Final Progress Report

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List of Terms and Abbreviations

ACA	Affordable Care Act
Arise	Arise Chicago (a workers' center)
BLS	Bureau of Labor Statistics
CBO	Community Based Organization
CMS	Central Management Services (of Illinois)
CWC	Chicago Workers' Collaborative (a workers' center)
EDI	Electronic Data Interchange (v.3 is the updated FROI form)
FROI	First Report of Injury (in workers' compensation systems)
IAIABC	International Association of Industrial Accident Boards and Commissions
IDOL	Illinois Department of Labor
IDPH	Illinois Department of Public Health
ILO	International Labor Organization
IOSP	Illinois Occupational Surveillance Program
IWCC	Illinois Workers' Compensation Commission
IWJ	Interfaith Workers' Justice (a workers' center network)
LU	Latino Union (a workers' center)
MSHA	Mining Safety and Health Administration
NIMHD	National Institute on Minority Health and Health Disparities
NIOSH	National Institute for Occupational Safety and Health
OSHA	Occupational Safety and Health Administration
SOII	Survey of Occupational Injuries and Illnesses (BLS)
UIC	University of Illinois at Chicago
SPH	School of Public Health
WRII	Work Related Injury and Illness
WWJ	Warehouse Workers for Justice (a workers' center)

Abstract
Illinois Occupational Surveillance Program, 2010-2015
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Workplace injuries claim the health, well-being, productivity and lives of hundreds of people every year. Low wage workers, teens and older workers, immigrants and people with disabilities are disproportionally affected by these injuries. The Illinois Occupational Surveillance Program (IOSP) was established to prevent occupational illnesses and injuries in the State, with a focus on underserved worker populations.

IOSP, created with NIOSH funding in 2010, gathered and focused Federal and State data sources to uncover hazardous working conditions and to establish a longitudinal data collection system for evaluating intervention effectiveness. The basic approach was to explore databases that were not previously used for occupational surveillance. This work entailed linking cases across databases, comparing state with national data, studying high risk workforces, reviewing economic outcomes, evaluating health inequities, and building a more complex understanding of how work related injury and illness (WRII) comes about and its long term consequences. Sustainability requires demonstration of IOSP's value, and the commitment of government, employers, workers, and community based organizations. In the first five years, IOSP established a website and produced 14 peer-reviewed publications, 12 conference presentations, 9 grant proposals, 8 published reports, 7 testimonies or press releases, 9 fact sheets, 5 industry spotlights, and 14 Hazard Datasheets on Occupation. Bona fide agents (academicians) strengthened the relationship with the Illinois Department of Public Health. Investigators also work closely with the Illinois Workers' Compensation Commission, Region V and Illinois OSHA, and several worker advocacy organizations.

The key findings of this work are:

- A tight collaboration between university investigators, federal and state agencies, and community groups facilitates a productive and robust occupational health surveillance system that can tackle prevention focused activities
- CSTE Occupational Health Indicators can be easily assembled by state health department agents from many data sources, state agencies, and data managers and provided to NIOSH on an annual basis
- Methods used in other epidemiologic research can be brought to bear on occupational surveillance: data linkage of sentinel health indicators across multiple state databases yields a much higher number of cases than is captured by the Bureau of Labor Statistics and also shows a more detailed picture of how WRIIs occur and their long term consequences; geographic information systems can help identify communities at risk for occupational injury and provide evidence of work as a determinant of health; refinement of injury severity scoring would assist in better understanding the consequences of traumatic occupational injury; use of robust regression for workers' compensation economic data provides a more complex understanding of costs
- Workers' compensation databases provide a rich source of information for occupational surveillance
- There is a need for occupational surveillance expertise by international bodies, federal and state policymakers, community based organizations, and data systems managers which can be filled by university partners in an occupational State Based Surveillance system.
- Occupational and non-work-related injury surveillance can be easily integrated and can provide a holistic picture of health risks to working adults; it can also further methodologic work that benefits both general and occupational injury epidemiology

Section 1

Significant (Key) Findings

1. Enhance use of Federal data sources and non-traditional state data sources. IOSP utilized Federal and State data sources for reports, publications, and policy-oriented testimony. Data sources include: 1) BLS SOII, Current Population Survey; Quarterly Census of Employment and Wages; 2) Bureau of Census 2000 and 2010 Census; American Community Survey; 3) Illinois Trauma Registry; 4) Illinois Hospital Discharges; 5) Illinois Outpatient Visits (emergency room visits; came online in 2013, starting with 2010 data); 6) IWCC First Reports of Injury and Claims; 7) Illinois Poison Center calls. These data sources were used to produce 14 peer-reviewed publications, 12 conference presentations, 8 published reports, 9 fact sheets, 5 industry spotlights, and 14 Hazard Datasheets on Occupation.

2. Strengthen collaborations between researchers, state agencies, businesses, unions, and non-profits to promote awareness of occupational health issues and actions that address problems identified through surveillance. Collaborative work developed among the Illinois Central Management Services, Illinois Department of Labor, Illinois Workers' Compensation Commission, Illinois Department of Public Health, the Chicago Workers Collaborative, Region 5 OSHA, Illinois OSHA, the new Illinois Governor's office, three workers' centers (Chicago Workers' Collaborative, Warehouse Workers for Justice, Latino Union), one workers' center network and one migrant service organization (Community Health Partnership of Illinois). These led to publication of 2 collaborative reports; requests to provide 3 testimonies at legislative hearings; and collaborative submission of 9 grant proposals (3 funded, 2 pending, 4 not funded). Workers' Center partners became connected with governmental agencies and now communicate directly with them; state workers' compensation personnel now communicate directly with OSHA. University investigators in IOSP have been contracted for surveillance services by a county health department and by IWCC. University investigators have conducted specific studies for community partners. IOSP collaborators submitted a renewal application and were awarded another 5 years of funding in the NIOSH State Based Surveillance program.

3. Enhance occupational health surveillance methods. The following methods have been used and published in the peer reviewed literature: 1) robust regression for analyzing workers' compensation costs; 2) linkage of cases across multiple data sources; 3) exploration of geographic information systems in occupational health surveillance; 4) evaluation of injury severity scoring. These studies enhanced the evidence base of occupational health and described methodologic protocols that can be used by other occupational surveillance investigators. IOSP is working with IWCC to update Illinois First Reports of Injury; this harmonizes data fields with national standards and establishes an electronic reporting system (work completed and beta tested; should go online in 2016)

4. Disseminate results to stakeholders who can use them for targeted prevention activities. In the first five year period, IOSP work resulted in 14 peer-reviewed publications, 12 conference presentations, 9 grant proposals (3 funded, 2 pending, 4 not funded), establishment of a website (illinoisinjuryprevention.org), 8 published reports, 7 testimonies or press releases, 9 fact sheets, 5 industry spotlights, and 14 Hazard Datasheets on Occupation. It contributed 196 documents to the NIOSH State Based Surveillance Clearinghouse (http://wwwn.cdc.gov/niosh-survapps/statedocs/Documents.aspx?t=SIL&p=&s=). These documents include items produced by partners collaboratively and separately over the 5-year period.

5. Continuously evaluate, study and update the surveillance system as results become available, as stronger links are made with stakeholders, and as other states demonstrate innovative methods. By the

end of the five year period, we established metrics for continuous evaluation, study and update of IOSP. These metrics provide evidence of collaboration and growing partnership; they also provide evidence of the advancement of surveillance methods and activities; and they point IOSP in a direction for the next steps.

Translation of Findings

The research program of the Illinois Occupational Surveillance Program seeks to describe WRII, detect hazardous working conditions, elucidate occupational health inequities, examine short and long-term consequences of WRII, explore methodologic areas that can lead to better research, and provide surveillance data to "those who need to know," namely, employers, workers, worker advocates, and governmental agencies. The findings that point to a need for specific interventions are: 1) There are inequities in workers' compensation payments to Hispanic and African American workers, compared to whites; 2)There are inequities in occupational illness and injury by race and ethnicity; 3) Workers' compensation data sources can be improved in completeness and accuracy; 4) Traumatic occupational injuries cluster by home zip code and are predictable based on demographic features of communities; 5) The BLS SOII undercounts amputation injuries; 6) Coding expertise developed by investigators in this project can be applied to other surveillance coding systems; 7) Amputations and traumatic injuries are more severe and repeated in public sector, temporary services, and food manufacturing workers; 8) Direct reporting of trauma hospitalizations and workers' compensation reports to OSHA would facilitate enforcement efforts; 9) Surveillance research can be used to inform intervention practices.

Outcomes/Impact

Potential outcomes. The major potential outcome of the IOSP work is a robust occupational surveillance system in a state that is tied to preventive action and that: 1) promotes "occupational health in all"; 2) reduces occupational illness and injury; 3) continuously incorporates new stakeholders; 4) is recognized and utilized for its expertise; 5) provides a training ground for community members and for the next generation of occupational/public health practitioners.

Intermediate outcomes. 1) Community based organizations (CBOs) that reach out to workers have requested and used information provided by surveillance reports to conduct training of workers and health promoters. 2) CBOs have used IOSP as a hub for engaging OSHA and other stakeholders in specific health and safety intervention efforts. 3) IOSP members have been solicited to provide expertise through testimony, work groups, research projects, news interviews, and training; 4) Several press releases and news reports have disseminated findings and expertise from IOSP work. The impact of this work has not been directly ascertained.

End outcomes. 1) Legislation to protect workers in the temporary services industry in the State of California used a policy analysis conducted by an IOSP academic partner and students as one of its primary appendices; legislation was passed in 2015; 2) A more inclusive Intergovernmental Agreement between UIC (IOSP researchers, bona fide agent) and the Illinois Department of Public Health; 3) A contract between UIC (IOSP researchers) and the Illinois Workers Compensation Commission to convert FROIs to the version 3 EDI format of IAIABC and to establish a computer upload system. The system has been developed and beta tested by a single large vendor. It will be ready for statewide use in 2016; 4) Nine grant proposals have been written; 3 funded, 2 pending, 4 not funded. These further the work of IOSP to prevent WRIIs; 5) New research methods to improve occupational health surveillance are published and available for application by other researchers; 6) The ILO compensable occupational illness list is published with input from IOSP. This is disseminated internationally and used by many governments in their workers' compensation systems; 7) IOSP investigators have provided evidence for occupational illness case definitions to be used in WHO's ICD11.

Section 2
Scientific Report

BACKGROUND

Occupational Surveillance

Epidemiological surveillance is the systematic collection, analysis and dissemination of health data for planning, implementing, and evaluating public health programs. Occupational surveillance focuses on monitoring the health of working populations and exposure hazards in the workplace (Halperin & Frazier, 1985). The four essential components of an occupational surveillance system include: 1) gathering information on adverse health events and exposure circumstances; 2) distilling and analyzing the data; 3) disseminating information to interested parties; 4) intervening on the basis of the evidence provided by the data to alter the factors that produced the hazards and adverse health outcomes; and 5) evaluating these efforts.

How can occupational surveillance be used? It enables public health officials, businesses, researchers, enforcers, worker advocates, and other stakeholders to: 1) become familiar with the magnitude and distribution of occupational illnesses and injuries; 2) monitor trends over time; 3) identify emerging injury and exposure problems; 4) flag specific cases or situations for follow-up investigations; 5) set intervention priorities; and 6) evaluate intervention activities.

Employment in Illinois

Illinois is the 5th largest state in the US, with over 6.5 million people employed in every economic sector, including the most hazardous (BLS, 2012; http://www.bls.gov/opub/gp/pdf/gp12_14.pdf, p.7; BLS 2012b; http://www.bls.gov/emp/ep_table_201.htm; BLS 2014 http://www.bls.gov/eag/eag.il.htm).

Table 1. Illinois employees by economic sector*

Economic Sector	Number of employees	Proportion of total
Trade, Transportation, and Utilities	1,154,800	19.2%
Professional & Business Services	905,400	15.0%
Education & Health Services	879,700	14.6%
Government	830,000	13.8%
Manufacturing	574,800	9.5%
Leisure & Hospitality	551,600	9.2%
Financial Activities	368,600	6.1%
Other Services	250,800	4.2%
Construction	191,600	3.2%
Agriculture, Forestry, Fishing**	107,300	1.8%
Information	98,200	1.6%
Mining and Logging	9,700	0.2%

*Non-farm employment from USBLS; http://www.bls.gov/eag/eag.il.htm
**Farm employment, NASS: http://www.agcensus.usda.gov/Publications/2012/Full_Report/Volume_1,_Chapter_1_State_Level/Illinois/st17_1_055_055.pdf
**Farm employment does not include migrant and seasonal farm workers; may not include family members employed on farms

200,000 Illinois residents are injured at work each year. In Illinois, the number and variety of worker demographics, injury types, and sectors allows for robust and stable estimates of work related illness, injury, and fatality, a great potential to detect emerging hazards and sentinel health events, the possibility to conduct analyses with high statistical power, and the potential to generalize findings to other states.

Surveillance Databases

The Bureau of Labor Statistics conducts the official occupational surveillance system in the US. BLS collects data on workplace fatalities in its Census of Fatal Occupational Injuries (CFOI). BLS also conducts the annual Survey of Occupational illnesses and Injuries (SOII). Through SOII, the BLS estimates the number and rate of nonfatal injuries and illnesses by industry and state; for selected cases, details are provided regarding worker demographics and the circumstances surrounding the injury. SOII data are based on a stratified sample, and the system is designed to be generalizable to the workforce, as a whole. There have been a number of studies demonstrating that there is an undercount by our national surveillance system when compared to various state

systems. Some of the reasons are that workers fear retaliation for reporting, employers are unaware of reporting requirements, definitions of workplace injury varies, there is sometimes difficulty determining whether an injury occurred at work or is work-related, there are disputes of responsibility, health care providers may not recognize the relationship between work and illness, and others (Azaroff, 2002); when these issues are at play, cases simply do not get captured. Additionally, SOII provides a description of only a segment of the work-related illnesses and injuries (WRIIs) in the US; part of the "undercount" is due to specific exclusions (eg, public sector employees), to soliciting reports at the establishment level and not at individual sites in a company, the fact that only OSHA recordable cases get reported, and other issues.

There are many databases collected by the states for a variety of purposes that could be used for occupational surveillance. The following table lists databases that either are, or could be used, for occupational surveillance, nationally.

Database	Agency in Charge	Sources of Data	Features and Comments
Census of Fatal Occupational Injuries in Illinois (CFOI)	IDPH (Epidemiology) with US DOL Bureau of Labor Statistics	Death certificates, WC claims, OSHA 300 logs, newspaper reports	Requires 2 sources to corroborate a case. 1992-2002 used SIC and Census occupational coding. 2003 & above use NAICS and SOC.
Survey of Occupational Illnesses & Injuries (SOII)	IDPH (Epidemiology) with US Bureau of Labor Statistics	Response to random BLS survey of 6,000 companies and governmental agencies	Farms with less than eleven full time employees are not part of the survey. All industrial sectors are in the survey & is made up of large, medium and small companies. The response rate of this sample survey is above 90%.
Adult Blood Lead Registry (ABLR)	IDPH (Epidemiology)	Labs certified by OSHA and includes all state based labs	Adult blood lead levels $\geq$ 40 reported to OSHA. Have identified companies and SIC codes for these industries. Using NAICS codes from 2008 forward.
Occupational Disease Registry	IDPH (Epidemiology)	ODR is made up of the CFOI, ABLR, SOII	Annual report of CFOI and SOII. ABLR is reported in the Illinois Health and Hazardous Substances Registry report. CFOI and SOII also reported by BLS
Illinois Trauma Registry	IDPH (EMS)	IL Level 1, 2 trauma units	Has variable for "work related;" has "payer source" (=workers compensation); has place of injury (=industrial place). Work-related may be under-reported.
Prehospital (ambulance run) database	IDPH (EMS)	Every ambulance run is reported	Does not have variable for work-related, but does have location and address of injury occurrence
Death Certificates	IDPH (Vital Records)	Physician/funeral home Local Registrar	Last job may not be most significant job. Informant may not be knowledgeable of decedent's job.
Cancer Registry	IDPH (Epidemiology) with support by CDC	All hospitals, ambulatory treatment center, radiation therapy centers and path labs in Illinois. Also have data exchange with other	Very complete and has been certified as the Gold Standard Registry by NAACCR; could look for occupational cancers like mesothelioma. However, data elements on occupation and

		states.	industry are very incomplete
Hospital Discharges	IDPH (Center for Health Statistics)	Hospitals report through IL Hosp Assn; dataset comes to IDPH from IHA	Very comprehensive. However, the information available is only about discharge—difficult to determine multiple hospitalizations for same person. No occupational data field.
Workplace Inspections	IL Department of Labor	Workplace investigations	Small number of workplaces; in-depth investigation; not in a searchable database
Workers Compensation First "accident" Reports	Illinois Workers Compensation Commission (IWCC)	First report of injury by employer	Only 50% computerized; remainder on paper; 100,000 per year; supposed to be made after 3 days lost time, but variable
Workers Compensation Claims	IWCC	Claims made by injured workers	60,000 per year. Database available and hard copies of files available
Toxic Exposure Surveillance System	Illinois Poison Center (IPC)	Cases called in by individuals, doctors, employers, others	In-depth, telephone investigations; could be used for occupational sentinels, like pesticide poisoning; currently uploaded to national database and not reported for Illinois; there is a pesticide questionnaire that could be implemented in Illinois
Occupational Medical Records	Stroger Occ Med Clinic, UIC OM Clinic, private clinic networks (eg, 5-clinic migrant network) around the State	Individual clinic visits; data computerized at UIC	Protected by HIPAA; not centralized in Illinois
Integrated Management Investigation System	OSHA	Workplace fatalities and investigations	Excludes transportation fatalities, govt workplaces, agriculture. In-depth investigations. No follow up on deaths occurring from heart attacks or diabetic distress. Available by request.
National Agricultural Statistics Service	USDA	Farming statistics—denominator data re: farming operations	Possible to get more detailed denominator data by special request
Crash Outcomes Data Evaluation System (CODES)	IDPH and IDOT	Traffic crash reports, hospital discharges, EMS records (pre-hospital ambulance runs, trauma registry), death certificates	Transportation crashes are greatest source of occupational fatality. Should be required to have a "work-related" variable and race. Currently, work is not considered. Has not been analyzed in Illinois
FACE	CDC/NIOSH	In depth investigation of	Exists in some states, but not Illinois

		workplaces post event	
National Electronic Injury Surveillance System (NEISS)	CDC/NCIPC/CPSC/ NIOSH	In 2000 began to report ER visits of occupational causes; samples 100 hospitals around the country	Illinois does not participate as of August 2009
Integrated Management Investigation System	Mine Safety & Health Administration	Mine fatalities and injuries	Could be accessed to describe mines in Downstate Illinois; 23 fatalities in 2008; cases appear in BLS CFOI, also
Fatalities from Violence	IL Medical Examiner Police CFOI	In depth information about crime, not workplace	Limited access and availability of information related to work
Migrant farm worker clinic database	Community Health Partnership of Illinois	Computerized medical records of workers and their families	Clinic visits by migrant farm workers and their families to 5 clinics in Northern Illinois. HIPAA protected. Would need to construct interface or conduct chart reviews
Pesticide spills	IEMA	Self reporting by companies	Report the spill but do not state if employees were injured
Employment Data	US Bureau of Labor Statistics Illinois Dept of Employment Security	ES 202 data from U. S. Bureau of Labor	Monthly and annualized numbers available for various industrial sectors
Integrated Management Investigation System	OSHA – Region 5	Workplace fatalities	Excludes transportation fatalities, govt workplaces, agriculture. In-depth investigations. No follow up on deaths occurring from heart attacks or diabetic distress

SPECIFIC AIMS

Specific aims of the Illinois Occupational Surveillance Program, over its 5-year funding cycle, were to:

- enhance use of Federal and state data sources;
- strengthen collaborations between researchers, state agencies, businesses, unions, and non-profits to promote awareness of occupational health issues and actions that address problems identified through surveillance;
- conduct analyses of individual surveillance databases, linked records across two more databases, and data that is aggregated from national repositories to better inform the injury/illness numbers, rates, and trends in terms of risk factors, severity, resources used, short and long-term outcomes, and cost;
- disseminate results to stakeholders who can use them for targeted prevention activities;
- continuously evaluate, study and update the surveillance system as results become available, stronger links are made with stakeholders, and other states demonstrate innovative methods.

METHODS
To establish a dynamic occupational surveillance program in Illinois, our goals were to:

1) Assemble, analyze, and report occupational surveillance results
Based on our relationships with state agencies, as described above, we gathered the 19 Occupational Health Indicators on a yearly basis and wrote summary reports at two different points for dissemination throughout the state and to other state-based programs. These reports interpret findings in terms of the limitations of data collection and include narrative information on trends, emerging issues, high-risk occupations, industries and work populations. They focus on issues that could be used to inform priority setting for both the State of Illinois, and for NORA sector programs.

Our group is particularly interested in acute injury. We therefore utilized non-traditional sources of data---Trauma Registry and Prehospital databases—to enhance our understanding of the circumstances and the consequences of occupational injury. We continually shared surveillance results with interest groups within and outside of occupational health.

We have conducted many projects to link cases across several databases—Trauma Registry, Hospital Discharge, EMS Prehospital, and Workers Compensation Claims. Our intent was to explore the issue of undercount/case capture; we also sought to establish a large database that has a wide range of variables that include exposure circumstances, adverse health events, injury severity, clinical management, functional impairment, and cost. This allowed us to conduct more complex, multivariable analyses using this dataset, which is newly formed through data linkage procedures.

2) Identify and Interact with State Partners
We established a stakeholders group (Advisory Board) to develop a dynamic occupational surveillance program in Illinois that: guides informative descriptive studies as well as more rigorous and complex research; feeds new knowledge back to professionals in training, state agencies, non-profits, and other stakeholders in the State and nationally; sets priorities for intervention that are based on surveillance results, feasibility of interventions, and cost; evaluates and interprets results of research and intervention programs; and suggests creative ways of widely disseminating results.

In order to enhance use of Federal and State-level public health data, we continued to work with the Illinois Department of Public Health, Office of Policy, Planning and Statistics in the Division of Epidemiologic Studies to foster collaborative and enhanced use of the databases they manage. These include the BLS CFOI, BLS SOII, and Adult Blood Lead Registry. It has not been necessary to access the Cancer Registry since we are able to obtain Malignant Mesothelioma cases online. In addition, we are working with the IDPH Office of Preparedness and Response and have received the Trauma Registry and Prehospital databases to conduct occupational surveillance research using their databases.

We worked directly with the **Illinois Workers Compensation Commission** on cleaning and using their databases for the purpose of public health surveillance and prevention. We have identified several issues that would enhance surveillance utilizing Claims and First Reports of Injury—namely, creation of a web-based reporting form for First Reports of Injury, and eliminating current electronic uploads and mailed-in hard copies. This would require a rulemaking change in the State. IWCC has been integral in helping us understand collection issues and interpretation of our results, using their databases. IWCC is an integral part of this partnership.

We worked with the **Illinois Poison Center** to examine specific issues of interest—pesticide poisoning and developing “real time surveillance.” Although pesticide poisoning is the only occupational poisoning listed in the CSTE OH Indicators, it is possible to utilize this database to assess other occupational poisonings.

We worked with one of the four **OSHA** area offices in the state on issues related to traumatic injury among construction workers and amputations across employment sectors.

We worked with four **Workers' Centers** and one workers' center network organization in Chicago, as well as one **migrant health service organization** to inject health and safety training and advocacy into their agendas.

3) **Prepare an Annual Report**
We prepared a report of our accomplishments and the impact of our surveillance program, along with lessons learned, in continuing applications to NIOSH. This was intended to include at least the following parameters: number of students trained, number of professionals trained, qualitative description of our activities, OH Indicators results, status of our website, number of manuscripts submitted for publication, updated list of stakeholders, description of stakeholders meetings, description of statewide legislation, description of educational materials, abstracts of presentations.

4) **Delineate Objectives and Strategies to Enhance the Program**
As individual stakeholders coalesced into a group over time, the goal was to refine objectives and strategies of the program. We convened stakeholders at the beginning of the project, and annually to review data we have analyzed (both the research and the straight surveillance results) and to brainstorm a research and an intervention agenda.

RESULTS

- **A tight collaboration between university investigators, federal and state agencies, and community groups facilitates a productive and robust occupational health surveillance system that can tackle prevention focused activities**

The major outcome of the first five years of IOSP is a partnership among occupational safety and health stakeholders in Illinois to prevent and control work-related injury and illness in the State. Collaborative work with state agencies, employers, workers, and worker advocates has led to identification of IOSP as a hub of OSH activity in Illinois. Strong collaborations developed between researchers, governmental agencies, businesses, and worker advocacy organizations to promote awareness of occupational health issues and actions that address problems identified through surveillance. These partners include Illinois Central Management Services, Illinois Department of Labor, Illinois Workers' Compensation Commission, Illinois Department of Public Health, the Chicago Workers Collaborative, Region 5 OSHA, the new Illinois Governor's office, other investigators, three workers' centers, and one migrant service organization. There were two major reports published by UIC, IDPH, and IWCC on occupational health indicator trends in the State. Collaborative work on this project led to 9 publications in the realm of WRII, 5 publications in general injury epidemiology, 12 conference presentations, 9 grant proposals (3 funded, 2 pending, 4 not funded), establishment of a website, 8 published reports, 7 testimonies or press releases, 9 fact sheets, 5 industry spotlight bulletins, and 14 Hazard Datasheets on Occupation.

Stakeholders assembled for 3 separate "think tank" activities on the following topics:
1) Ethical issues related to direct reporting of severe occupational injuries from trauma centers to OSHA
2) How to address the high number of amputation injuries in Illinois
3) How to prevent injuries in the temporary employment services industry (ie, "temp" labor)

These led to collaborative submission of grant proposals, providing sentinel workers' compensation injury data directly to OSHA. Workers' Comp (IWCC) personnel met with OSHA to gather information about a rogue employer. Investigators were interviewed for feature pieces on radio programs and also recruited to testify in three different legislative hearings (2010, 2015, 2015) related to workers' compensation in Illinois. NIOSH State Based Surveillance funding was awarded for a second 5-year period as a result of collaborative application for funding.

- **CSTE Occupational Health Indicators can be assembled from many data sources, state agencies, and data managers and provided to NIOSH on an annual basis**

Annual reports were provided to NIOSH and reside on the NIOSH SBS website. We also published summary bulletins in collaboration with IDPH and IWCC to report and explain indicator numbers, rates, and trends over time. These can be found at illinoisinjuryprevention.org.

- **Methods used in other epidemiologic research can be brought to bear in the realm of occupational surveillance**

Data Linkage and integrating publicly available datasets

Amputations in Illinois. By linking cases across three databases (trauma registry, workers' compensation claims, hospital discharge) over an 8 year period, we were able to demonstrate a much higher number of amputation injuries in Illinois than what was captured by the BLS Annual Survey. We found that public sector, temporary services, and food industry employers had the worst injuries and were repeat offenders. We also were able to recommend a weighting change to BLS, based on our findings.

Workers' Compensation (WC) Payouts. There is an inequity in payment between African Americans and Hispanics (lower) compared to whites, even after controlling for employment variables (linkage of workers compensation and trauma registry; WC does not capture race/ethnicity, but trauma registry does).

Disparities in post-fall rehabilitation. Whites are more likely than African Americans and Hispanics to go to a skilled nursing facility for rehabilitation following a traumatic fall injury (linkage of hospital discharge with trauma registry)

Geographic Information Systems

Clustering of traumatic occupational injuries by home zipcode. Using the social-ecological model, we hypothesized that the home residences of injured workers would be clustered predictably and geographically. Health care and publicly available datasets were linked by home zip codes of traumatically injured workers in Illinois from 2000 to 2009. We calculated numbers and rates of injuries, determined the spatial relationships, and developed 3 models. RESULTS: Among the 23,200 occupational injuries, 80% of cases were located in 20% of zip codes and clustered in 10 locations. After component analysis, numbers and clusters of injuries correlated directly with immigrants; injury rates inversely correlated with urban poverty. CONCLUSIONS: Traumatic occupational injuries clustered spatially by home location of the affected workers and in a predictable way. This puts an inequitable burden on communities and provides evidence for the possible value of community-based interventions for prevention of occupational injuries. Work should be included in health disparities research. Stakeholders should determine whether and how to intervene at the community level to prevent occupational injuries.

Injury Severity Coding

Injury Severity Score vs. Trauma Mortality Prediction Model. Performance benchmarking requires accurate measurement of injury severity. Despite its shortcomings, the Injury Severity Score (ISS) remains the industry standard 40 years after its creation. A new severity measure, the Trauma Mortality Prediction Model (TMPM), uses either the Abbreviated Injury Scale (AIS) or DRG International Classification of Diseases-9th Rev. (ICD-9) lexicons and may better quantify injury severity compared with ISS. We compared the performance of TMPM with ISS and other measures of injury severity in a single cohort of patients. 337,359 patient records were included. Five injury severity measures (ISS, maximum AIS score, New Injury Severity Score [NISS], ICD-9-

Based Injury Severity Score [ICISS], TMPM) were computed using either the AIS or ICD-9 codes. These measures were compared for discrimination (area under the receiver operating characteristic curve), an estimate of proximity to a model that perfectly predicts the outcome (Akaike information criterion), and model calibration curves. RESULTS: TMPM demonstrated superior receiver operating characteristic curve, Akaike information criterion, and calibration using either the AIS or ICD-9 lexicons. Calibration plots demonstrate the monotonic characteristics of the TMPM models contrasted by the non-monotonic features of the other prediction models. CONCLUSION: Severity measures were more accurate with the AIS lexicon rather than ICD-9. NISS proved superior to ISS in either lexicon. Since NISS is simpler to compute, it should replace ISS when a quick estimate of injury severity is required for AIS-coded injuries. Calibration curves suggest that the non-monotonic nature of ISS may undermine its performance. TMPM demonstrated superior overall mortality prediction compared with all other models including ISS whether the AIS or ICD-9 lexicons were used. Because TMPM provides an absolute probability of death, it may allow clinicians to communicate more precisely with one another and with patients and families.

- **Workers' compensation provides a rich source of data for occupational surveillance**

Workers' compensation data captures WRIIs that are not captured in other datasets because of reporting requirements and barriers to reporting; these are limitations that apply to all surveillance systems. Additionally, workers' compensation data contains variables that are not available elsewhere: the "claims" database contains economic indicators, more detail on time lost, narratives of cases, and descriptors of longer term outcomes. Illinois workers' compensation cases have been linked across other databases, as described above.

One IOSP study using workers' compensation data demonstrated a disparity in payouts by race and ethnicity, after controlling for other demographic features and injury severity. News reports in the State decried this finding. These results have been used as evidence to inform further investigations related to occupational health inequities, as serves as "preliminary data" for grant proposals.

Investigators have been able to collaborate with the "Coal Miners' Lung Disease" program in Illinois, which has coal mines in the southern part of the State. Accessing, linking, and analyzing workers' compensation data enhances MSHA, OSHA, and BLS statistics on WRIIs among miners. This work has led to publication and is informing public health practice in the State and nationally.

IOSP's work with workers' compensation data has led to tight links and additional work with the Illinois Workers' Compensation Commission. Dr. Lee Friedman, co-investigator, was contracted to upgrade the First Reports of Injury reporting system in Illinois. He has upgraded FROIs to IAIABC EDI v.3 standards and established a batch upload system in the State. One of the largest insurance vendors has successfully used this system and it is ready to be rolled out in 2016.

Use of workers' compensation data in this project led to invitations: by NIOSH to participate in Workers' Compensation meetings and the new Center for Workers' Compensation Studies; by IWCC to present to workers' compensation arbitrators in Illinois; by IWCC to assist with revising data collection and management efforts in the state; by Central Management Services in Illinois to investigate a carpal tunnel syndrome "outbreak" in a Federal prison; by a county health department to conduct a study of trauma utilization in the State as a result of work with Trauma Registry data and trauma centers; by the National Safety Council to evaluate outcomes of the Safe Communities America program.

- **There is a need for occupational surveillance expertise by international bodies, federal and state policymakers, community based organizations, and data systems managers which can be filled by university partners in an occupational State Based Surveillance system**

IOSP partners have been solicited by international bodies (ILO, WHO), state government (CMS, IWCC, IDPH), and community partners (CWC, LU, WWJ) to provide data and to partner on more focused projects of interest to them.

Use of workers' compensation data in this project led to invitations: by NIOSH to participate in Workers' Compensation meetings and the new Center for Workers' Compensation Studies; by IWCC to present to workers' compensation arbitrators in Illinois; by IWCC to assist with revising data collection and management efforts in the state; by Central Management Services in Illinois to investigate a carpal tunnel syndrome "outbreak" in a Federal prison.

Expertise with, and access to, health related data led to a contract from a county health department to conduct a study of trauma utilization in the State as a result of work with Trauma Registry data and trauma centers; by the National Safety Council to evaluate outcomes of the Safe Communities America program; by the Illinois Poison Center to assist with their database and with grant writing for that organization.

Experience in coding led to an invitation from the World Health Organization to participate in established Occupational Diseases coding criteria (definitions of occupational diseases) for the International Classification of Disease 11th edition (ICD 11). It also led to an invitation from the International Labor Organization to revise the List of Occupational Diseases that ILO provides for governments to use in their workers' compensation systems.

- **Occupational and non-work-related injury surveillance can be easily integrated and can provide a holistic picture of health risks to working adults; it can also further methodologic work that benefits both general and occupational injury epidemiology**

Because of our access and use of a variety of Federal and State databases that arose out of NIOSH funding to establish IOSP, we have been able to conduct general (non-occupational) injury surveillance in the State. This led to partnerships with Children's Hospital in Chicago, with the Childhood Lead Registry, and with the Injury Coordinator at IDPH. We have helped to create links within IDPH among individuals/departments that saw their work as disparate, and now communicate around injury prevention. Some of the methodologic work to look at injury severity, GIS, and data linkage can equally apply to occupational and general injury epidemiology. Efforts to frame worker health and safety in a more holistic fashion (e.g., NIOSH's Total Worker Health program), and also the need to garner resources to support occupational health and safety research make the framing of "occupational health in all" extremely important. Though funds from NIOSH for IOSP have not been used directly for this type of research, the establishment of IOSP as our state-based surveillance program has allowed us to leverage other resources, both internal and external, to foster development of general injury epidemiology in our School of Public Health, and also in the State of Illinois.

PROGRAM EVALUATION

By the end of the five year period, we established metrics for continuous evaluation, study and update of IOSP. These metrics provide evidence of collaboration and growing partnership; they also provide evidence of the advancement of surveillance methods and activities.

Meetings among various sub-groups were set at regular intervals. Based on discussions and plans, the execution/completion of planned activities was monitored. Reminders were provided, as needed, and updates were added to agendas of the subsequent meetings. The groups that met were: 1) IOSP management core (co-PIs and coordinator (weekly); 2) all co-Investigators (monthly); 2) IOSP core & NIOSH (annual reports, final report); 3) IOSP & NIOSH & other SBS awardees: (annual meeting in December); 4) IOSP & CSTE & other

SBS awardees (2 meetings/year, December & June; intermittent conference calls); 5) investigators and IDPH (biannual); 6) University investigators and IWCC (quarterly); 7) Co-Is and IDOL (annually); 7) IOSP Advisory Board (annually); Co-Is and community organizations (bi-monthly).

Other metrics include assessment of intergovernmental agreements (timeliness, qualitative assessment of process and what is included/excluded); joint publications, grant proposals, activities (number, quality of journals, use of findings, number and type of practical application of findings, consistency of activities); sub-contracts among partners for projects (number and quality); evidence of advancing surveillance activities and methods (peer reviewed publications; reports; service on academic, policy-oriented think-tanks; service on practice-oriented work groups; contracts to re-construct or re-organize a surveillance system).

These metrics will be followed and expanded as IOSP moves forward into second 5-year period.

OUTPUTS

Publications

1. Forst L, Masters D, Zanoni J, Avila S, Chaidez F, Miller A. Medical interpretation for immigrant workers. New Solut 2012;22(1):37-50. doi: 10.2190/NS.22.1.d.
2. Friedman L, Krupczak C, Brandt-Rauf S, Forst L. Occupational amputations in Illinois 2000-2007: BLS vs. data linkage of trauma registry, hospital discharge, workers compensation databases and OSHA citations. Injury 2013 May;44(5):667-73. doi: 0.1016/j.injury.2012.01.007. Epub 2012 Feb 24.
3. Friedman LS, Ruestow P, Forst L. Analysis of ethnic disparities in workers' compensation claims using data linkage. J Occup Environ Med. 2012 Oct;54(10):1246-52. doi: 10.1097/JOM.0b013e31825a34d1.
4. Baron SL, Beard S, Davis LK, Delp L, Forst L, Kidd-Taylor A, Liebman AK, Linnan L, Punnett L, Welch LS. Promoting integrated approaches to reducing health inequities among low-income workers: Applying a social ecological framework. Am J Ind Med 2013 Mar 26. doi: 10.1002/ajim.22174
5. Ruestow P and Friedman LS. Relationship between acute measures of severity and workers' compensation outcomes. Am J Ind Med 2013 Oct;56(10):1149-56.
6. Cook A, Weddle J, Baker S, Hosmer D, Glance L, Friedman L, Osler T. A comparison of the Injury Severity Score and the Trauma Mortality Prediction Model. J Trauma Acute Care Surg 2014 Jan;76(1):47-52; discussion 52-3. doi: 10.1097/TA.0b013e3182ab0d5d.
7. Friedman LS, Krajewski A, Vannoy E, Allegretti A, Wahl M. The association between U.S. Poison Center assistance and length of stay and hospital charges. Clin Toxicol (Phila) 2014 Mar;52(3):198-206. doi: 10.3109/15563650.2014.892125.
8. Forst L, Friedman L, Chin B; Madigan D. Spatial clustering of occupational injuries in communities. Am J Publ Health 2015 Jul;105(S3):S526-S533
9. Mabila SL, Gracia G, Cohen R, Almberg K, and Friedman LS. Injury and Illness Data for Illinois Mining Industry Employees, 1990 to 2012. J Occ Environ Med. 2015 Epub ahead of print

Note: *the following are general injury surveillance research publications that investigators were able to conduct with the databases that were assembled in the Illinois Occupational Surveillance Program*

1. Friedman LS. Dose--response relationship between in-hospital mortality and alcohol following acute injury. Alcohol 2012 Dec;46(8):769-75. doi: 10.1016/j.alcohol.2012.08.006. Epub 2012 Oct 22.
2. Toomey A, Friedman L. Mortality in cancer patients after a fall-related injury: The impact of cancer spread and type. Injury 2014;45(11):1710-6. doi: 10.1016/j.injury.2014.03.008. Epub 2014 Mar 27.
3. Koopmans JM, Friedman L, Kwon S, Sheehan K. Urban crash-related child pedestrian injury incidence and characteristics associated with injury severity. Accid Anal Prev. 2015 Apr;77:127-36. doi: 10.1016/j.aap.2015.02.005. Epub 2015 Feb 19.

4. Krajewski AK, Friedman LS. Hospital outcomes and economic costs from poisoning cases in Illinois. Clin Toxicol (Phila). 2015 Jun;53(5):433-45. doi: 10.3109/15563650.2015.1030677. Epub 2015 Apr 14.
5. Friedman LS. Complications associated with blood alcohol concentration following injury. Alcohol 2014;48(4):391-400. doi: 10.1016/j.alcohol.2014.01.008. Epub 2014 Apr 24.

Presentations

1. Friedman LS and Forst L. Traumatic Injuries among Workers in Residential Facilities. Conference of the Council of State and Territorial Epidemiologists (2010).
2. Forst L. Occupational Skin Disease in North America. Global Workshop on Occupational Skin Disease. World Health Organization. Geneva, Switzerland. Feb. 2011.
3. Forst L. Invited Speaker. Hazards of Hair Care Products. University of the West Indies, St. Augustine Campus. Trinidad/Tobago. April 2012.
4. Forst L. Invited Speaker. Use of Workers' Compensation Data for Occupational Safety and Health Washington, DC June 19 – 20, 2012
5. Forst L. Occupational Surveillance in Illinois. Presented to the new Director of the Illinois Department of Public Health, March 2013.
6. Forst L. Archiving Data. Presented to Fogarty-funded GEOHub. Kyiv Ukraine. March 2013.
7. Allegretti-Browning A, Friedman L. Occupational Poisonings Using Data Linkage of Poison Center and Hospital Discharge Data. Presented at American Occupational Health Conference, Orlando, May 2013.
8. Forst L, Chin B, Friedman L. Occupational Injuries at the Community Level. Occup Environ Med. 2014 Suppl:A70-1. Presented at EPICOH Chicago, June 2014
9. Gracia G, Forst L. Monitoring Mercury Exposure among Artisanal and Small-Scale Miners: Developing and Evaluating a Surveillance Protocol. Occup Environ Med. 2014 Jun;71 Suppl 1:A105-6. Presented at EPICOH Chicago, June 2014
10. Forst L. Occupational Hazards in the Temporary Services Industry. Council of State and Territorial Epidemiologists. Webinar. February 27, 2015
11. Forst, L. Workers in the Temporary Services Industry 2015. Presented at American Occupational Health Conference. Baltimore. May 2015.
12. Forst L, Schmitz M. Injury and Occupation Coding in a Needs Assessment Mandated by the ACA. National Occupational Injury Research Symposium. WVa, May 2015.

Grant Proposals Submitted

Funded

1. CDC/AAPC. Optimizing Real-Time Surveillance of Poison center Data for Drinking Water-related Exposures. Friedman PI. 2013.
2. CDC/PRC: Illinois Prevention Research Center. Special Interest Project. Workplace Health Research Network. Health Promotion and Protection for Low-wage Workers. Forst Co-I. 2013-8.
3. NIOSH: Illinois Occupational Surveillance Program 2 +Adult Blood Lead Registry. Forst & Friedman Co-PIs. Funded for 5 years (2015-2020).

Not funded

1. NIMHD: R01. Workers' Compensation and Working Poor. Forst, PI.
2. Illinois ERC Pilot Project Research Training. Illinois Education and Research Center: Workers' Compensation and Working Poor. Forst, Co-I.
3. NIOSH: Putting Workers' Compensation Data to Work in Illinois. 2015-2018. Forst & Friedman Co-PIs.
4. Home Depot foundation. PPE for Temp Workers 2012. Forst and Bell Co-PIs.

Pending review at time of this report

1. Institute of Medicine of Chicago: Workers' Compensation and the Working Poor. Forst PI.
2. NIOSH: Putting Workers' Compensation Data to Work in Illinois. 2016-2019. Forst & Friedman Co-PIs.

Reports

1. Occupational Health Indicators, annually, 2010-2015. Reported to NIOSH, State Based Surveillance
2. Occupational Health Indicators in Illinois 1998-2011. Published by IDPH, IWCC, UIC in partnership under IOSP
3. Annual Report to the Illinois Workers Compensation Commission for calendar years 2010-2015

4. 196 separate documents/reports uploaded to NIOSH Clearinghouse site http://wwwn.cdc.gov/niosh-survapps/statedocs/
5. Occupational Health Indicators in the WHO's ICD 11. Participant (Forst), Working Group, Geneva. Ongoing
6. ILO List of Occupational Diseases for International Labor Organization, Working Group (Forst), Geneva. Ongoing
7. Occupational Hazards at Menard Correctional Facility: Report to Illinois Central Management Services on a study of excess upper extremity conditions among correctional officers. September, 2012.
8. Forst L, Editor, "Recording and Notification of Occupational Accidents and Diseases." International Labor Organization, Geneva, 2013. http://www.ilo.org/safework/info/publications/WCMS_210950/lang--en/index.htm

Press Releases/Interviews/Testimonies

1. Forst, L. Ninety-eight minutes. Temp Workers. WBEZ (NPR station in Chicago) http://www.wbez.org/news/98-minutes-radio-story-104504. Journalist: Chip Mitchell
2. Forst L. Temp Worker Injuries. December, 2012. Propublica reporter, Rick Morris.
3. Forst, L., Lee Friedman, Brian Chin, Dana Madigan. Spatial Clustering of Occupational Injuries in Communities. American Journal of Public Health: July 2015, Vol. 105, No. S3, pp. S526-S533. http://ajph.aphapublications.org/doi/abs/10.2105/AJPH.2015.302595
4. Forst L. Interviewed for article on Temp labor. http://www.propublica.org/article/temporary-work-lasting-harm
5. Forst L. Interviewed for Public Health Minute. https://soundcloud.com/publichealthminute (recorded; to be produced and made available in October 2015)
6. Batra S, Forst L. Testimony on Workers' Compensation before the Illinois State Legislature, May 2015. View on left hand side, bottom of the page at http://illinoisinjuryprevention.org/
7. Forst L. Invited testimony on Workers' Compensation before the Illinois Senate, June 2015. View on left hand side, bottom of the page at http://illinoisinjuryprevention.org/

Website

- Created for this project and are continuously updated: http://illinoisinjuryprevention.org/

Informational Documents created (uploaded to website)

- Hazard Data Sheets on Occupation: 1) airline pilots, 2) artisan miners, 3) childcare workers, 4) cricket players, 5) dishwashers, drummers, 6) elementary education teachers, 7) flight attendants, 8) house cleaners, 9) house keepers, 10) respite workers, 11) road construction workers, 12) soccer players, 13) stevedores, 14) undertakers.
- Fact Sheets: 1) Are workplace injuries going down? 2) Computer vision syndrome, 3) Electrical injuries, 4) Falls, 5) Motor vehicle crashes in work zones, 6) Non-fatal injuries and illnesses, 7) Occupational amputations, 8) Vulnerable workers, 9) Workplace violence.
- Industry Spotlights: 1) Construction, 2) Healthcare, 3) Manufacturing, 4) Transportation, 5) Utilities.

Translation of Findings

The research program of the Illinois Occupational Surveillance Program seeks to describe WRII, detect hazardous working conditions, elucidate occupational health inequities, examine short and long-term consequences of WRII, explore methodologic areas that can lead to better research, and provide surveillance data to "those who need to know," namely, employers, workers, worker advocates, and governmental agencies. The findings that point to a need for specific interventions are:

1) **There are inequities in workers' compensation payments to Hispanic and African American workers, compared to whites:** this should lead to an examination of arbitrated decisions in the State

2) **There are inequities in occupational illness and injury by race and ethnicity:** there is a need for research to more carefully examine "work" as a determinant of health

3) **Workers' compensation data sources are limited in completeness and accuracy.** IOSP investigators are developing an upgraded system for FROIs. This will allow better capture of cases, more complete data, and the ability to conduct research using FROIs as a data source. The new system will harmonize with other states using the most updated FROI version. Illinois will also serve as an example of other states looking to upgrade.
4) **Traumatic occupational injuries cluster by home zip code and are predictable based on demographic features of communities**: communities are a potential venue for worker training; incorporation of work into the Social Determinants of Health model is strengthened
5) **The BLS SOII undercounts amputation injuries**: BLS could adjust its weighting method to better count (generalize) and describe occupational illnesses and injuries
6) **Coding expertise developed by investigators in this project can be applied to other surveillance coding systems**; Forst is working on WHOs ICD 11 as regards coding for occupational surveillance; Forst worked on the ILO list of compensable occupational diseases based on coding; Friedman was invited to upgrade the FROI system for the State of Illinois. IOSP partners should look for other opportunities for examining coding and other basic surveillance issues.
7) **Amputations and traumatic injuries are more severe and repeated in certain employment settings**: OSHA and the Illinois Department of Labor should increase scrutiny to those employers.
8) **Direct reporting of trauma hospitalizations and workers' compensation reports to OSHA would facilitate enforcement efforts**. IOSP has provided workers' compensation data to OSHA. Patient confidentiality laws hinder direct reporting out of trauma centers; this is an issue that needs attention.
9) **Surveillance research informs field work**: IOSP investigators work in partnership with workers' centers to identify specific hazardous workplaces and to provide training to at-risk workers who cannot be reached in their workplaces. One such project has led to OSHA citations of several industries.

Outcomes/Impact

The major outcome of the first five years of IOSP is a partnership among occupational safety and health stakeholders in Illinois to prevent and control work-related injury and illness in the State. Collaborative work with state agencies, employers, workers, and worker advocates has led to identification of IOSP as a hub of OSH activity in Illinois. It should be noted that Illinois has a population of 12.9 million, with over 6 million workers covering all sectors of the economy. IOSP partners have been solicited by international bodies (ILO, WHO), state government (CMS, IWCC, IDPH), and community partners (CWC, LU, WWJ) to provide data and to partner on more focused projects of interest to them.

Surveillance methodology is enhanced by research using secondary data. Recommendations for injury severity scoring came out of one IOSP study. Data linkage, incorporating publicly available demographic data, and geographic information systems methods have been applied and their value in OSH research demonstrated through IOSP outputs.

Many students (10-20 students per year), who will become the next public health workforce in Illinois and other states, have been trained in occupational surveillance through participating in IOSP activities. Many grant proposals are being written to implement interventions where need was identified through IOSP activities.

Potential outcomes
The major potential outcome of the IOSP work is a robust occupational surveillance system in a state that is tied to preventive action, that

- promotes "occupational health in all"
- reduces occupational illness and injury
- continuously incorporates new stakeholders
- is recognized and utilized for its expertise
- provides a training ground for community members and for the next generation of occupational/public health practitioners.

Intermediate outcomes

In iterative fashion, community based organizations that reach out to workers have requested and utilized information provided by surveillance reports to conduct training of workers and health promoters. They have also used IOSP as a hub for engaging OSHA and other stakeholders in specific health and safety intervention efforts. There is now a direct line of communication between community groups and federal and state agencies that no longer requires involvement of the IOSP academicians.

IOSP members have been solicited to provide expertise through testimony, work groups, research projects, news interviews, and training. Legislation around workers' compensation changes in Illinois has had input from IOSP. In 2011, the use of an impairment rating guide became required physicians for providing reports to be used in workers' compensation arbitration; Forst testified on this issue before the state legislature. There is an effort to significantly alter workers' compensation in Illinois; Forst and and Dr. Sumeet Batra, an Occupational Medicine resident (also a NIOSH ERC trainee), have testified in legislative hearings on this topic; outcome is pending.

Several press releases and news reports have disseminated findings and expertise from IOSP work. These are described in the Press Releases/Interviews/Testimonies listed below. The impact of this work has not been directly ascertained.

End outcomes

- Legislation to protect workers in the temporary services industry in the State of California used a policy analysis conducted by an IOSP academic partner and students as one of its primary appendices; legislation was passed in 2015.
- A more inclusive Intergovernmental Agreement between UIC (IOSP researchers, bona fide agent) and the Illinois Department of Public Health.
- A contract between UIC (IOSP researchers) and the Illinois Workers Compensation Commission to convert FROIs to the version 3 EDI format of IAIABC and to establish a computer upload system. The system has been developed and beta tested by a single large vendor. It will be ready for statewide use in 2016.
- Nine grant proposals have been written; 3 funded, 2 pending, 4 not funded. These further the work of occupational surveillance to prevent WRIIs.
- New research methods to improve occupational health surveillance are published and available for application by other researchers.
- The ILO compensable occupational illness list is published with input from IOSP. This is disseminated internationally and used by many governments in their workers' compensation systems.

A detailed list of outcomes follows:

Partnerships

- In year 1, we strengthened collaborations through establishing an advisory board that represents stakeholders to guide informative descriptive and complex analytic studies.
- *Illinois Central Management Services:* In year 3, we were contracted to conduct an epidemiological study and a workplace walkthrough of Menard Correctional Facility.
- *Illinois Department of Labor:* In year 3, we met to discuss health and safety interventions in the public sector and temporary employment agencies.
- *Illinois Workers Compensation Commission:* In year 3, we provided assistance organizing data for State level reporting. In year 4 through year 5, we received a contract to develop a web-based form for First Reports of Injury for Illinois and presented on occupational illness and injury sentinels to the Arbitrators once per year for 3 years.
- *Illinois Department of Public Health*: In year 3, we brought IDPH personnel to the CSTE and SBS meetings; we applied for a CSTE Epidemiology Fellow in partnership with UIC and IDPH in years 2 and 3 (unsuccessful). In year 4, we attended quarterly meetings to improve data sharing between the State Health Department and researchers. IDPH also provided funds for UIC School of Public Health to

review policy related to release of HIPAA protected data. IOSP serves as the model for the value and importance of data release in the State and investigators are actively engaged in studying state legislation to improve data sharing. In year 5, we continued to attend quarterly meeting to improve data sharing. IDPH provided funds for UIC School of Public Health to review policy related to release of HIPAA protected data. IOSP continues to serve as the model for the value and importance of data release.

- *Worker Centers, Chicago Workers Collaborative*: In year 3, we wrote one grant proposal for personal protective equipment to Home Depot Foundation (not funded). We brought personnel from the Illinois Workers Compensation Commission to meet with workers at Latino Union. In year 4, we applied for a NIOSH R01 to conduct surveillance and do a training intervention based on surveillance findings. We also continued annual funding for Occupational Health Internship Program to work with community groups (Workers for Justice, Chicago Workers' Collaborative) that are associated with the Illinois SBS program (IOSP).In years 4 and 5, we brought OHIP interns to Chicago to work with CWC. We also began conducting a series of collaborative projects, including training of workers on health and safety, gathering surveillance data from workers; co-wrote a grant proposal.
- *Region 5 OSHA*: In year four, we met with the Region 5 Director three times. We developed a work plan to help Region 5 OSHA improve their enforcement activities. The program entailed identifying employers with repeated cases of amputations, electrocutions and severe burns. In addition, a corresponding program targeting temporary employment agencies has been developed. We also submitted a comment on the new OSHA recordkeeping rule. In year five, we met with the Region 5 and are developing a work plan for reporting from trauma centers and from workers' compensation reports to Region 5 OSHA to improve their enforcement activities. We were solicited by OSHA Region V for partnership related to reporting as well. We met with the Assistant Secretary of Labor for Occupational Safety and Health (David Michaels) regarding the implementation of the new recordkeeping requirements.
- *Other investigators:* In year 4, we worked to establish two SBS groups to think through the conduct of surveillance related to workers in the Temporary Services Industry and workers engaged in Hydraulic Fracturing. We had one brainstorming in each of the two groups at the last SBS meeting and have had individual calls. UIC also received funding to become a Prevention Research Center. We worked with internal and external collaborators to become a Workplace Health Research Network Collaborating Center, with the primary leadership role. Funding is from CDC. In year five, IOSP investigators were part of the CDC's Workplace Health Research Network, which is a SIP of the UIC Prevention Research Center. We were on working groups with UNC, CUNY, UWashington to collaborate on health promotion projects.
- *Support from new State administration:* In year 5, we submitted a grant proposal (NIOSH: Workers' Compensation) that we received endorsement for from the new Illinois Governor and new appointees to the Illinois Workers' Compensation Commission

Increased credibility among peer reviewers/experts

- Renewed funding of the Illinois SBS Fundamental Program + Lead
- Funded co-investigator of CDC's Prevention Research Center funding of Special Interest Project—Workplace Health Research Network
- Invitation to NIOSH's Workers' Compensation think tank meeting X2
- 6 Solicitations for peer reviewing surveillance-related manuscripts by journals
- 2 solicitation to peer review grant proposals (Ontario, Canada; NIOSH SEP)
- Invitations to speak/talk to the press about low wage workers
- Invitation to present at American College of Occupational and Environmental Medicine annual conference
- Invitation by the International Labor Organization to re-visit criteria for inclusion of occupational disease sentinels in its list of compensable occupational diseases
- Invitation by WHO to provide evidence for definitions of occupational diseases to be used in ICD 11
- Invitation to write a curriculum on occupational health for subsistence gold miners

Advancing research methods related to surveillance

- Purchased a computer with a large hard drive to assemble the following in a data library: BLS SOII dataset from 1992 (its inception) through present, Illinois Trauma Registry from 1995- 2008, EMS Prehospital Database, Hospital Discharge data, and Workers Compensation Claims. We continuously updated this data library throughout the last 5 years
- Increased evidence-directed intervention design relating to gaps in workplace wellness programming related to active commuting (article cited above)
- Use of GIS and data linkage in occupational health: demonstrated the burden of occupational injuries on communities and work as a determinant of health
- Participated on a national work group with the American Association of Poison Control Centers to develop a coding crosswalk between the PCC Poisindex system and ICD-9 and ICD-10 coding Crosswalk was finalized in June 2015. Coding and basis for much of the crosswalk was developed
- Worked with national group of researchers in developing and creating SAS code for new injury severity scale. New scale improves on the ISS (injury severity scale) both statistically and in predicting mortality. SAS code is publicly available to researchers
- Worked with BRFSS administrator and University of Illinois Hospital to incorporate Industry and Occupation into survey tools

Increasing expertise among researchers

Year 1

Mentored the following students to conduct their listed projects:

- Chiping Nieh (PhD candidate): Assembling the OHI indicators for 2008
- Peter Ruestow (PhD candidate): conducting data linkage of all the occupational cases in the Trauma Registry, Work Comp Claims and Hospital Discharge; doing analysis to evaluate ethnic disparities in WC compensation
- Colin Krupczak (MS candidate): linking amputation cases among Illinois databases. Describing amputations in BLS SOII
- Matthew Hornyak (MS Candidate) – Describing workers comp claims among workers in the automotive industry. He won an internal academic award based, in part, on this research
- Alfreda Holloway Beth (PhD Candidate) - injuries to police officers and correctional officers using workers compensation data

Year 2

Mentored the following students to conduct their listed projects:

- Freda Holloway-Beth, PhD Dissertation
- April Toomey, MSc
- Matt Hornyak, MSc
- Abraham Chukwu, Capstone
- Shirley Sheppard, Independent research project with publication

Year 3

Mentored the following students to conduct their listed projects:

- Tran, Molly, MD. OM Resident. Workers comp injuries among health care workers.
- Nobis, Ana, MD, OM Resident. Occupational illnesses and injuries among farmworker youth
- Vu, Lyndsey, MBBS. MPH candidate. Suicides among Asian Americans in the trauma registry
- Krajewski, Allison, PhD candidate. Occupational injuries in the Illinois trauma registry
- Allegretti-Browning, Amy, MD. Occ Med Resident. The value of poison centers input in treatment of occupational injuries.
- Harris, Anthony, MD. Occ Med Resident. Cost of triaging occupational injuries.
- MPH Capstone Projects

- Olaworetan, Elizabeth. MPH Capstone: Occupational injuries in Illinois youth
- Vora, Viraj. MPH Capstone: Occupational facial injuries in the Illinois Trauma Registry
- Targeted research training (TRT) group: This is an activity of the Illinois Education and Research Center. Ten students participated in our TRT group on surveillance in AY 2012-3. We had 10 sessions to conduct a community assessment of the 60612 zipcode in Chicago. We searched online for data on businesses, risk factors, occupational illnesses and injuries, employment, and demographics for this zipcode and completed a community level occupational health assessment. This was a training exercise for students on finding, manipulating, analyzing, and interpreting data related that could be used for occupational surveillance at the community level.

Year 4
Mentored the following students to conduct their listed projects:

- Holloway-Beth, Alfreda. Injuries to law enforcement personnel in Illinois.
- Krajewski, Alison: Worksite hazards and poisoning surveillance in Illinois.
- Chen, Brian. Identifying community level clusters of occupational injuries and illnesses.
- Batra, Sumeet. Motor vehicle crashes among emergency services personnel
- Gordon, Andrew. The impact of emergency bypass on acutely injured workers
- Gracia, Gabriela. An analysis of first reports of injury filed for injured miners in Kentucky
- Mabila-Abduba, Sithembile. A descriptive analysis of injuries and illnesses among Illinois miners
- Ngan, Stephanie. A description of workers' compensation claims filed for injured hospital employees.
- Madigan, Dana. Workers employed in the Temporary Services Agency
- Meyers, Sonya. Occupational Injuries among Women in Illinois
- Vora, Viraj. Facial injuries in the Illinois Trauma Registry
- Three MDs have graduated from the program and are working in Occupational Health careers where they are able to apply knowledge gained during surveillance training; the remainder are still in training.
- One MSc student successfully defended his thesis and graduated. 1 PhD student has successfully defended her dissertation and graduated. (Both students conducted occupational surveillance projects, described above.
- A PhD student (Alfreda Holloway-Beth) won the prestigious Bruton Scholarship which includes a $10,000 award.
- Two MPH students will graduate using these data for their capstone and are applying for jobs in occupational health and safety.

- Targeted research training (TRT) group. In AY 2013-4, students conducted an assessment of hazards faced by hair salon workers. This included a worksite walk-through, interviewing workers, reviewing publicly available data.

Year 5
Mentored the following students to conduct their listed projects:
- Matthew Schmitz, PhD Candidate. Conducted study and submitted manuscripts on NIOCCS methodology.
- Liza Topete, MS Candidate. Surveillance in the plastics and rubber industries.
- Rosalinda Fitts. MPH Candidate. Heat and Cold Related Injuries.
- 25 public health students trained in occupational surveillance methods
- 6 Occupational Medicine residents trained in occupational surveillance

Other
- New assistant professor David Swedler, PhD MPH, collaborating on occupational surveillance work
- New Project Coordinator for IOSP, Alanah Raykovich, MPH
- Three MDs have graduated from the program and are working in Occupational Health careers where they are able to apply knowledge gained during surveillance training; the remainder are still in training.

- Targeted research training (TRT) group: AY 2014-5. How to develop a questionnaire for interviewing workers. Students developed a tool to conduct a survey in Federally Qualified Health Centers for a future project to survey low wage workers.

Cumulative Inclusion Enrollment Report

This report format should NOT be used for collecting data from study participants.

Study Title: Illinois Occupational Surveillance Program

Comments: Secondary data analysis was used; there were no subjects enrolled; estimated 17,500 people included based on occupational cases in the Illinois Trauma Registry for a 7 year period (lagged data was assembled for year prior to the initiation of funding); this is a gross estimate.

Racial Categories	Ethnic Categories									Total
	Not Hispanic or Latino			Hispanic or Latino			Unknown/Not Reported Ethnicity			
	Female	Male	Unknown/ Not Reported	Female	Male	Unknown/ Not Reported	Female	Male	Unknown/ Not Reported	
American Indian/ Alaska Native	0	0	0	0	0	0	0	0	0	0
Asian	32	198	0	0	0	0	0	0	0	230
Native Hawaiian or Other Pacific Islander	0	0	0	0	0	0	0	0	0	0
Black or African American	23	1172	0	0	0	0	0	0	0	1,195
White	2002	12637	0	273	2588	0	0	0	0	17,500
More Than One Race	0	0	0	0	0	0	0	0	0	0
Unknown or Not Reported	0	0	0	0	0	0	0	0	0	0
Total	2,057	14,007	0	273	2,588	0	0	0	0	18,925