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 → Injury/Illness → 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)

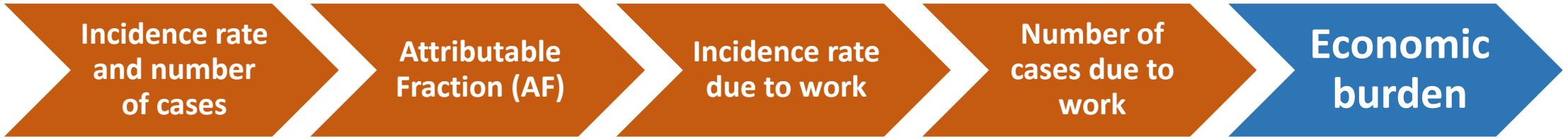
Economic information

- 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



- All USA
- By sector

- Determine exposure prevalence and relative risk

- Apply AF to incidence rate

Three sets of approaches to estimate economic burden

Approach	Comments	Decision makers
Medical Costs and Productivity Losses	Used by Leigh (2011, 2016) for NIOSH-sponsored estimates of the societal costs of occupational injuries and illnesses	Public health community
	Used for employer level analyses	Employers
Risk-Money Tradeoffs	Include mandated approaches to estimate the impact of regulations by federal agencies	Regulatory community
Reductions in Quality of Life	Include WHO-sponsored assessments of the global burden of disease (GBD) that use Disability-adjusted Life Years (DALYs)	Public health community

Lung cancer (and bronchus) age 30+

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

Lung cancer projected deaths

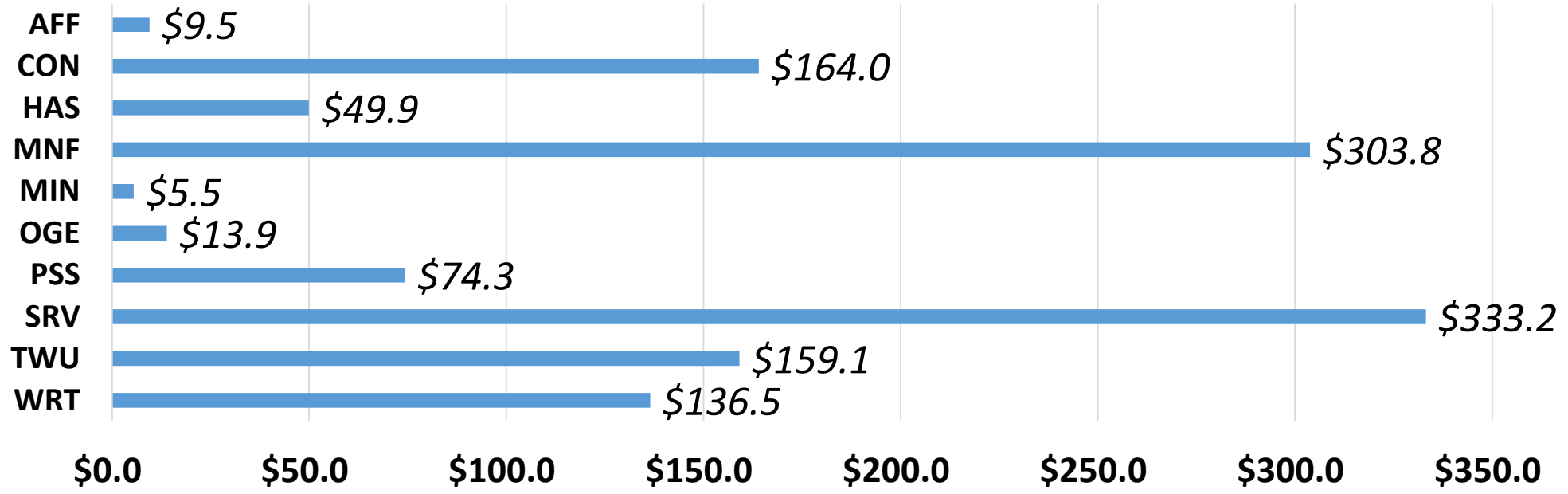
- Determined the number of lung cancer patients who would die each year following diagnosis *from lung cancer*
  - based on information collected by the Surveillance, Epidemiology, and End Results (SEER) Program of the National Cancer Institute
  - all races, males and females
  - adjusted for non-cancer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

Cases diagnosed in all sectors		Deaths							
		Year 2	Year 3	Year 4	Year 5	Year 6	Year 7	Year 8	Total
Low estimate	7,268	3,853	2,377	753	176	35	6	1	7,203
High estimate	13,448	7,130	4,399	1,394	326	65	12	2	13,328

Lung cancer medical costs

Costs per case based on information collected by SEER, adjusted to 2015 dollars			
	Initial year	**Each continuing year**	**Last year of life**
Lung cancer	***$76,679***	***$8,771***	***$136,028***
Melanoma	$6,793	$2,093	$88,445
Leukemia	$44,981	$11,507	$190,211

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



Years Lived with Disability (YLD) and Years of Life Lost (YLL) by condition: Global Burden of Disease (GBD) 2013

Condition	YLD/case	YLL/death
Asthma	0.044	25.2
COPD	0.077	13.4
TB	0.300	20.1
Lung cancer	***0.122***	***19.0***
Mesothelioma	0.224	17.7
Bladder cancer	0.070	14.2
Leukemia	0.012	19.8
Melanoma	0.056	23.2
Sinonasal and nasopharynx cancer	0.091	26.1

Top ten low estimates: Lung cancer, Melanoma, and Leukemia by sector

Cases		Deaths		Medical costs		YLL	
SRV Lung	1,938	SRV Lung	1,921	SRV Lung	$333,232,355	SRV Lung	36,499
MNF Lung	1,767	MNF Lung	1,751	MNF Lung	$303,829,500	MNF Lung	33,269
CON Lung	954	CON Lung	945	CON Lung	$164,036,980	CON Lung	17,955
TWU Lung	925	TWU Lung	917	TWU Lung	$159,050,531	TWU Lung	17,423
CON Mel	870	WRT Lung	787	WRT Lung	$136,525,537	WRT Lung	14,953
WRT Lung	794	PSS Lung	428	PSS Lung	$74,280,897	CON Mel	9,326
SRV Mel	787	CON Mel	402	HSA Lung	$49,864,491	SRV Mel	8,445
AFF Mel	543	SRV Mel	364	CON Mel	$48,521,042	PSS Lung	8,132
PSS Lung	432	HSA Lung	287	SRV Mel	$43,892,023	AFF Mel	5,823
HSA Lung	290	AFF Mel	251	PSS Leu	$31,446,198	HSA Lung	5,453

Top ten high estimates:
Lung cancer, Melanoma, and Leukemia by sector

Cases		Deaths		Medical costs		YLL	
TWU Lung	3,292	TWU Lung	3,263	TWU Lung	$566,047,943	TWU Lung	61,997
SRV Lung	2,920	SRV Lung	2,894	SRV Lung	$502,083,838	SRV Lung	54,986
MNF Lung	2,538	MNF Lung	2,515	MNF Lung	$436,400,267	MNF Lung	47,785
SRV Mel	2,467	CON Lung	1,721	CON Lung	$298,671,105	CON Lung	32,699
CON Mel	2,335	WRT Lung	1,226	WRT Lung	$212,697,845	SRV Mel	26,471
CON Lung	1,737	SRV Mel	1,141	PSS Lung	$178,652,434	CON Mel	25,056
AFF Mel	1,271	CON Mel	1,080	SRV Mel	$137,587,828	WRT Lung	23,294
WRT Lung	1,237	PSS Lung	1,030	CON Mel	$130,226,015	PSS Lung	19,570
PSS Lung	1,039	AFF Mel	588	AFF Mel	$70,885,338	AFF Mel	13,642
PSS Mel	816	PSS Mel	378	HSA Lung	$59,149,603	PSS Mel	8,770

Average ranking by deaths, medical costs, and YLL

Low estimates	High estimates
SRV Lung	TWU Lung
MNF Lung	SRV Lung
CON Lung	MNF Lung
TWU Lung	CON Lung
WRT Lung	WRT Lung
PSS Lung	SRV Mel
CON Mel	CON Mel
SRV Mel	PSS Lung
HSA Lung	AFF Mel
AFF Mel	PSS Mel

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:
  - the conventional employer-employee relationship, and
  - 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:
  - individual earnings,
  - family poverty status, and
  - 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.)

Dependent variable	Method
Annual personal income	Multiple imputation regression
Family income to poverty status ratio (poor or near-poor vs. not-poor)	Multiple imputation logistic regression
Access to ESHI and PSL	Logistic regression

- 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

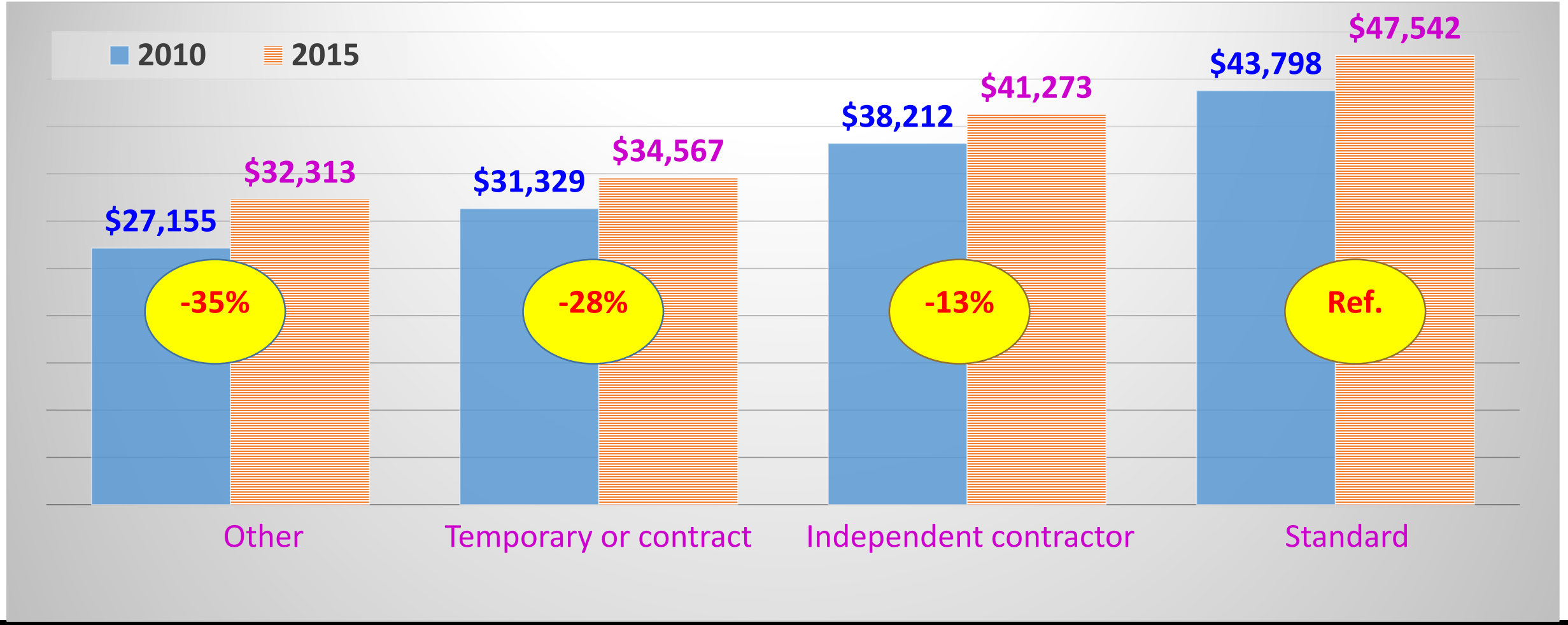
Difference between self-employed and employed independent contractors

- 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

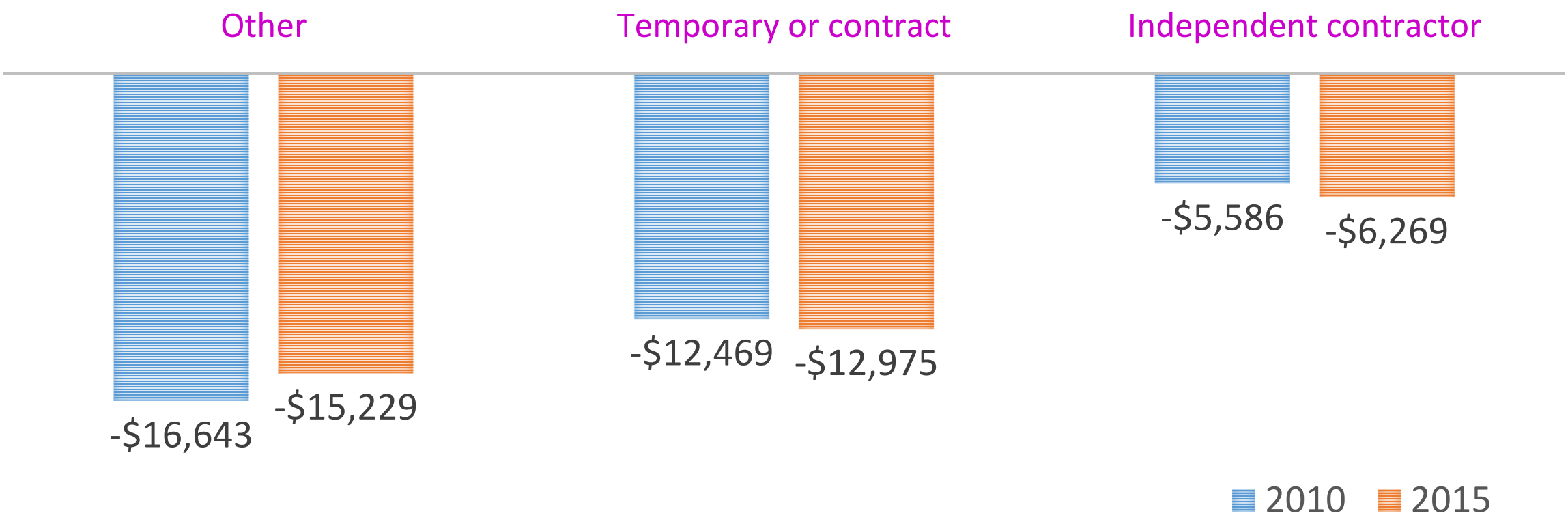
Univariate



1. Annual real personal earnings

Univariate (cont.)

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



1. Annual real personal earnings (cont.)

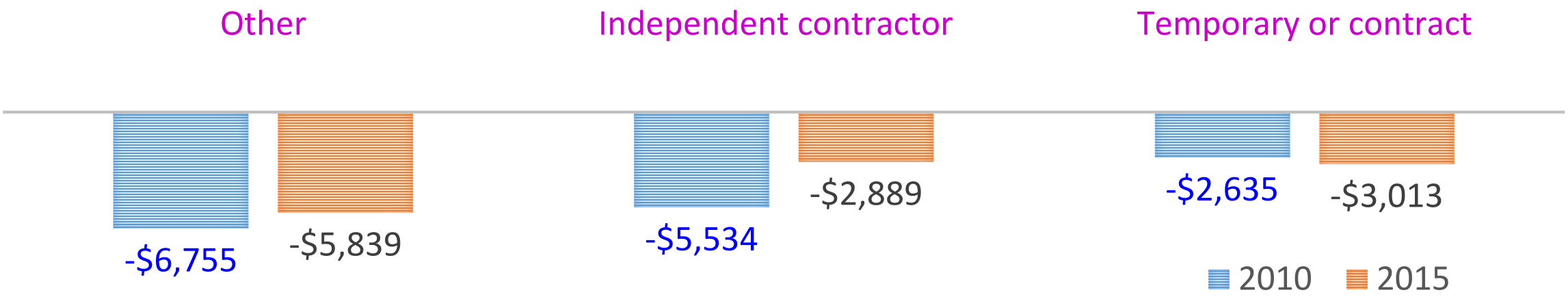
Multivariable

- 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

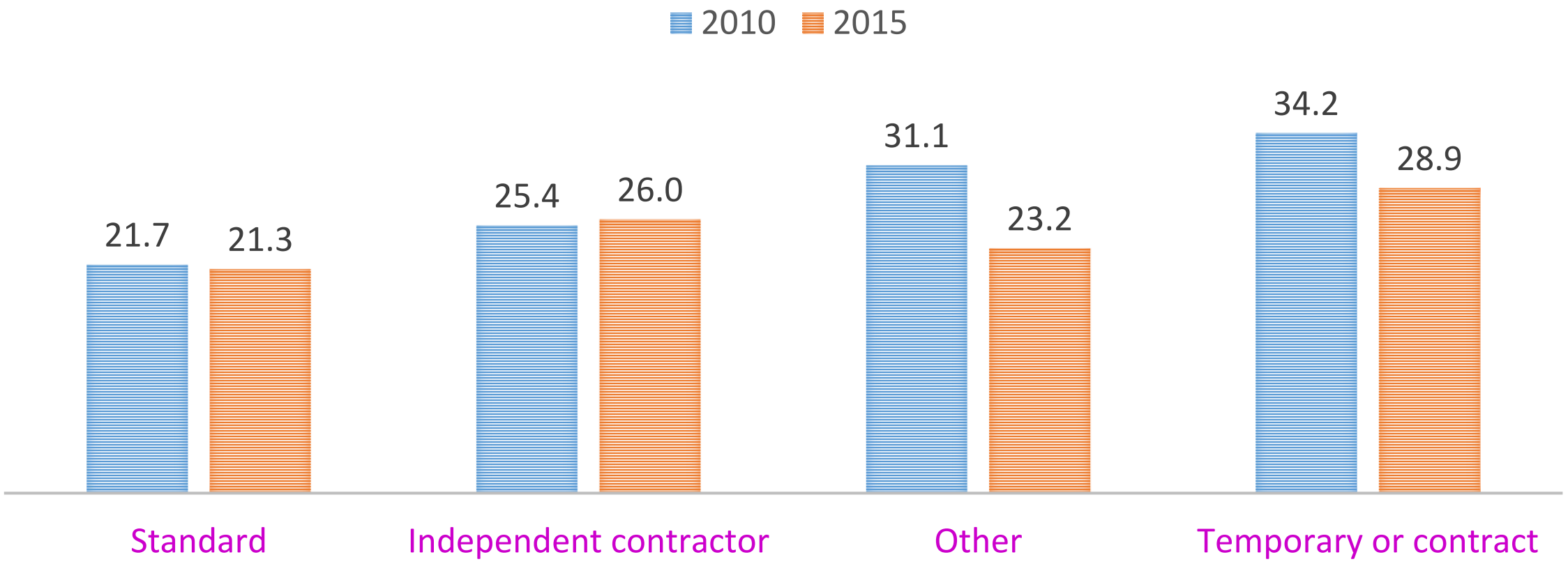


Controlling for sex, age, education, marital status, race/ethnicity, number of adults working in the family, overall health status, number of hours worked per year, industry, firm size, and geographic region.

2. Family poverty status

Univariate

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



2. Family poverty status (cont.)

Multivariable

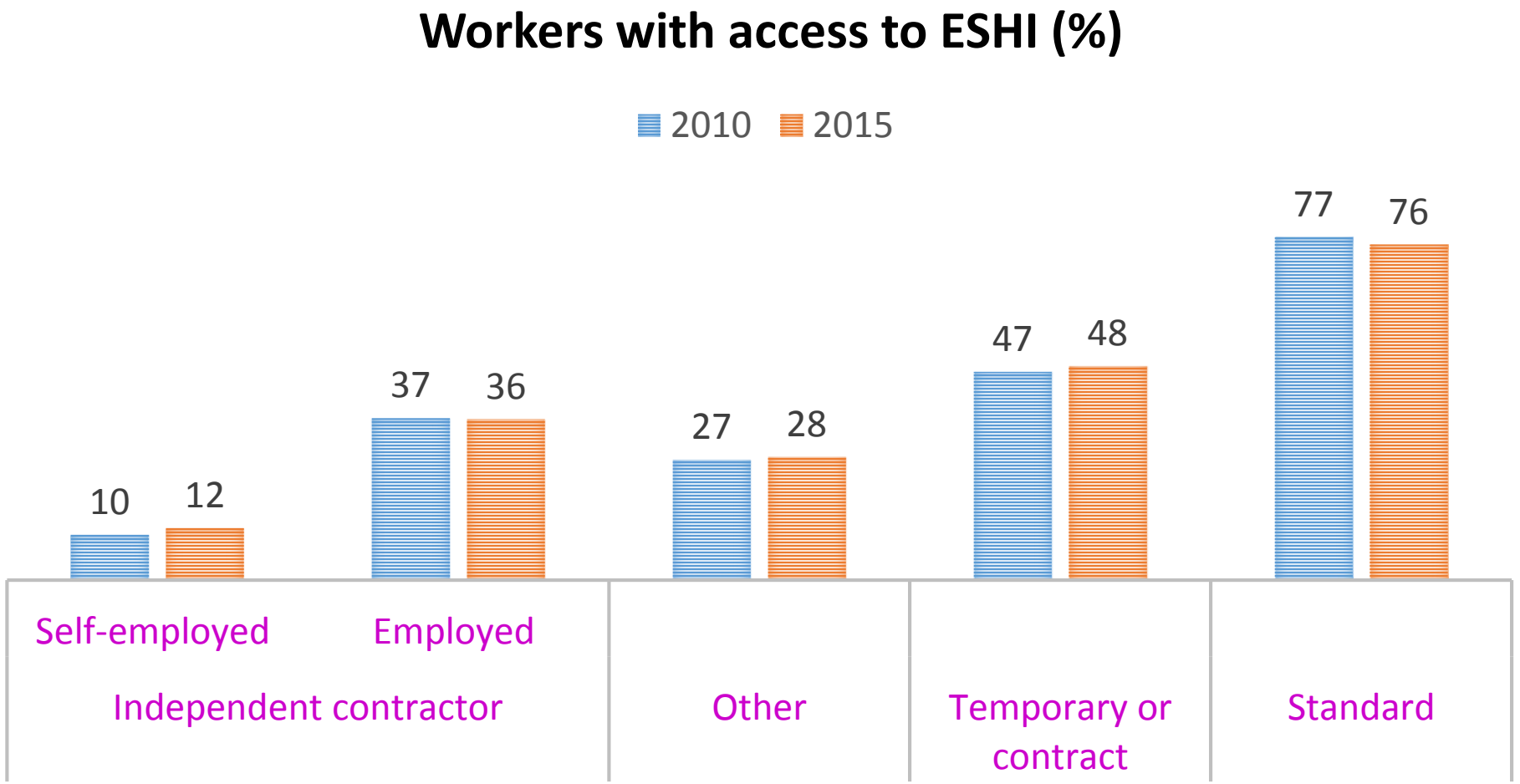
Multiple-imputation logistic regression results, controlling for covariates

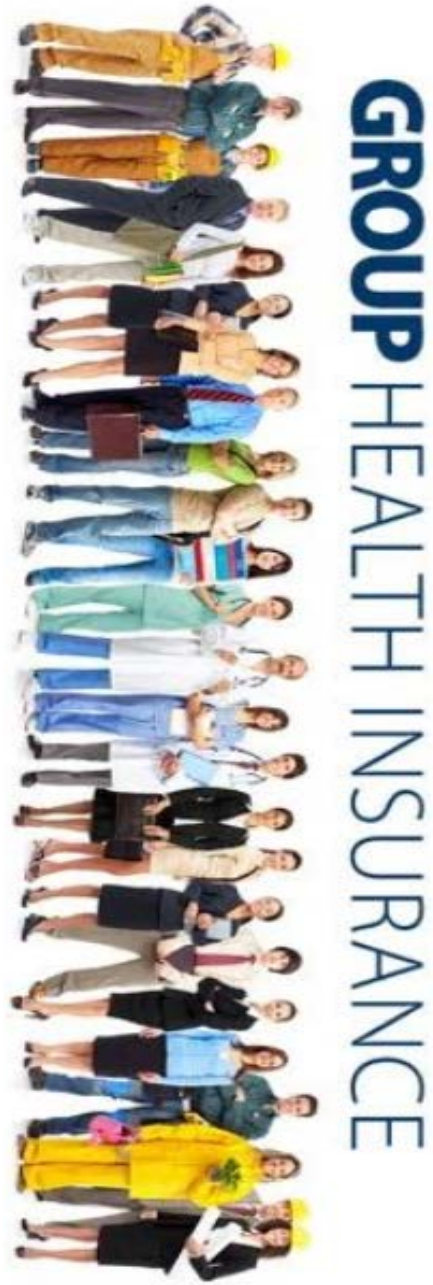
	Odds Ratios of workers living in poor or near-poor families [95% confidence intervals]	
	2010	**2015**
Independent contractor	1.40 [1.16 – 1.69]	1.40 [1.17 – 1.68]
Temporary or contractor	1.25 [0.89 – 1.75]	1.39 [0.93 – 2.10]
Other	1.65 [1.26 – 2.15]	1.40 [1.03 – 1.90]
Standard	Reference	
Number of observations	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.

3. Access to ESHI

Univariate





3. Access to ESHI (cont.)

Multivariable

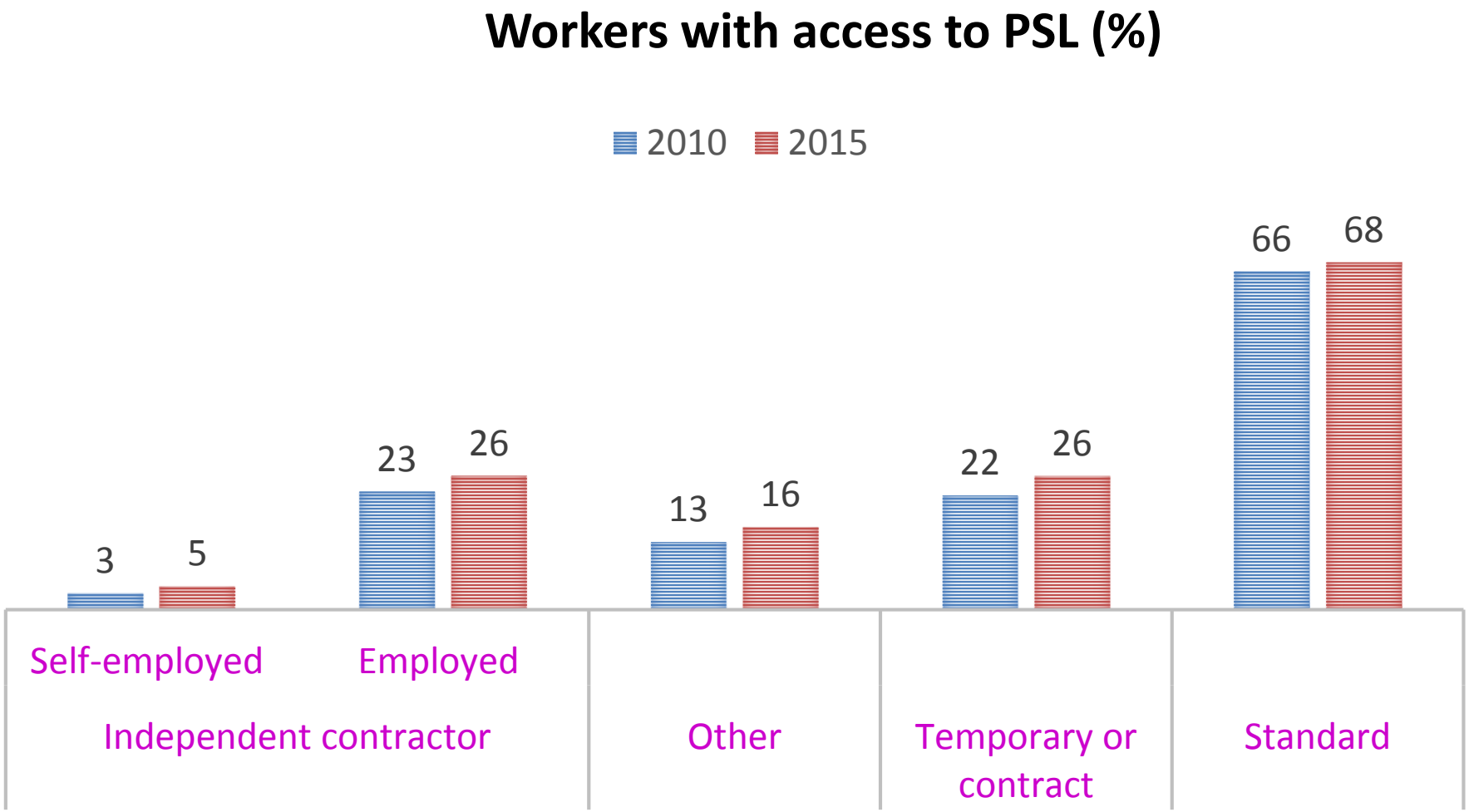
Logistic regression results, controlling for covariates

	Odds Ratio of having access to ESHI [95% confidence intervals]	
	2010	**2015**
Self-employed Independent Contractor	0.02 [0.02 – 0.03]	0.07 [0.06 – 0.09]
Employed Independent Contractor	0.16 [0.13 – 0.21]	0.19 [0.15 – 0.24]
Temporary or Contract	0.35 [0.25 – 0.48]	0.38 [0.28 – 0.52]
Other	0.11 [0.09 – 0.15]	0.16 [0.12 – 0.21]
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



4. Access to PSL (cont.)

Multivariable

Logistic regression results, controlling for covariates

	Odds Ratio of having access to PSL [95% confidence intervals]	
	2010	**2015**
Self-employed Independent Contractor	0.01 [0.00 – 0.02]	0.02 [0.01 – 0.03]
Employed Independent Contractor	0.15 [0.11 – 0.20]	0.16 [0.13 – 0.21]
Temporary or Contract	0.18 [0.13 – 0.26]	0.20 [0.14 – 0.29]
Other	0.07 [0.05 -0.10]	0.10 [0.07 – 0.14]
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.

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.

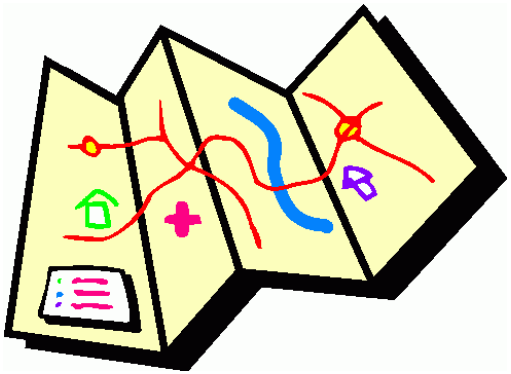
Thank you!

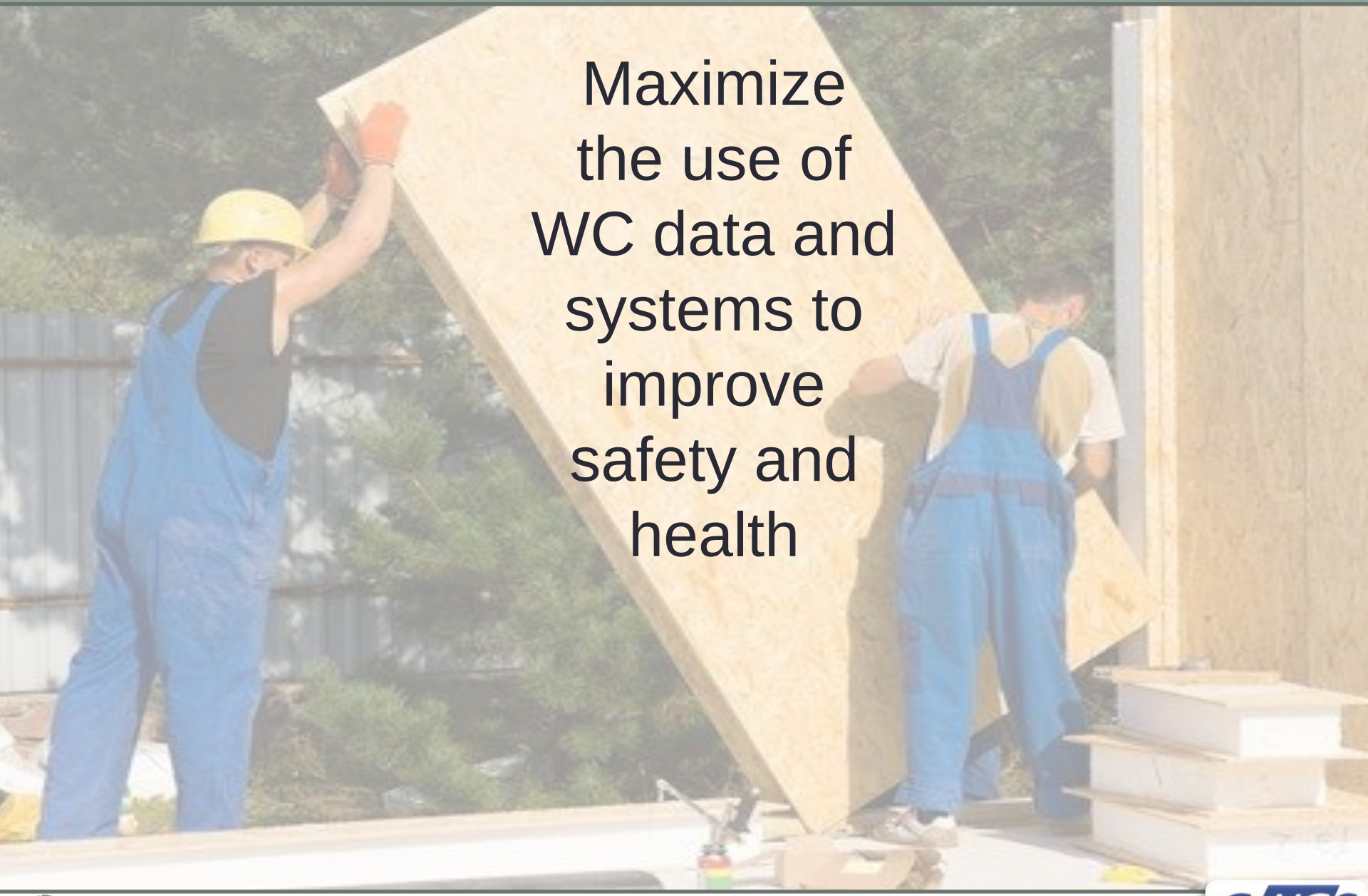
Using WC Systems to Improve Safety through Partnerships

Steve Wurzelbacher, NIOSH
Ibraheem Al-Tarawneh, Ohio Bureau of Workers' Compensation
Alysha Meyers, NIOSH
Tim Bushnell, NIOSH
Mike Lampl, Ohio Bureau of Workers' Compensation
Dave Robins, Ohio Bureau of Workers' Compensation
Steve Bertke, NIOSH
Chih-Yu Tseng, NIOSH
Libby Moore, NIOSH
Jill Raudabaugh, NIOSH
Xiangyi Duan, NIOSH

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

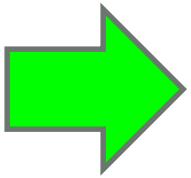
Claims Data

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**
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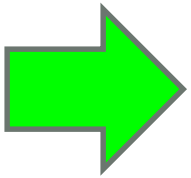


- **Focus on the FROI/SROI to start**
  - Claims narrative
  - Codes for cause, industry, occupation
- **Solutions**
  - Link to data on company size (employee count)
  - Auto-coders for cause, industry, occupation

Model and Proof of Concept

Claims Data

- 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

SHARP
Safety & Health Assessment & Research for Prevention

- 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

Ohio
Bureau of Workers' Compensation

https://www.ncbi.nlm.nih.gov/pubmed/27667651

CDC Workplace Safety and Health NIOSH

CWCS
CENTER FOR WORKERS' COMPENSATION STUDIES

State WC Claims Data Studies

Claims Data

- 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

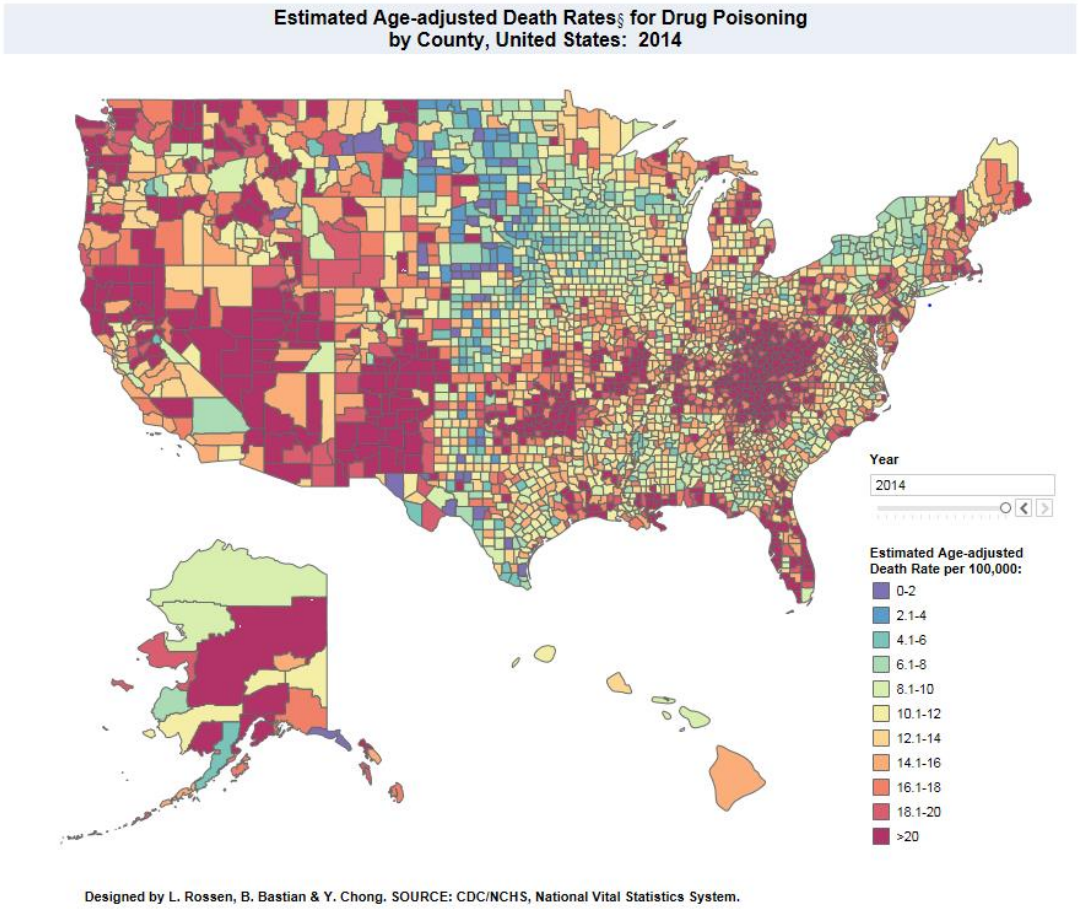
Cause

- Adaptable to any narrative data and code set
  - Basic Cause
    https://www.ncbi.nlm.nih.gov/pubmed/23206504
  - Detailed Cause
    http://www.ncbi.nlm.nih.gov/pubmed/26745274

Industry/Occupation

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

Data-Visualization

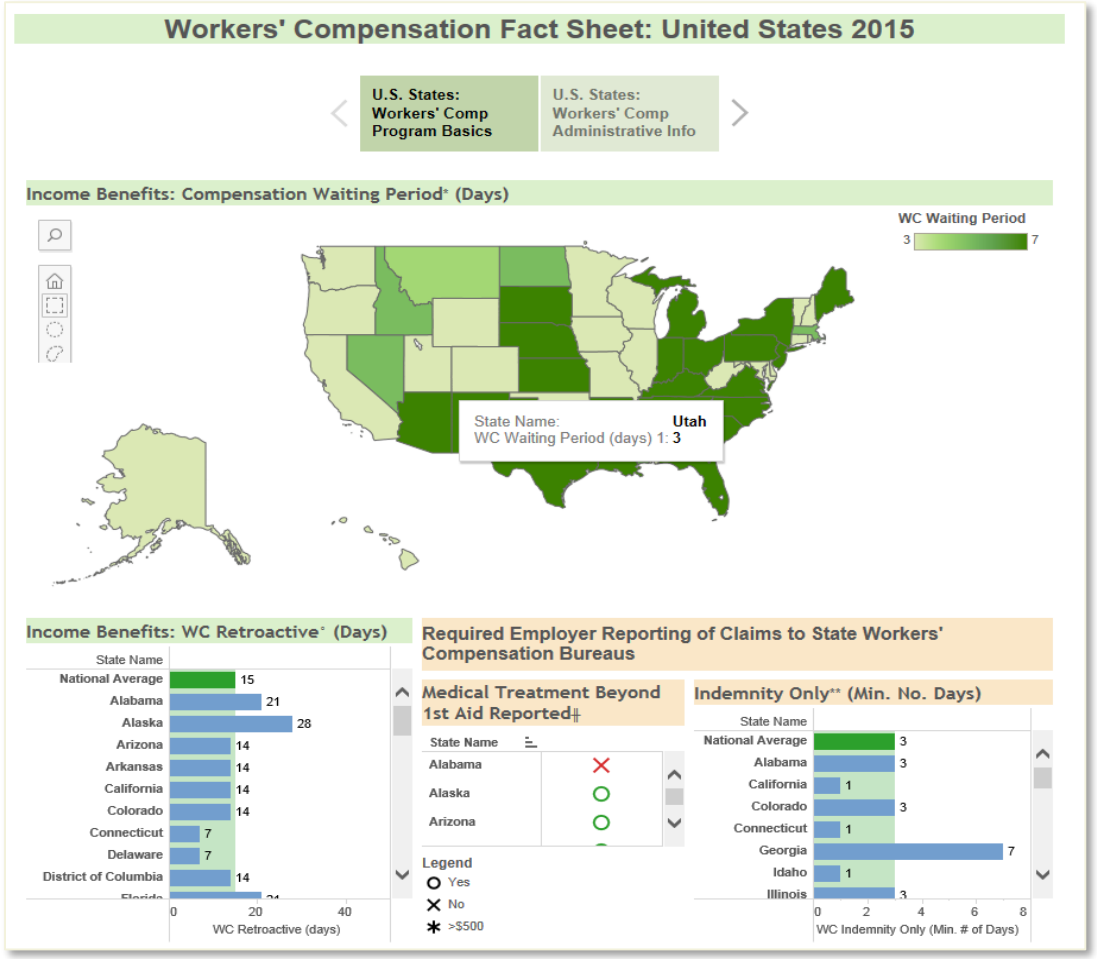


- Interactive
- Accessible
- Easy to Use
- Fast
- Adaptable

CDC Workplace Safety and Health NIOSH

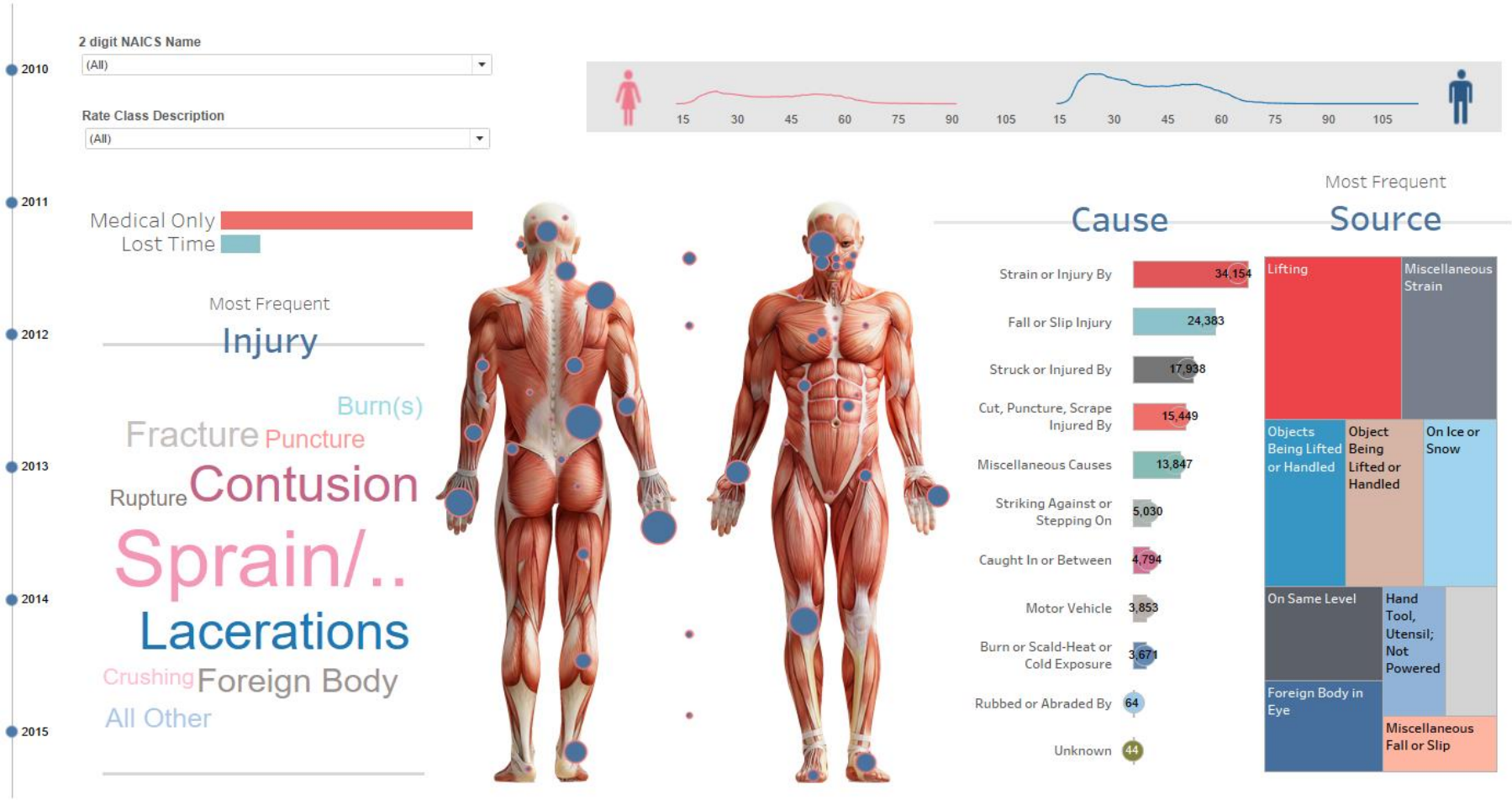
CWCS CENTER FOR WORKERS' COMPENSATION STUDIES

WC Data-Visualization



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

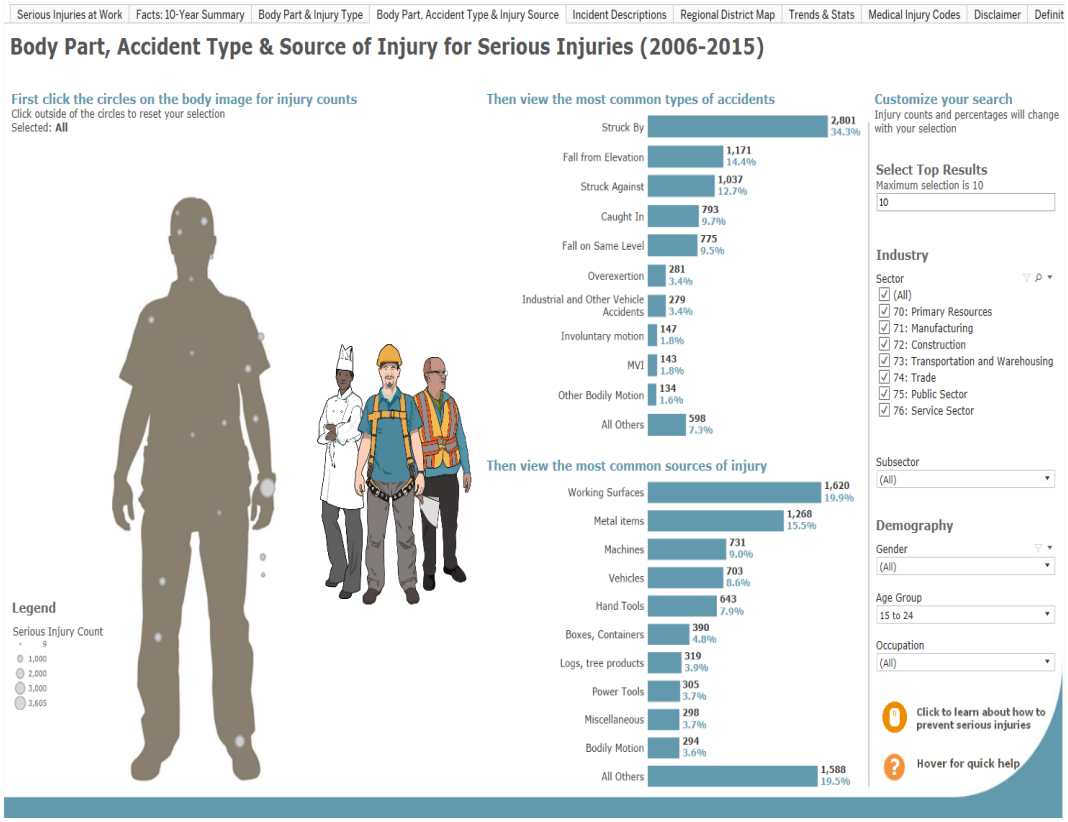
WC Data-Visualization



CDC Workplace Safety and Health NIOSH

CWCS CENTER FOR WORKERS' COMPENSATION STUDIES

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

Insurer Exposure Assessment Studies

- 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

Employer Data

Outreach

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

Employer Data

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

Employer Data

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

- Compare to AIHA suggested template
  - Lippman, M., Gomez, M. R., and Rawls, G. M. (1996). Data elements for occupational exposure databases: Guidelines and recommendations for airborne hazards and noise. Applied Occupational and Environmental Hygiene, 11(11), 1294-1311.

- Peer-reviewed pub planned as deliverable

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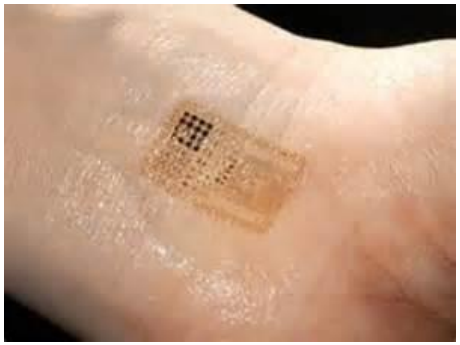
Future Exposure Assessment

- 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/workercomp/cwcs/publications.html
- Develop/disseminate NIOSH hazard alerts, apps

NIOSH Ladder App

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

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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

http://www.ncbi.nlm.nih.gov/pubmed/25223846

Claims Data

Employer Data

Outreach

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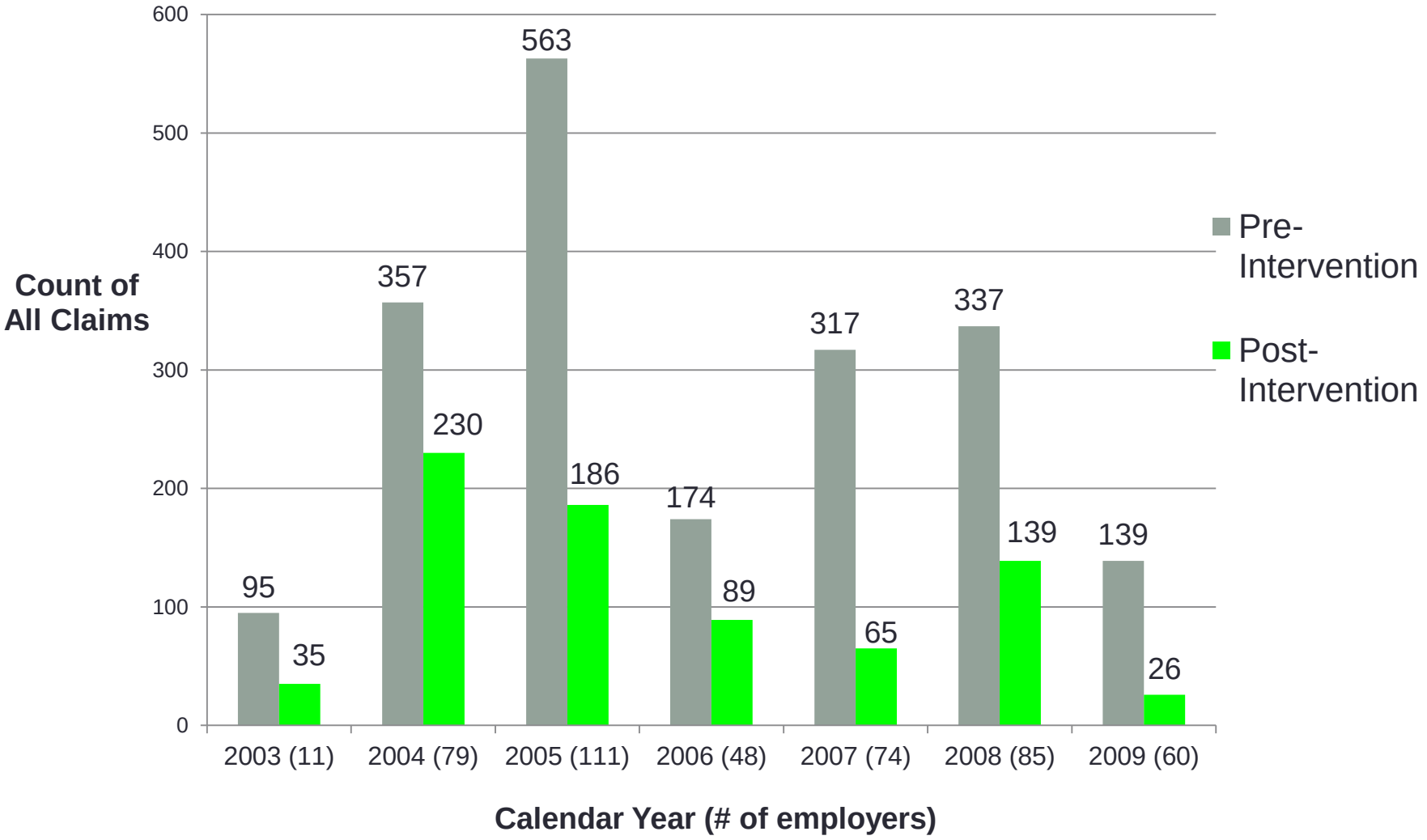
Count of Claims (Medical Only and Lost Time) Pre- and Post-Intervention



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

Before

After

Other OHBWC Safety Grant Summaries

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

- https://www.bwc.ohio.gov/Employer/Services/SHBestPractices/BestPractices

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/


Surveillance
Use WC Data to Focus Research and Prevention
Methods Development
Building New Partnerships
Research

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

Claims Data

Employer Data

Outreach

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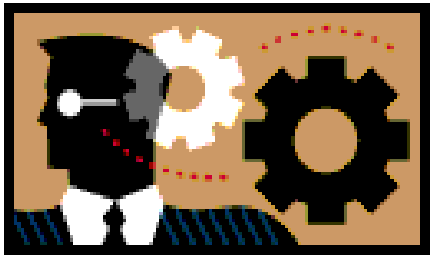
Practice
Research

Interested in Working with the CWCS?



- **More information:**
  - **CWCS Website**
    - http://www.cdc.gov/niosh/topics/workercomp/cwcs
    - **cwcs@cdc.gov**
- **Questions?**

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