Insurer quadrupled SIG budget, in 2014 provided $15 million to 535 employers

  – Allocated additional $45 million for fiscal years 2015-17

Count of Claims (Medical Only and Lost Time)
Pre- and Post-Intervention

Count of All Claims

Calendar Year (# of employers)
Most Effective Equipment

• Ergonomic
  • Hoists, cranes, manipulators, and vacuum lifts
  • Hoists and cranes (overhead, gantry, bridge, jib, etc.)
  • Lift-tilt tables and positioners
  • Mobile material handling equipment (non-riding)
  • Powered cots

• Safety
  • Specialty saws
  • Slip resistant flooring
Lift Table Example

- Work table holds doors at an optimal height for packaging
- Eliminate back bending, twisting and turning while lifting and packaging
- OHBWC Best practice video link:
  - [https://www.ohiobwc.com/basics/videos/safety/LoadVideo.asp?txtVName=SafeGrantChampionDoor](https://www.ohiobwc.com/basics/videos/safety/LoadVideo.asp?txtVName=SafeGrantChampionDoor)
Other OHBWC Safety Grant Summaries

- Automated, self-climbing hydraulic platform scaffolding
- Truck lift-gate systems
- Hydro-mobile scaffolding
- Mobile work stands
- Articulating boom lift

Future Prevention

- New control technologies
  - Human augmentation - exoskeletons
  - Increasing use of robotics, automation
  - Smart factories, vehicles

- Virtual reality safety training
  - https://www.youtube.com/watch?v=N6UDkcXabEo

- Wellness - HR, steps, diet monitors, FitBit

http://blogs.cdc.gov/niosh-science-blog/2016/03/04/exoskeletons/
Use WC Data to Focus Research and Prevention

- Surveillance
- Building New Partnerships
- Research
- Methods Development
Partnership Opportunities

- **Claims and employer data**
  - Analyze available data
    - Industry, occupation, cause, counts and rates
  - Develop data dashboards
  - If you can Predict, you can Prevent

- **Intervention effectiveness studies**
  - Funded grant programs
  - Other partnerships with insurers and employers
Interested in Working with the CWCS?

• More information:
  • CWCS Website
    • http://www.cdc.gov/niosh/topics/workercomp/cwcs
    • cwcs@cdc.gov

• Questions?