NIOSH EXTRAMURAL RESEARCH AND TRAINING PROGRAM

ANNUAL REPORT OF FISCAL YEAR 2018

Prepared by the Office of Extramural Programs
National Institute for Occupational Safety and Health

Centers for Disease Control and Prevention
National Institute for Occupational Safety and Health

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DEPARTMENT OF HEALTH AND HUMAN SERVICES
Centers for Disease Control and Prevention
National Institute for Occupational Safety and Health

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December 2019

FOREWORD

I am pleased to deliver the FY2018 annual report on the National Institute for Occupational Safety and Health (NIOSH) Extramural Research and Training Program. The data in this report reflect the exceptional work of the extramural community of researchers supported by NIOSH and the Office of Extramural Programs.

In this report, we look at how NIOSH invested in our multidisciplinary centers, investigator-initiated research projects, and cooperative research agreements. We also report on our training project grants, state surveillance programs, small business innovation research, and global health initiatives. This report does not include data on the World Trade Center (WTC) Health Program grants program. Information about the WTC Health Program is available on the NIOSH website.

We analyze funding and activity by program area and review extramural research support of NIOSH research priorities and goals. We include links to the NIOSH website throughout the report for direct access to additional data and information. Section IV describes the public health relevance and accomplishments of our varied and multidisciplinary portfolios with program highlights from FY2018.

I would like to acknowledge the work of the NIOSH Office of Extramural Programs in compiling this report and the contributions of the extramural research community in protecting the workforce by producing new occupational safety and health knowledge and transferring it into practice.

John Howard, MD
Director, National Institute for
Occupational Safety and Health
Centers for Disease Control and Prevention

EXECUTIVE SUMMARY

In FY2018, the National Institute for Occupational Safety and Health (NIOSH) funded 151 extramural awards totaling $92,151,881. Multidisciplinary centers received 36 awards totaling $59,107,157 (64%) in these program areas:

- $28.4 million for 18 Education and Research Centers
- $18.6 million for 11 Centers for Agricultural Safety and Health
- $6.3 million for 6 Centers of Excellence for *Total Worker Health®*
- $5.8 million for 1 National Center for Construction Research and Training

Investigator-initiated and career development research received 48 awards totaling $16,575,147 (18%). Cooperative research agreements received 33 awards totaling $9,157,411 (10%). Specialty training programs received 29 awards totaling $5,470,466 (6%), and 5 small business innovation research projects received a total of $1,841,700 (2%).

Funding for global health initiatives included a cooperative agreement with the World Health Organization (WHO) to support the Global Plan of Action on Workers' Health, which works to strengthen the abilities of national health systems to respond to the specific health needs of workers.

NIOSH also cosponsored global occupational safety and health activities with the National Institutes of Health (NIH) Fogarty International Center's Global Environmental and Occupational Health (GEOHealth) program. This program supports a multinational network of regional hubs led by institutions in low- or middle-income countries that partner with U.S. institutions.

In FY2018, NIOSH extramural researchers wrote 602 peer-reviewed articles in 298 journals. Education and Research Centers had the most articles (259) published, followed by investigator-initiated (R01) research (117). These articles appeared most often in the *Journal of Occupational and Environmental Medicine*.

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LIST OF ABBREVIATIONS

SECTOR PROGRAMS

ALL	All Sectors or Multiple Sectors
AFF	Agriculture, Forestry, and Fishing
CON	Construction
HSA	Healthcare and Social Assistance
MNF	Manufacturing
MIN	Mining
OGE	Oil and Gas Extraction
PSS	Public Safety
SRV	Services
TWU	Transportation, Warehousing, and Utilities
WRT	Wholesale and Retail Trade

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I. NIOSH EXTRAMURAL RESEARCH AND TRAINING PORTFOLIO

NIOSH Extramural Research and Training Programs include multidisciplinary research and training centers, investigator-initiated research, mentored research scientist development awards, training project grants, and small business innovation research projects in occupational safety and health. State surveillance programs and global occupational health initiatives enhance the breadth and depth of extramural research and training at NIOSH. The Research and Training Portfolio webpage describes these programs. The NIH Guide for Grants and Contracts publishes extramural funding opportunity announcements. This information also appears in the Funding Opportunities listed on the NIOSH Extramural Research and Training Programs webpage. The Appendix of this report lists all the NIOSH funding opportunity announcements published in FY2018.

NATIONAL OCCUPATIONAL RESEARCH AGENDA

The National Occupational Research Agenda (NORA) is a partnership program to stimulate new research and improved workplace practices. Unveiled in 1996, NORA serves as a research framework for the nation and for NIOSH that identifies and speaks to the most pressing issues in work-related safety and health. As steward of NORA, NIOSH launched the third decade in FY2017, which consists of ten industry sectors and seven cross-sectors representing major occupational safety and health issues and outcomes. NORA partners develop broad strategic objectives for research in each of those sectors and cross-sectors, and then work on those areas through information sharing, partnerships, and enhancing dissemination and implementation of evidence-based practices.

NIOSH PROGRAM AREAS

NIOSH organizes its research portfolio according to the NORA framework, with ten sector programs and seven cross-sector programs. Additionally, NIOSH has core and specialty program areas, which represent essential activities, mandates, special focus areas, and methods to use in research that support the sector and cross-sector programs. Each program area has research priorities and goals. This includes the most important goals for the extramural program—projects by researchers outside of NIOSH. Research to Practice (r2p) is a central focus of NIOSH programs and NIOSH-funded research. The r2p webpage offers more information on the NIOSH r2p program.

Table 1 offers links to more information about these program areas and research priorities. Select a name to access its webpage.

Table 1. NIOSH program areas

NIOSH Sector Programs	
Agriculture, Forestry, and Fishing	Oil and Gas Extraction
Construction	Public Safety
Healthcare and Social Assistance	Services
Manufacturing	Transportation, Warehousing, and Utilities
Mining	Wholesale and Retail Trade
NIOSH Cross-sector Programs	
Cancer, Reproductive, Cardiovascular, and Other Chronic Disease Prevention	Respiratory Health
Hearing Loss Prevention	Traumatic Injury Prevention
Immune, Infectious, and Dermal Disease Prevention	Healthy Work Design and Well-Being
Musculoskeletal Health	
NIOSH Core and Specialty Programs	
Authoritative Recommendations	Nanotechnology
Center for Direct Reading and Sensor Technologies	National Center for Productive Aging and Work
Center for Maritime Safety and Health Studies	Occupational Health Equity
Center for Occupational Robotics Research	Personal Protective Technology
Center for Motor Vehicle Safety	Prevention through Design
Center for Workers' Compensation Studies	Safe • Skilled • Ready Workforce
Emergency Preparedness and Response	Small Business Assistance
Engineering Controls	Surveillance
Exposure Assessment	Translation Research
Health Hazard Evaluations	

II. NIOSH EXTRAMURAL RESEARCH

FUNDING DISTRIBUTION FY2018

In FY2018, NIOSH awarded $92,151,881 in extramural funding. Figure 1 shows the distribution of awards by activity. Sixty-four percent (64%) of the extramural funding went to multidisciplinary centers, followed by 18% for investigator-initiated and career development research grants. Other cooperative research agreements made up 10% of the FY2018 grant distributions, followed by speciality training programs (6%), and small business innovation research projects (2%).

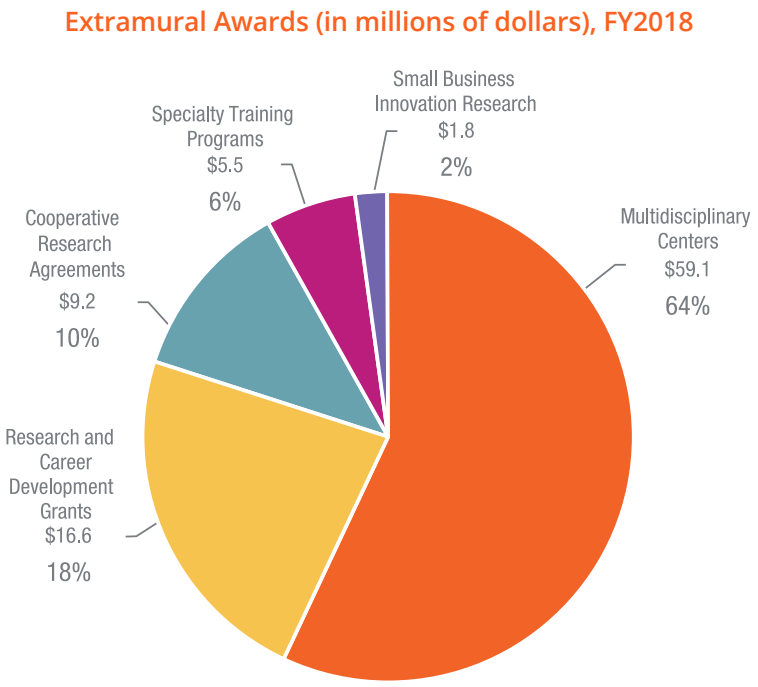


Figure 1. NIOSH extramural grant distribution, FY2018

In FY2018, NIOSH presented 151 awards: 33 (22%) for new projects and 118 (78%) for continuing awards. Table 2 summarizes all NIOSH extramural awards for FY2018. Of these awards,

- 48 (32%) funded investigator-initiated research and career development;
- 36 (24%) funded multidisciplinary research and training centers, which include Education and Research Centers, Centers for Agricultural Safety and Health, CPWR—The Center for Construction Research and Training, and Centers of Excellence for *Total Worker Health*®;
- 33 (22%) funded cooperative research agreements;
- 29 (19%) funded training program grants; and
- 5 (3%) funded small business innovation research.

The Office of Extramural Programs (OEP) webpage has a searchable list of all active awards funded by NIOSH and NIOSH funding opportunity announcements.

SUMMARY OF ALL AWARDS BY TYPE OF FUNDING

Table 2. Summary of all awards by type of funding in FY2018

Award Category	Award Mechanism	Number of Awards	Funding
Multidisciplinary Centers		36	$59,107,157
Education and Research Centers	Training Grant (T42)	18	$28,400,861
Centers for Agricultural Safety and Health	Cooperative Research Agreement (U54)	11	$18,611,221
National Center for Construction Research and Training	Cooperative Research Agreement (U60)	1	$5,750,000
Centers of Excellence for *Total Worker Health*®	Cooperative Research Agreement (U19)	6	$6,345,075
Investigator-initiated Research Grants		48	$16,575,147
Research Grants	Investigator-initiated (R01, R03, R21, R13, U13)	43	$16,041,598
Career Developmental Research	Mentored Career Scientist (K01)	5	$533,549
Cooperative Research Agreements		33	$9,157,411
State Surveillance Program	Cooperative Research Agreement (U60)	26	$6,802,162
Workers' Compensation Surveillance	Cooperative Research Agreement (U60)	3	$598,612
Agricultural, Forestry, and Fishing Safety and Health	Cooperative Research Agreement (U01)	2	$449,999
National Mesothelioma Virtual Bank	Cooperative Research Agreement (U24)	1	$1,081,638
World Health Organization	Cooperative Research Agreement (E11)	1	$225,000
Specialty Training Programs		29	$5,470,466
Training Project Grants	Training Grant (T03)	27	$4,502,466
Miner Safety and Health Training Program	Cooperative Research Agreement (U60)	2	$968,000
Small Business Innovation Research		5	$1,841,700
Small Business Innovation Research	Phase I (R43) & Phase II (R44)	5	$1,841,700
Total Extramural Funding		**151**	**$92,151,881**

EXTRAMURAL RESEARCH PORTFOLIO FY2018

NIOSH extramural research includes multidisciplinary centers, investigator-initiated research, and cooperative agreements. All applications for extramural funding are peer-reviewed for scientific merit and reviewed internally for programmatic relevance. Descriptions of these NIOSH extramural research elements follow.

Multidisciplinary Centers

NIOSH funds targeted research and outreach activities through multidisciplinary centers, which focus on high-risk industries that contribute disproportionately to work-related injury and illness in the United States. A variety of grant mechanisms, including cooperative research agreements and center training grants, fund these centers. Two multidisciplinary centers, Centers for Agricultural Safety and Health (Ag Centers) and CPWR—The Center for Construction Research and Training, perform critical research and training into the many safety and health hazards in agriculture and construction.

Another valuable center, the Centers of Excellence for *Total Worker Health*®, conducts research on the concepts of *Total Worker Health* (TWH). The Centers of Excellence advance TWH knowledge by building the scientific evidence base through research and practice that aims to improve the overall safety, health, and well-being of the diverse worker population in our nation. Their research examines the integration of occupational safety and health protection with workplace policies, programs, and practices to advance worker safety, health, and well-being.

A national network of Education and Research Centers (ERCs) carries out multidisciplinary education and research training activities. These university-based centers offer graduate and post-graduate training in the core and allied fields of occupational safety and health. Along with degree training, ERCs deliver continuing education and outreach to the occupational safety and health community throughout the federal health region they serve.

NIOSH awarded approximately $59.1 million to 36 multidisciplinary centers in FY2018:

- 18 ERCs received $28.4 million.
- 11 Ag Centers received $18.6 million.
- 6 Centers of Excellence for *Total Worker Health*® received $6.3 million.
- CPWR—The Center for Construction Research and Training received $5.8 million (see Figure 2).

Section IV describes each of these center portfolios and lists individual center grants.

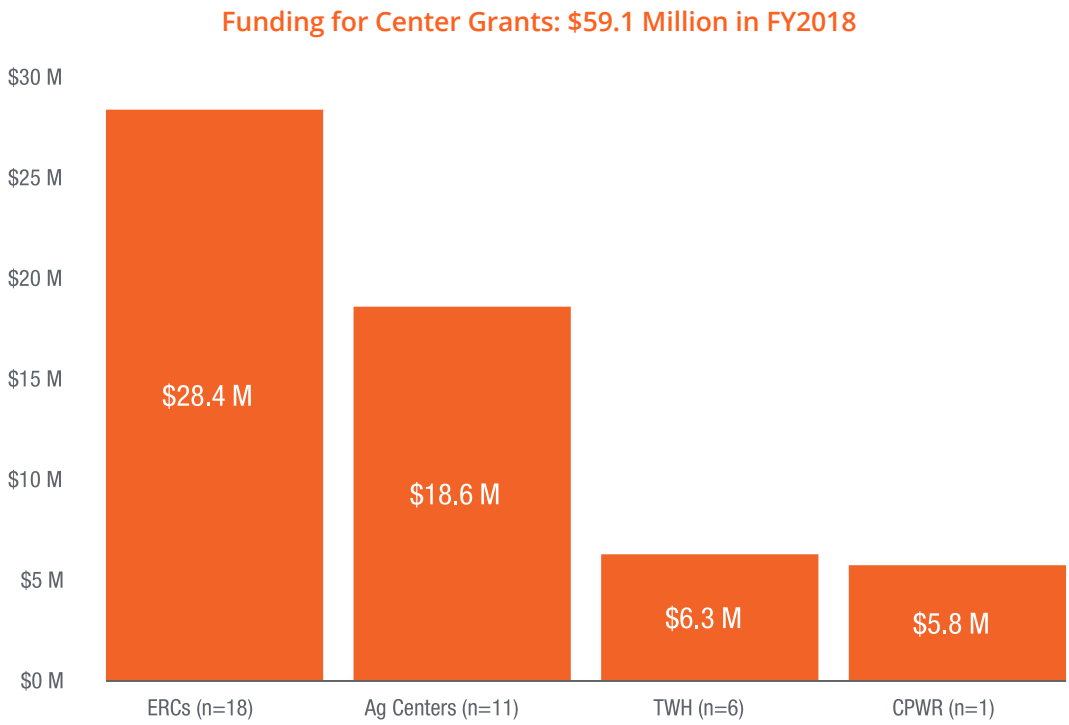


Figure 2. Multidisciplinary center awards, FY2018

ERCs = Education and Research Centers; Ag Centers = Centers for Agricultural Safety and Health; CPWR = National Center for Construction Research and Training; TWH = Centers of Excellence for *Total Worker Health®*

Investigator-initiated Research

Research Grants

Through its funding awards for investigator-initiated research, the NIOSH extramural research program supports relevant, quality scientific investigations that aim to help reduce job-related injuries and illnesses. These diverse awards include funding for large occupational safety and health research projects (R01), small occupational safety and health research grants (R03), and exploratory occupational safety and health research grants (R21).

The extramural research portfolio includes research scientist career development awards (K01), which offer mentored training for the next generation of occupational safety and health scientists. These competitive K01 awards offer up to 3 years of funding and a scientific focus designed to develop the skills and productivity of new career scientists.

Conference Grants

NIOSH values quality scientific meetings, which help prevent injuries, illnesses, and fatalities caused by workplace hazards. NIOSH awards conference grants under research grant mechanisms (R13 and U13). In FY2018, NIOSH funded one R13 conference grant and two U13 cooperative agreement conference grants (see Table 3).

Table 3. Investigator-initiated research and conference grant funding, FY2018

Grant Type	New Awards	New Funding	Continuing Awards	Continuing Funding	Total Funding
R01	8	$3,943,190	21	$10,085,089	$14,028,279
R21	8	$1,698,777	0	$0	$1,698,777
K01	3	$317,549	2	$216,000	$533,549
R03	3	$234,542	0	$0	$234,542
R13	0	$0	1	$20,000	$20,000
U13	1	$30,000	1	$30,000	$60,000
Total	**23**	**$6,224,058**	**25**	**$10,351,089**	**$16,575,147**

NIOSH awarded $16.6 million to new and continuing research projects, mentored scientist grants, and conference grants in FY2018 (see Table 3). Section IV describes investigator-initiated research outputs.

Cooperative Agreements

NIOSH uses cooperative agreements to partner with state health departments, universities, labor unions, and nonprofit organizations in a variety of surveillance and research opportunities. NIOSH funds a broad array of cooperative agreements to develop knowledge for preventing work-related diseases and injury.

Unlike grants, which are conducted independently of the sponsoring agency, cooperative agreements combine the knowledge of federal and nonfederal researchers to achieve public health efforts that would not otherwise occur. A cooperative agreement requires a clear need for a program's staff to do the proposed project. NIOSH evaluates if the cooperative agreement has enough importance to deserve committing the staff resources needed during the term of the cooperative agreement award.

Cooperative research agreements funded in FY2018 totaled $9.2 million and included long-standing state surveillance programs and third-year funding for workers' compensation surveillance. Agriculture, Forestry, and Fishing (AFF) for forestry safety research, the National Mesothelioma Virtual Bank, and the World Health Organization's Global Health Program also received funding.

Figure 3 shows how NIOSH distributed funds and how many cooperative research agreements received funding.

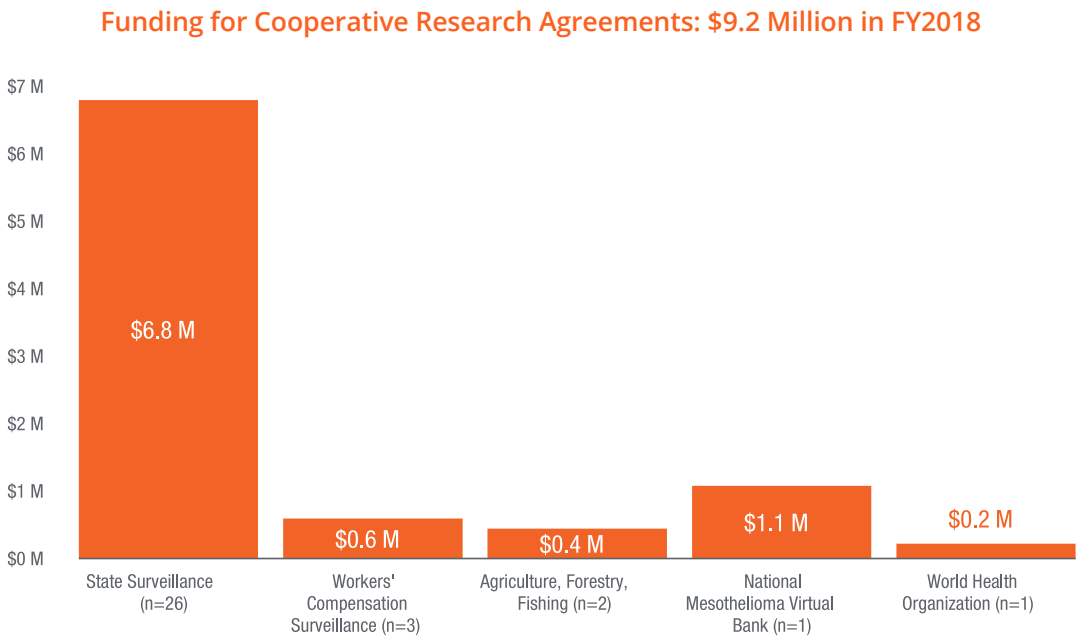


Figure 3. Cooperative agreements, FY2018

State Surveillance Program

The state surveillance program supports states to develop their ability to monitor work-related injuries, illnesses, and fatalities. This program helps expand the role of states in conducting in-depth surveillance and follow-up through investigations and interventions. These 26 NIOSH-sponsored programs contribute to a national occupational health surveillance strategy and create opportunities for research and intervention. The State Surveillance Program webpage focuses on these state-based initiatives. Table 2 reports the total number and funding for all state surveillance awards (new and continuing) for FY2018.

Workers' Compensation Surveillance Program

The Workers' Compensation Surveillance Program cooperative agreement helps states increase their capacity to compile, analyze, and distribute workers' compensation data. These agreements give resources to state health and workers' compensation agencies so they can start or expand state-based workers' compensation surveillance and partnering efforts. States can use their data to discover trends and emerging issues, along with analyze high-risk occupations, industries, and worker populations. This alliance helps prevent work-related injuries, illnesses, fatalities, and hazards within states and across the nation. In FY2018, NIOSH had three cooperative agreements related to workers' compensation surveillance. Table 2 shows the total funding amount for the Workers' Compensation Surveillance Program.

Agriculture, Forestry, and Fishing

The NIOSH Office of Agriculture Safety and Health began this research cooperative agreement program in FY2014 to complete several goals:

- Further the understanding of risks and conditions associated with forestry- or logging-related occupational injuries, illnesses, and fatalities.
- Explore methods to reduce risks and prevent or minimize exposure to hazardous conditions in these work environments.
- Translate important scientific findings into prevention practices and products to reduce work-related injuries, illnesses, and fatalities in this area.

The cooperative agreement program also increases knowledge on the effectiveness of current interventions and the best ways to make proven interventions widely available to help workers in this sector—in particular, addressing the unique needs of vulnerable workers.

National Mesothelioma Virtual Bank

The National Mesothelioma Virtual Bank advances translational research for the scientific community by collecting quality data and biospecimens for mesothelioma research. This resource gives researchers access to de-identified clinical data associated with a multitude of biospecimens. It will support scientific discovery, improve detection, and help develop effective treatments for mesothelioma. This work supports research that addresses the complex mechanisms and biological changes associated with mesothelioma and its disease progression. The National Mesothelioma Virtual Bank may ultimately help improve the quality of life of current and former workers who have malignant mesothelioma.

Global Partnerships

NIOSH is a member of the Global Network of WHO Collaborating Centers for Occupational Health—institutions that carry out activities to assist WHO to improve global worker health. NIOSH involvement includes program planning; combined research, training, and management; and interacting with WHO's Program on Workers' Health.

NIOSH cosponsored global occupational safety and health activities with the National Institutes of Health (NIH) Fogarty International Center's Global Environmental and Occupational Health (GEOHealth) program. This program supports a multinational network of regional hubs led by institutions in low- or middle-income countries that partner with U.S. institutions. More information on the work done by this program is available at the GEOHealth website.

Specialty Training Programs

Along with the ERCs described under Multidisciplinary Centers, NIOSH supports professional training in occupational safety and health through Training Project Grants (TPGs). Most TPGs are academic training programs that support undergraduate, graduate and post-graduate training. These programs, located throughout the United States, enrich the national network of graduate training that ERCs also offer.

NIOSH funds the Emergency Responder Training Program, a TPG, through the International Association of Fire Fighters. This grant supports a comprehensive, nationwide hazardous

materials training program for firefighters, paramedics, and other emergency responders across the United States.

The Miner Safety and Health Training Program–Western United States cooperative agreement, which is also a funded cooperative agreement, connects the mining community with mining-relevant information, resources, and methods. These resources increase the capacity and value of safety training for western states' miners. The Western Mining Safety and Health Training Resource Center provides these programs and activities at the University of Arizona, along with the Energy, Mining, and Construction Industry Safety Program at the Colorado School of Mines.

Table 2 shows the number and funding of all specialty-training grants (new and continuing) awarded in FY2018.

Small Business Innovation Research

The Small Business Innovation Research (SBIR) program stimulates the private sector to innovate technology. The SBIR program also helps small businesses to commercially apply federally supported research. In this process, they meet federal research needs as well as their own research and development needs.

The SBIR program funds small businesses in their early stages as they commercialize novel technologies for occupational safety and health. This competitive program helps small businesses join in federal research and development, produce life-saving technologies, and create jobs. Improving the return on investment from federally funded research boosts the nation's economy and improves society.

NIOSH solicits Phase I and Phase II research proposals from science and technology-based firms. Phase II proposals are limited to small businesses that complete their Phase I projects. Table 2 shows awards and funding for all FY2018 SBIR grants.

EXTRAMURAL RESEARCH ACTIVITY BY NIOSH PROGRAM AREA

The third decade of the NORA sector structure organizes the NIOSH research program portfolio. Figure 4 shows FY2018 funding for investigator-initiated research and career development research across the sectors. Extramural research in FY2018 took place across most of the NIOSH sector program areas except Oil and Gas Extraction (OGE). All Sectors* (ALL) received the most funding, followed by Manufacturing (MNF) and AFF.

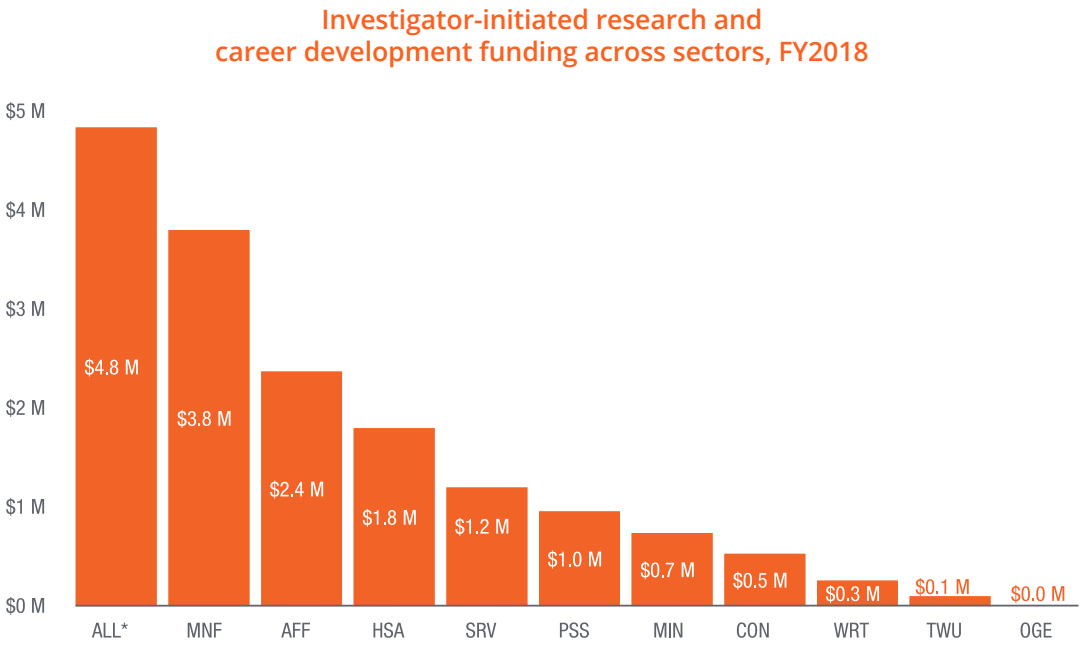


Figure 4. Research funding by sector program, FY2018

*Shows projects that contribute to advancing all or most of the NIOSH sector programs, including public health activity tools that cut across industry sectors.

SUCCESS RATES FOR RESEARCH PROJECT GRANTS, FY2008–2018

The success rate of reviewed new applications that receive funding in a fiscal year, calculated as a percentage, helps measure the viability of the research grants program. Success rates for new awards are calculated for the investigator-initiated research only, which includes the R01, R03, and R21 grant mechanisms. The success rate is a function of the number of applications received and the number of applications funded.

Figure 5 shows that throughout FY2008–2018, the success rate remained fairly stable until FY2014, when it decreased from 17% to 1% in FY2017 due to funding shortages. However, in FY2018, the success rate increased to 10%. For FY2008–2018, the mean annual number of applications was 176, the mean number of awards was 25, and the mean annual success rate was 15%. Figures 6–8 show the success rates for each research mechanism.

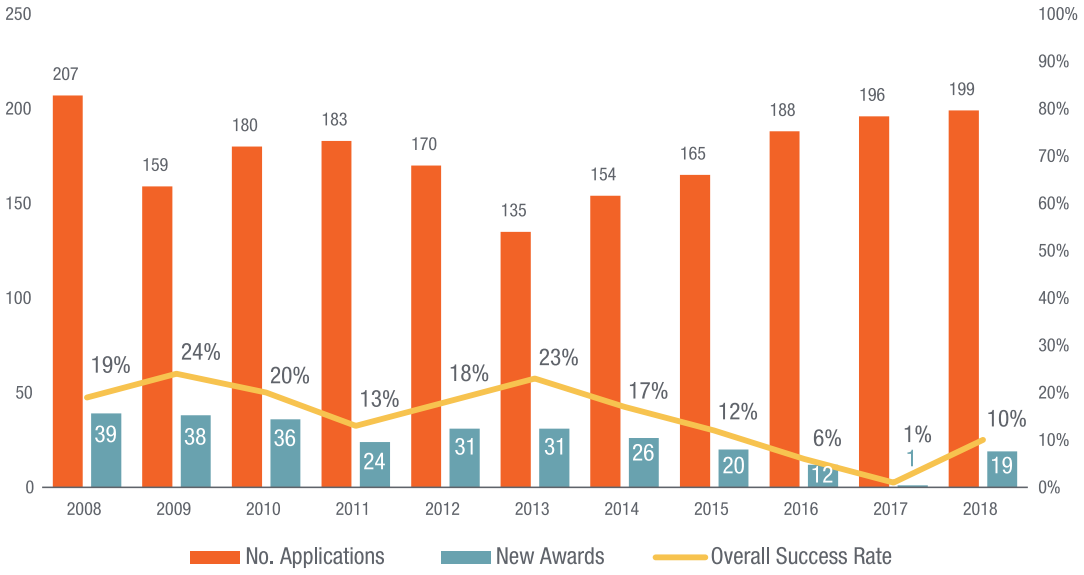


Figure 5. Overall success rates for research project grants, FY2008–2018

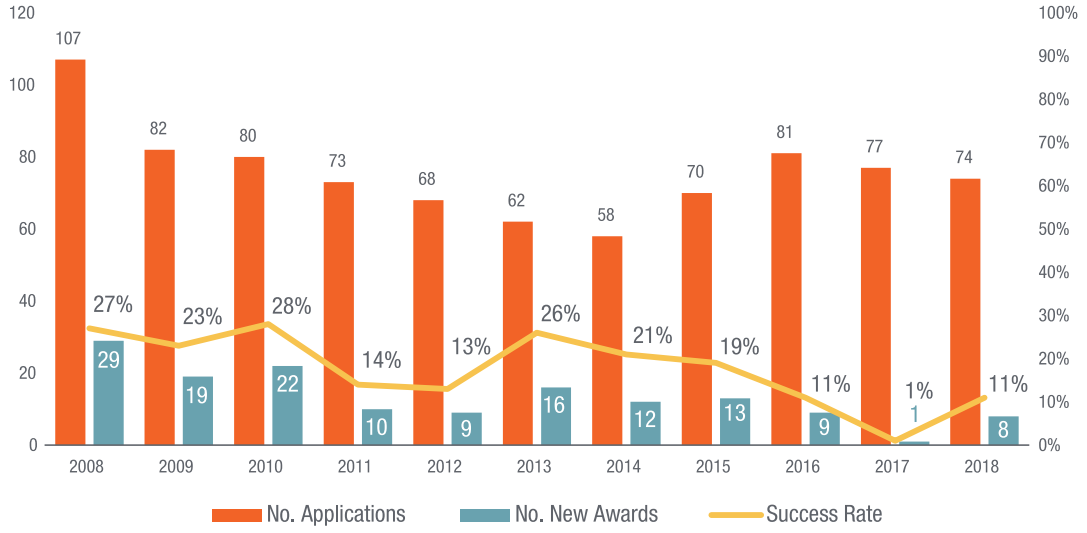


Figure 6. Success rates for R01 applications, FY2008–2018

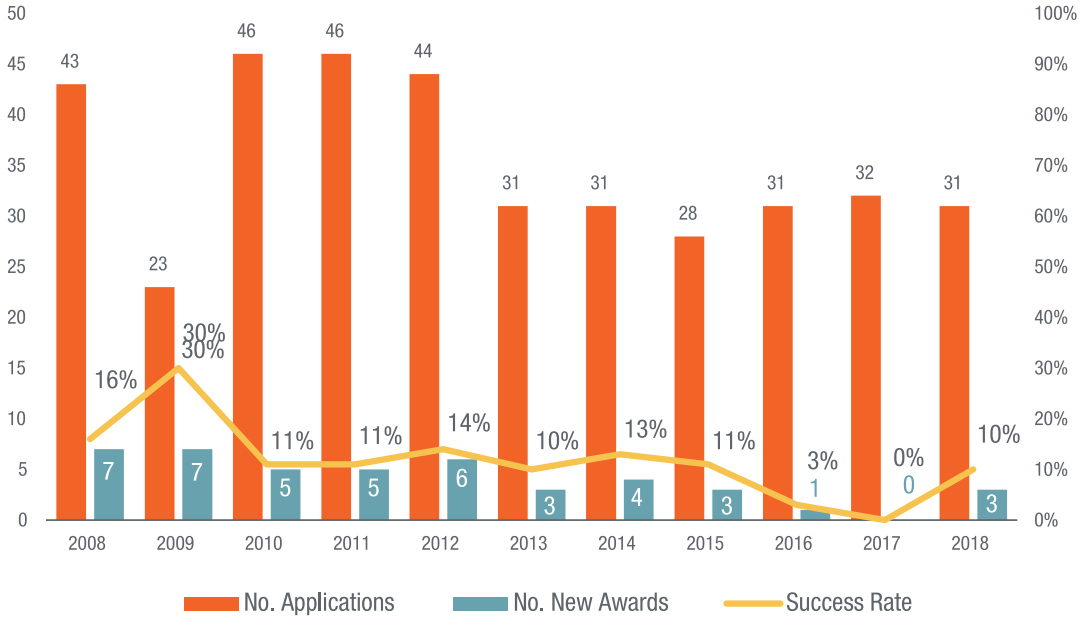


Figure 7. Success rates for R03 applications, FY2008–2018

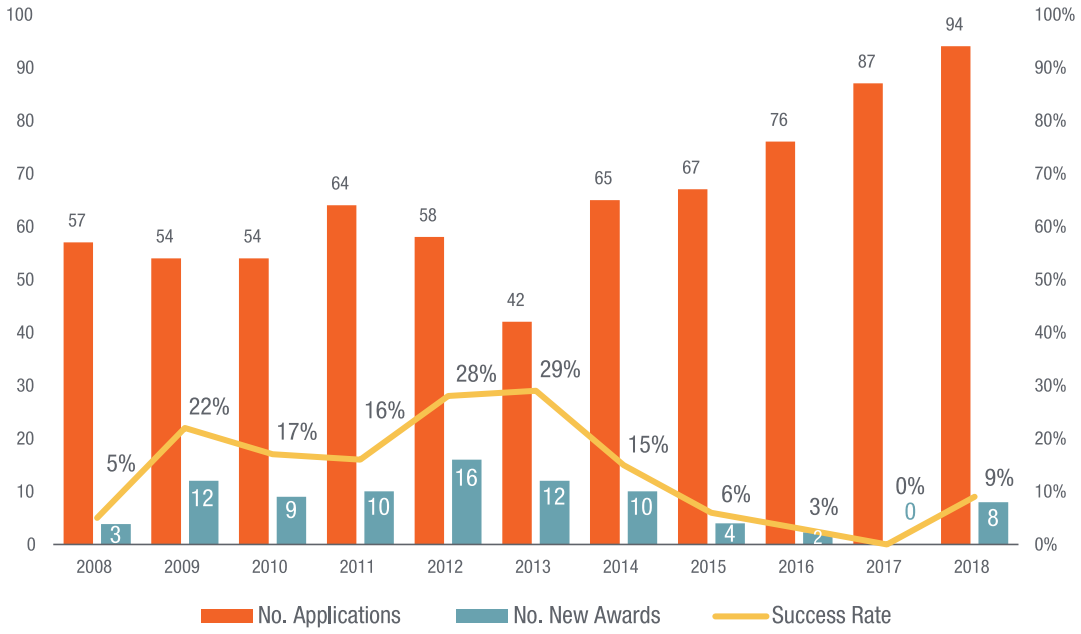


Figure 8. Success rates for R21 applications, FY2008–2018

III. EXTRAMURAL RESEARCH GOALS IN FY2018

Extramural researchers addressed the greatest number of goals in CON, followed by AFF, MNF, PSS, and SRV.

In FY2018, NIOSH continued to use the same goals from the second decade of NORA for extramural research while new goals were being developed for the NIOSH Strategic Plan for FYs 2019–2023. Extramural researchers respond to these goals through research, service, and outreach. NIOSH annually assesses extramural projects that focus on strategic goals.

In FY2018, extramural research projects addressed 49 of the 109 (45%) NORA strategic goals. Extramural research in CON (Construction) worked on the most goals, followed by AFF, MNF, PSS (Public Safety), and SRV (Services). In particular, the AFF sector's extramural research responded to all strategic goals.

Figure 9 shows the number of strategic goals by sector and the number of goals addressed by extramural researchers. It also shows which goals were unaddressed or not worked on, as well as those that were inactive in FY2018. NIOSH considers goals inactive when they are retired and are no longer being addressed by new projects.

Extramural researchers addressed 45% of all strategic goals in FY 2018.

HOW TO READ THIS GRAPHIC

Each sector program is displayed with its own icon. To the right of the icon, the number of strategic goals addressed by extramural research in FY2018 is indicated. Please see the key below.

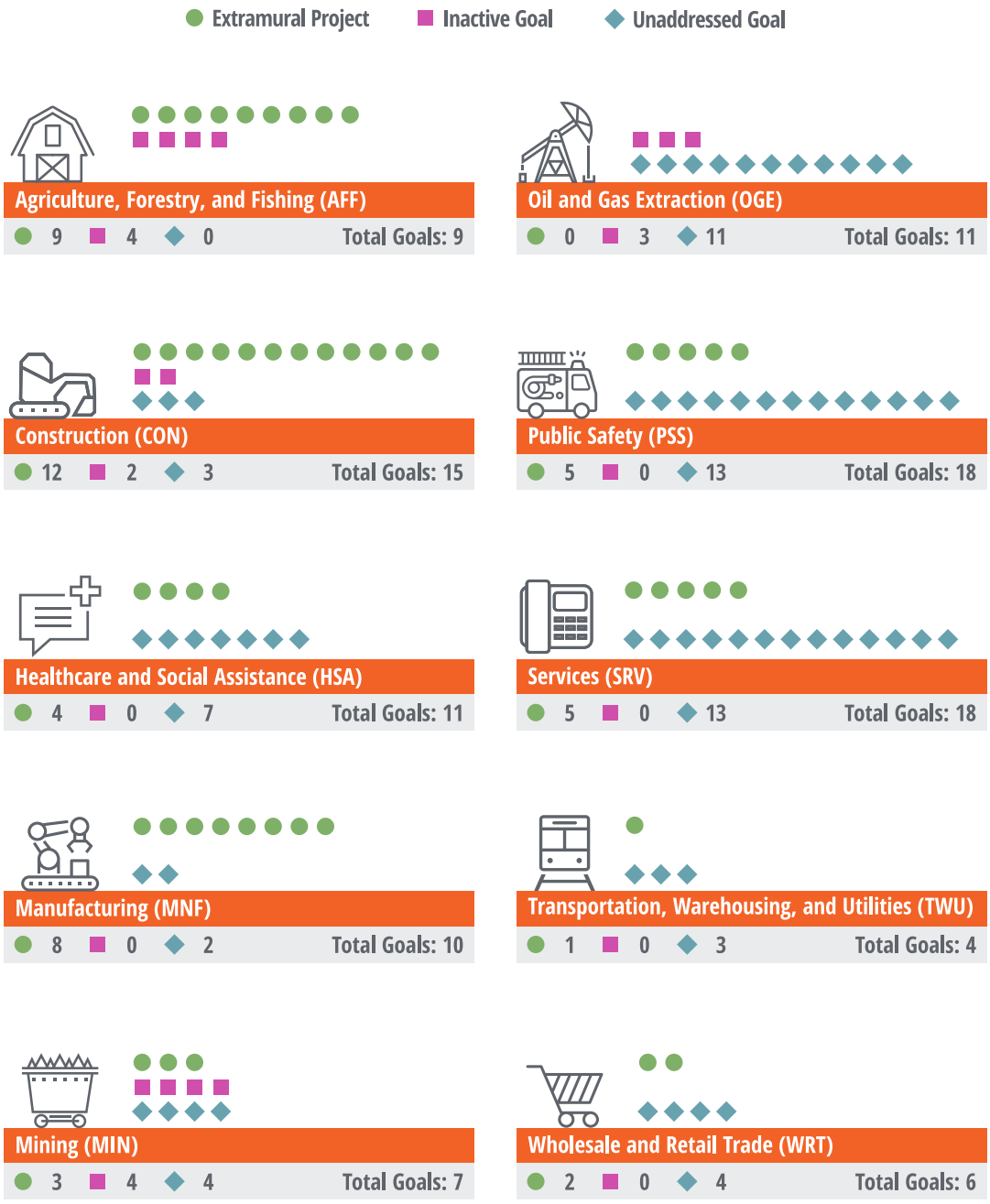


Figure 9. NIOSH extramural research support of goals by sector, FY2018

EXTRAMURAL RESEARCH ACTIVITY BY SECTOR GOALS, FY2018

To describe NIOSH-funded extramural research in FY2018, NIOSH reviewed the strategic goals by industry sectors that projects addressed. Tables in the following sections show how extramural research projects focused on the NORA sector strategic goals in FY2018.

Agriculture, Forestry, and Fishing

Table 4 shows how FY2018 extramural research projects addressed strategic goals in the Agriculture, Forestry, and Fishing (AFF) Sector. Extramural research projects supported all nine strategic goals for this sector. They most often addressed the SG1 (Surveillance) strategic goal (n=20). Four strategic goals (SG4, SG5, SG6, and SG7) were inactive in FY2018.

Table 4. Agriculture, Forestry, and Fishing research projects by strategic goal, FY2018

Strategic Goal (SG)	Extramural Projects
SG1: Surveillance	20
SG2: Vulnerable Workers	6
SG3: Outreach and Partnerships	9
SG4: Agricultural Safety (inactive after FY2016)	8
SG5: Agricultural Health (inactive after FY2016)	10
SG6: Forestry Injuries (inactive after FY2016)	1
SG7: Forestry Illness/Disease (inactive after FY2016)	2
SG8: Commercial Fishing Injuries	2
SG9: Commercial Fishing Illness/Disease	4

Construction

Table 5 shows how extramural FY2018 research projects addressed the Construction (CON) Sector's strategic goals. Extramural research FY2018 projects supported 11 of 13 active strategic goals for this sector. Two strategic goals (SG2 and SG10) were inactive in FY2018. Surveillance, SG14, had the most projects in FY2018 (n=35).

Table 5. Construction research projects by strategic goal, FY2018

Strategic Goal (SG)	Extramural Projects
SG1: Falls Prevention	1
SG2: Electrocution (inactive after FY2011)	0
SG3: Struck-by Incident Prevention	1
SG4: Hearing Loss Prevention	4
SG5: Silica	1
SG6: Welding Fumes	1
SG7: Musculoskeletal Disorders	2
SG8: Safety and Health Cultures	1
SG9: Safety and Health Management	2
SG10: Industry and Work Organization (inactive after FY2011)	1
SG11: Training and Education	0
SG12: Health Disparities	1
SG13: Prevention through Design	1
SG14: Surveillance	35
SG15: Engaging Media	0

Healthcare and Social Assistance

Table 6 shows how FY2018 extramural research projects in the Healthcare and Social Assistance (HSA) Sector addressed strategic goals. Extramural research FY2018 projects worked on 4 of 11 strategic goals. Research projects did not address seven strategic goals. Extramural research had the most projects in SG1, Safety Culture (n=6).

Table 6. Healthcare and Social Assistance research projects by strategic goal, FY2018

Strategic Goal (SG)	Extramural Projects
SG1: Safety Culture	6
SG2: Musculoskeletal Disorders	3
SG3: Hazardous Drugs and Chemicals	0
SG4: Sharp Injuries	1
SG5: Infectious Disease	2
SG6: Zoonotic Diseases in Veterinary Medicine and Animal Care	0
SG7: Injuries in Veterinary Medicine and Animal Care	0
SG8: Respiratory Hazards in Veterinary Medicine and Animal Care	0
SG9: Reproductive Hazards in Veterinary Medicine and Animal Care	0
SG10: Physical Hazards in Veterinary Medicine and Animal Care	0
SG11: Cross-cutting Issues	0

Manufacturing

Table 7 shows how FY2018 extramural research projects in the Manufacturing (MNF) Sector addressed their strategic goals. Extramural research supported eight goals in FY2018. Extramural research addressed the most projects in strategic goal SG5, Respiratory Diseases (n=7).

Table 7. Manufacturing research projects by strategic goal, FY2018

Strategic Goal (SG)	Extramural Projects
SG1: Contact with Objects and Equipment	1
SG2: Falls	2
SG3: Musculoskeletal Disorders	3
SG4: Hearing Loss	4
SG5: Respiratory Diseases	7
SG6: Cancer	1
SG7: Vulnerable Populations	1
SG8: Small Business	0
SG9: Emerging Risks	2
SG10: Catastrophic Incidents	0

Mining

Table 8 shows how FY2018 extramural research projects in the Mining (MIN) Sector addressed strategic goals. Extramural research supported three strategic goals in FY2018 and addressed the most projects in strategic goal SG1, Respiratory Diseases (n=3).

Table 8. Mining research projects by strategic goal, FY2018

Strategic Goal (SG)	Extramural Projects
SG1: Respiratory Diseases	3
SG2: Noise-induced Hearing Loss	2
SG3: Musculoskeletal Disorders	2
SG4: Traumatic Injuries (inactive after FY2016)	0
SG5: Disaster Response and Prevention (inactive after FY2016)	0
SG6: Ground Failure Fatalities and Injuries (inactive after FY2016)	0
SG7: Interventions with New Technologies (inactive after FY2016)	0

Oil and Gas Extraction

Table 9 shows how FY2018 extramural research projects in the Oil and Gas Extraction (OGE) Sector addressed strategic goals. Extramural research projects did not support any strategic goals in FY2018. Three strategic goals (SG5, SG7, and SG11) are inactive.

Table 9. Oil and Gas Extraction research projects by strategic goal, FY2018

Strategic Goal (SG)	Extramural Projects
SG1: Transportation-related Injuries and Fatalities	0
SG2: Contact Injuries	0
SG3: Falls	0
SG4: Fires and Explosions	0
SG5: Improvement in Workplace Practices, Procedures, and Policies (inactive after FY2011)	0
SG6: Chemical Exposures	0
SG7: Develop Industry-specific Products (inactive after FY2014)	0
SG8: Fatigue	0
SG9: Vulnerable Workers	0
SG10: Small Businesses	0
SG11: Storage and Transportation (inactive after FY2016)	0

Public Safety

Table 10 shows how FY2018 extramural research projects in the Public Safety (PSS) Sector addressed strategic goals. Research projects addressed five strategic goals within this sector. Extramural research most often covered strategic goal SG5, Surveillance in Law Enforcement (n=4).

Table 10. Public Safety research projects by strategic goal, FY2018

Strategic Goal (SG)	Extramural Projects
SG1: Chronic Disease in Firefighters	0
SG2: Structural Firefighting Operations	0
SG3: Vehicle-related Injuries in Firefighters	0
SG4: Musculoskeletal Disorders	1
SG5: Surveillance in Law Enforcement	4
SG6: Vehicle-related Injuries in Law Enforcement	0
SG7: Criminal Assaults in Law Enforcement	0
SG8: Cardiovascular Disease in Law Enforcement	1
SG9: Traumatic Injury in Corrections	0
SG10: Infectious Disease in Corrections	0
SG11: Occupational Stress in Corrections	1
SG12: Vehicle-related Injuries in EMS (emergency medical services)	0
SG13: Patient- and Equipment-handling Injuries in EMS	0
SG14: Infectious Disease and Hazardous Exposures in EMS	0
SG15: Work Organization in EMS	0
SG16: Surveillance in EMS	0
SG17: Injuries and Illnesses in Wildland Firefighting	0
SG18: Health and Safety in Wildland Firefighting	1

Services

Table 11 shows how FY2018 extramural research projects in the Services (SRV) Sector addressed strategic goals. Projects supported five strategic goals for this sector. Extramural research most often focused on strategic goal SG17, Surveillance (n=30).

Table 11. Services research projects by strategic goal, FY2018

Strategic Goal (SG)	Extramural Projects
SG1: Illnesses and Fatal Injuries in Auto Repair	0
SG2: Illnesses and Injuries in Building Services	0
SG3: Health Disparities in Building Services	1
SG4: Illnesses and Injuries in Schools	0
SG5: Injuries in Hotel/Motel Industry	0
SG6: Illnesses in Hotel/Motel Industry	0
SG7: Health Disparities in Hotel/Motel Industry	0
SG8: Injuries/Illnesses in Government	0
SG9: Traumatic Injuries in Recreation and Entertainment Industries	0
SG10: Injuries in Food Services	1
SG11: Violence in Food Services	0
SG12: Injuries/Illnesses in Telecommunications	0
SG13: Traumatic Injuries in Telecommunications	0
SG14: Temporary Labor/Contractors/Contingent Workers	0
SG15: Injuries in Waste Collection, Disposal, and Recycling Industries	0
SG16: Musculoskeletal Disorders	1
SG17: Surveillance	30
SG18: Injuries/Illnesses in Nail and Hair Salons	1

Transportation, Warehousing, and Utilities

Table 12 shows how FY2018 extramural research projects in the Transportation, Warehousing, and Utilities (TWU) Sector addressed strategic goals. Extramural research covered one strategic goal for this sector (SG2, Musculoskeletal Disorders).

Table 12. Transportation, Warehousing, and Utilities research projects by strategic goal, FY2018

Strategic Goal (SG)	Extramural Projects
SG1: Traumatic Injuries	0
SG2: Musculoskeletal Disorders	1
SG3: Health and Wellness Programs	0
SG4: Chemical/Biological/Physical Hazards	0

Wholesale and Retail Trade

Table 13 shows how FY2018 extramural research projects in the Wholesale and Retail Trade (WRT) Sector addressed strategic goals. Projects addressed two strategic goals within this sector.

Table 13. Wholesale and Retail Trade research projects by strategic goal, FY2018

Strategic Goal (SG)	Extramural Projects
SG1: Musculoskeletal Disorders	1
SG2: Traumatic Injuries	2
SG3: Violence	0
SG4: Vehicle-related Injuries	0
SG5: Small Business Outreach	0
SG6: Vulnerable Workers	0

IV. FY2018 EXTRAMURAL RESEARCH PROGRAM HIGHLIGHTS

Selected outputs, outcomes, and accomplishments of NIOSH-funded extramural research during FY2018 are described in this section. The outputs include publications, reports, conference proceedings, presentations/posters, databases, tools, methods, guidelines, recommendations, education and training materials, inventions, and patents. From October 1, 2017, to September 30, 2018, NIOSH-funded extramural research led to 602 peer-reviewed publications. Researchers published their NIOSH-funded studies in an array of journals related to occupational safety and health. Most often, they published in the *Journal of Occupational and Environmental Medicine* (n=42), followed by the *Annals of Work Exposures and Health* (n=24), the *Journal of Occupational and Environmental Hygiene* (n=21), and the *Journal of Agromedicine* (n=20). We collected publications by extramural researchers from principal investigator reports to NIOSH, the NIH Reporter database, the NIOSHTIC-2 database, and the PubMed database. Find a searchable database of NIOSH publications, which includes grantee final reports and publications, by using the NIOSHTIC-2 publications search.

Detailed descriptions of other significant outputs and outcomes of NIOSH-funded extramural research funded during FY2018 by grant mechanism follow.

MULTIDISCIPLINARY CENTERS

NIOSH funds multidisciplinary centers that focus on industries with an excessive share of job-related injury and illness. Various grant mechanisms, including cooperative research agreements and center training grants, fund these centers.

CENTERS FOR AGRICULTURAL SAFETY AND HEALTH

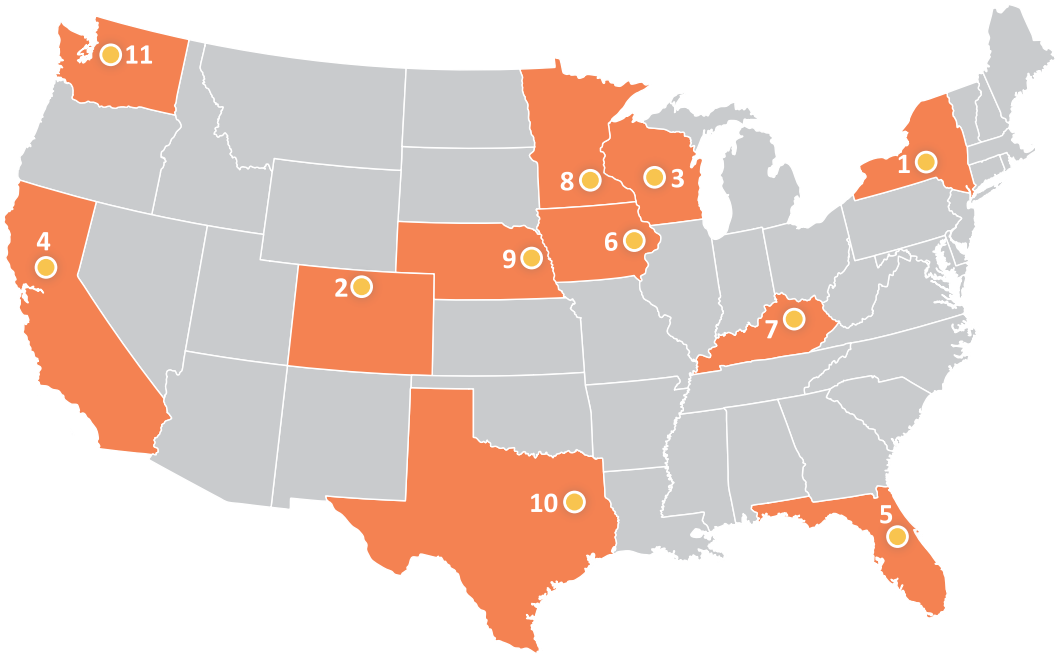
The Centers for Agricultural Safety and Health (Ag Centers), established as part of the NIOSH Agricultural Safety and Health Initiative through a cooperative agreement, represent a major NIOSH effort to protect the safety and health of farm workers and their families. These centers conduct research, education, and prevention projects to respond to the nation's pressing agricultural safety and health problems. Right now, 10 regional Ag Centers throughout the country work on regional safety and health issues unique to each area. NIOSH also supports the National Children's Center for Rural and Agricultural Safety and Health (Child Ag Center) within the National Farm Medicine Center in Marshfield, Wisconsin. With a national focus, the Child Ag Center strives to enhance the safety of all children exposed to hazards associated with agricultural work.

Public Health Relevance

In 1990, Congress established a national initiative in agricultural safety and health under Public Law 101-517. The intention of this initiative, "... when sustained over a period of time, would result in a significant and measurable impact on ... health effects among rural Americans." In response, NIOSH began funding the Centers for Agricultural Disease and Injury Research, Education, and Prevention in 1991. In FY 2015, the name changed to Centers for Agricultural Safety and Health. These centers strive to improve worker safety and health in the agriculture, forestry, and fishing industries—jobs that consistently ranked among the most dangerous in the United States. Although they still rank as some of the most dangerous, in the 25 years since the Act took effect, there have been significant decreases in injuries, illnesses, and death among farm workers. Part of the decline in injuries and deaths can be attributed to the work done by the Ag Centers.

The Ag Centers' work spans the full research-to-practice continuum. First, they conduct basic science to evaluate and quantify an issue. Researchers then transfer the results into engineering controls, educational outreach efforts, or policy changes aimed at preventing or mitigating the problem. The Ag Centers' research helps create and validate evidence-based approaches. However, the real impact occurs by application of these approaches through practical education, outreach, and prevention projects within their regions. Geographic diversity in agriculture, forestry, and fishing activities drives the need for regional engagement by the centers.

NIOSH Centers for Agricultural Safety and Health



1. Bassett Healthcare
2. Colorado State University
3. National Farm Medicine Center
4. University of California, Davis
5. University of Florida, Gainesville
6. University of Iowa
7. University of Kentucky
8. University of Minnesota
9. University of Nebraska Medical Center
10. University of Texas Health Science Center, Tyler
11. University of Washington

The Ag Centers made significant contributions to public health in FY2018:

- Integrating skill and know-how from multiple disciplines, institutions, and community partners to solve complex problems.
- Providing a continuum of basic research through translation and outreach activities that turn findings into evidence-based prevention programs.
- Responding to the many cultural, ethnic, educational, and language differences that are significant barriers to safety and health for many laborers in this workforce.
- Contributing knowledge to agricultural industries in the fields of medicine, nursing, industrial hygiene, epidemiology, engineering, and education.

Research Outputs: Publications in FY2018

Ag Center outputs are the products of research activities and include publications. We collected publications by NIOSH-funded extramural researchers from principal investigator reports to NIOSH, the NIH Reporter database, the NIOSHTIC-2 database, and the PubMed database. From October 1, 2017, to September 30, 2018, Ag Centers published 81 articles in peer-reviewed journals. Find a searchable database of NIOSH publications, which includes grantee final reports and publications, by using the NIOSHTIC-2 publications search.

Program Highlights in FY2018

Ag Centers Addressing Heat-related Illnesses Across the United States

Heat-related illnesses (HRI) include heat stroke, heat exhaustion, and heat cramps. These are preventable conditions, but are common hazards in the Agricultural, Forestry, and Fishing Sector. Many outdoor workers are at increased risk for HRI as they perform strenuous activities in hot environments for prolonged periods. Precautions including sufficient hydration, acclimatization or adjusting to changes in climate, and awareness of HRI symptoms and treatment are effective in preventing negative health effects and death. However, it takes multilayered efforts in research, translation, and education to combat elevated heat exposures in agricultural, forestry and fishing. The following are a few HRI projects underway at various Ag Centers.

Florida: Heat Stress and Biomarkers of Renal Disease

Recently, agricultural workers in Central America have experienced a well-documented increase in chronic kidney disease. Many claim their work in hot environments and persistent dehydration leads to adverse renal or kidney-related effects. However, there is limited understanding of the underlying biological processes associated with this problem. Agricultural workers in the United States are also at risk, particularly in states with hot, extended growing seasons.

This study measures physiological indicators of HRI in Florida farmworkers and includes metabolomics analyses to determine negative pathways or associations to renal impairment. Researchers are exploring whether biomarkers or biological indicators of renal damage are present in Mexican migrant farmworkers living in the United States when compared with Mexican migrant workers not in agriculture. They are recruiting 70 agricultural workers and 30 individuals of similar heritage who do not work in heat-intensive agricultural activities.

By describing the occupational environment of these workers, along with their body anthropometrics or human body measurements, dehydration levels, and self-reported HRI symptoms, investigators hope to determine if biomarkers indicating kidney injury are present. If so, the scientists will focus on whether these biomarkers differ in agricultural workers when compared to workers not employed in agriculture. This is the first study to document the extent of association between heat exposure and chronic kidney disease in a U.S. migrant farmworker population. Researchers aim to better describe the possible metabolic pathways affected by heat exposure.

Details:
http://www.sccahs.org/index.php/research/

Texas: The Impact of Thermal Load on Shrimp Fishermen's Use of Personal Flotation Devices

Falls overboard are the second most frequent cause of death in the U.S. commercial fishing industry and the leading cause of death in

southeastern shrimp fisheries, accounting for 61% of worker fatalities. The long-term goal of this project is to increase the routine use of personal floatation devices (PFDs) among Vietnamese commercial shrimp fishermen in the Gulf of Mexico and, consequently, reduce falls-overboard fatalities in commercial fisheries.

Findings from a prior study showed that increased thermal load while working was a major barrier to wearing PFDs in the commercial fishing industry. The objective of this translation project is to test the impact of heat on use of these devices. The investigators will also design and test a multimodal and culturally appropriate social marketing campaign to increase adoption of Occupational Safety and Health Administration/NIOSH recommendations for heat stress reduction and increase comfort, access, and acceptability of PFDs. By reducing the impact of heat stress while working, researchers hope fishermen will be more likely to wear PFDs. Overall, this study aims to (1) understand, measure, and compare physiological responses to the thermal environment and heat stress symptoms, with and without PFDs, and cooling devices among Vietnamese shrimp fishermen, and (2) identify commercially available personal cooling equipment designs that have demonstrated comfort and workability.

Details:
https://www.uthct.edu/swagc-current-projects

Washington: A Multilevel Approach to Heat-related Illness Prevention in Agricultural Workers

This project will develop and evaluate a multilevel approach to HRI prevention in agricultural workers. It builds on the Center's previous HRI work with Washington tree-fruit growers and farmworkers who are largely foreign-born, Spanish-speaking workers. The current study relies on an advisory group that includes workers, farm managers, and other stakeholders to guide the development, testing, and dissemination of an intervention.

The project will focus on participatory worker HRI education to address risk factors for agricultural workers at individual, workplace, and community levels. This intervention will include tailored recommendations for tree-fruit growers on how to reduce HRI risk on hot workdays, which will be developed using data from Washington State University's AgWeatherNet weather station network. Researchers will create a final consensus document for workers with recommendations for multilevel HRI risk factor assessment and intervention development. The Center plans to distribute the recommendations to workers, growers, housing and healthcare stakeholders, scientists, and public health practitioners.

Details:
https://deohs.washington.edu/pnash/multi-level-approach-heat-related-illness-prevention-agricultural-workers

NATIONAL CENTER FOR CONSTRUCTION RESEARCH AND TRAINING

The CPWR—Center for Construction Research and Training received a NIOSH National Construction Center cooperative agreement for 2014–2019 through an extramural competition. The Center, with its diverse construction community, leads in applied construction research, making effective interventions available to the construction industry. Along with its consortium of six academic partners, CPWR researches safety and health risks that construction workers face on the job, including their causes and solutions. Their research projects support NORA Construction Sector research goals as well as emerging issues.

Public Health Relevance

For the past 25 years, the funding for CPWR comes through a series of competitive program announcements, as the NIOSH-sponsored Center of Excellence for Construction Safety and Health Research. For FY2018, CPWR's research activities focused on NORA Construction Goals 1 through 15. This work included applied research for hazards and health conditions, emerging issues research in nanomaterials, construction industry data and tracking, and the distribution and transfer of research. Research projects also responded to the National Academy of Sciences' recommendations for the NIOSH construction research program, including distributing research-to-practice solutions. CPWR has cultivated and optimized external partnerships for prevention, protections, research, and research translation for protecting U.S. construction workers.

Research Outputs: Publications in FY2018

CPWR outputs are the products of research activities and include publications. We collected publications by NIOSH-funded extramural researchers from principal investigator reports to NIOSH, the NIH Reporter database, the NIOSHTIC-2 database, and the PubMed database. From October 1, 2017, to September 30, 2018, CPWR published eight articles in peer-reviewed journals. Find a searchable database of NIOSH publications, which includes grantee final reports and publications, by using the NIOSHTIC-2 publications search.

Program Highlights in FY2018

CPWR Data Center Leading the Way in Construction Safety and Health Surveillance

CPWR's Data Center is prominent in tracking industry, employment, and safety and health outcome trends in construction, using mostly nationally representative datasets. The Center analyzes data from more than 40 sources, including the U.S. Bureau of Labor Statistics Survey of Occupational Injuries and Illnesses, NIOSH Occupational Hearing Loss (OHL) Worker Surveillance Data, National Occupational Mortality Surveillance System, Occupational Safety and Health Administration (OSHA) Inspection Data, and OSHA Chemical Exposure Health Data.

Through this effort, CPWR increases its construction safety and health knowledge and fills gaps in research literature, as well as provides construction stakeholders with important, timely data. In FY2018, CPWR used these data to develop the sixth edition of *The Construction Chart Book – The U.S. Construction Industry and Its Workers*. This publication contains the most complete data available on all aspects of the U.S. construction industry including figures

related to economics, demographics, employment/income, education/training, and safety and health issues. Additionally, CPWR's Data Center researchers coded all construction death cases investigated by the NIOSH Fatality Assessment and Control Evaluation program between 1982 and 2015 into a database. Partnering with NIOSH, CPWR published the findings of this project in the *Journal of Safety Research* and in *Accident Analysis & Prevention*.

The Center also develops and distributes Quarterly Data Reports (QDRs) on high priority topics, such as the increased burden of fatal injuries among small construction employers. The QDRs have been cited in articles in Safety+Health Magazine, Construction Dive, Bloomberg Law, etc. Next steps for the Data Center are expanding its surveillance efforts to include research on sustainable employability, intervention effectiveness, prevention through design, longitudinal mortality study, and substance abuse.

Details:

https://www.cpwr.com/publications/research-findings-articles/cpwr-quarterly-data-reports-data-briefs

https://www.cpwr.com/publications/research-findings-articles/construction-chart-book

https://www.sciencedirect.com/science/article/pii/S0022437516303991

https://www.ncbi.nlm.nih.gov/pubmed/28292698

https://www.cpwr.com/research/construction-face-database

The Exposure Control Database

Despite the need, the construction industry lacked an easy-to-use, publicly available data system to proactively estimate exposures to common hazards and then apply effective controls to mitigate them. To bridge the gap, CPWR developed the Exposure Control Database (ECD)—an interactive web-based tool designed to help estimate exposure to major health hazards, including respirable silica, welding fumes, noise, and lead. This system uses a predefined list of evidence-based search variables to retrieve objective exposure measurements based on user input. It then approximates likely exposure to the selected hazard and supplements these data with graphical displays. CPWR developed the database in collaboration with NIOSH researchers through the CPWR/NIOSH Engineering Control Workgroup. The ECD has largely been populated with objective exposure measurements from peer-reviewed literature and NIOSH reports, as well as measurements collected by CPWR's industry partners. The database officially launched on August 30, 2018. Since its inception, more than 1,400 people from 35 countries have accessed the database more than 2,000 times. These users represent universities, government agencies, general contractors, insurance companies, and labor unions.

Details:

http://ecd.cpwrconstructionsolutions.org/

Exploring Emerging Issues in Construction Through Small Studies

The CPWR Small Study Program is unique because it creates opportunities to explore promising technologies or policy interventions and investigate emerging hazards on construction worker safety and health without significant use of time or resources. During the 25 years of operating this program, CPWR received 284 letters of intent and funded 119 studies that each lasted up to one year. This research represents an array of topics, organizations, beneficiaries, and locations. For example, one small study explored awareness of nano-enabled construction products in heavy industrial/commercial construction. In this study, while most of those surveyed recognized terms like "nanotechnology" and "nanoparticles," only 25% of them knew these materials are used in construction materials. However, when shown a list of nano-enabled

construction products, 44% of survey respondents recognized or had used these products. Small studies like this have supported the need for training on emerging hazards while other studies have informed the design of important large-scale research.

During FY2018, CPWR funded eight small studies centered on topics such as (1) identifying fall hazards with drones, (2) preventing risks to solar power system installers at the design phase, (3) adapting mix-reality technologies to visualize possible workplace locations of dangerous situations, (4) implementing work-zone safety through mobile technology, (5) evaluating new policy changes on worker safety outcomes, and (6) exploring construction workforce sustainability. Many investigators have entered the field of construction safety and health research through a CPWR small study. More than 60% of small study recipients published their findings in peer-reviewed journals.

Details:

https://www.cpwr.com/research/small-study-program

CENTERS OF EXCELLENCE FOR *TOTAL WORKER HEALTH®*

In FY2018, NIOSH funded six Centers of Excellence, located throughout the United States, to explore and research the concepts of *Total Worker Health* (TWH). NIOSH defines TWH as policies, programs, and practices that integrate protection from work-related safety and health hazards with the promotion of injury and illness prevention efforts to advance worker well-being. TWH principles aim to broadly integrate workplace systems to control hazards and exposures, organization of work, compensation and benefits, work-life balance, and organizational change management. Their approach works toward a hazard-free workplace for all workers.

The centers made important efforts toward TWH:

- Pilot testing of promising workplace policies and programs.
- Developing and distributing best practices and tool kits.
- Creating strategies to overcome barriers for adoption of work-based interventions to protect and promote health.
- Investigating costs and benefits associated with integrated programs.
- Promoting increased development and application of biological markers of stress, sleep, and depression to protect workers and improve worker health.
- Examining the relationships between workplace policies and practices and worker health outcomes.

Public Health Relevance

The Centers of Excellence develop and evaluate interventions to improve safety, health, and well-being—TWH approaches—in high-risk industries that can reduce healthcare costs when adopted on a broad scale. The centers enable translation from research to practice, testing the process and feasibility of applying TWH approaches in real-world environments through the sectors of manufacturing, healthcare, transportation, public safety, services, and construction. They also have initiatives focused on small business. Efforts include an integrative and comprehensive approach to reduce workplace hazards and promote worker health. This approach includes identifying the links between workplace culture and personal high-risk behaviors, as well as issues that transcend the workplace, such as work-family strain.

Research Outputs: Publications in FY2018

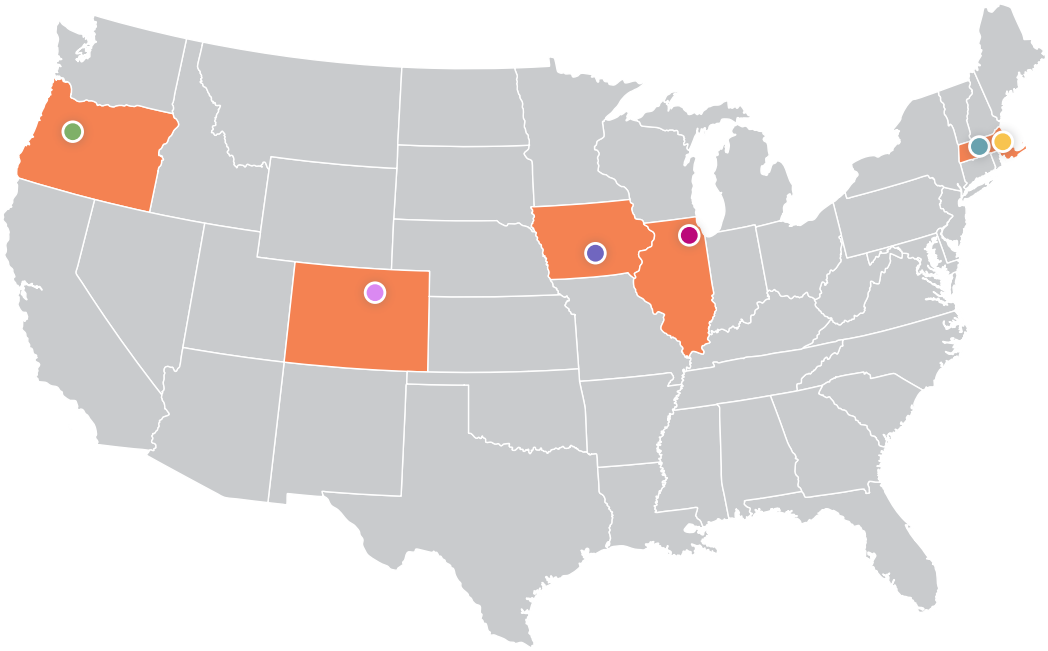
The Centers' outputs are the products of research activities and include publications. We collected publications by NIOSH-funded extramural researchers from principal investigator reports to NIOSH, the NIH Reporter database, the NIOSHTIC-2 database, and the PubMed database. From October 1, 2017, to September 30, 2018, the Centers of Excellence published 39 articles in peer-reviewed journals. Find a searchable database of NIOSH publications, which includes grantee final reports and publications, by using the NIOSHTIC-2 publications search.

Program Highlights FY2018

Thousands of Healthcare Providers Take Training to Help Prevent Opioid Misuse

The effects of opioid use and misuse are not isolated to work or home environments and the potential for addiction may be preceded

Centers of Excellence for *Total Worker Health*®



- Oregon Healthy Workforce Center (OHWC)
- University of Iowa Healthier Workforce Center of the Midwest
- Center for Health, Work, & Environment
- Center for the Promotion of Health in the New England Workplace (CPH-NEW)
- The Harvard T.H. Chan School of Public Health Center for Work, Health, & Well-being
- UIC Center for Healthy Work

by injuries that occur in the workplace. By using TWH principles, NIOSH is developing solutions to help workers and employers facing this epidemic in their communities. NIOSH-funded grantees and other partners are working to address the opioid crisis. In collaboration with partners, the Center for Health, Work & Environment and the Mountain and Plains ERC at the Colorado School of Public Health developed an evidence-based course to share best practices for treating patients experiencing pain while monitoring for and managing risks for opioid misuse and overdose. Intended for a healthcare audience, the course features guidelines for assessing patients, developing a comprehensive treatment plan, using first-line therapies, initiating an opioid trial and regimen, and preventing the diversion of legally prescribed or acquired opioid medications for unintended or illegal use. The course specifically addresses the management of pain in worker populations.

This two-hour webinar provides Continuing Medical Education (CME) credits for medical providers and prescribers. So far, nearly 3,000 healthcare workers have taken this training and received CME credits, and within the next five years, the Center plans to reach 10,000

medical providers. The Colorado Department of Regulatory Agencies included the course in its policies as a mandatory requirement for four healthcare-related professional licenses. The Colorado Medical Society also endorsed it. Additionally, the Colorado State Division of Workers' Compensation is requiring medical providers who treat injured workers to take the course, as is the state-based workers' compensation insurer, Pinnacol Assurance.

Details:

http://learn.chwe.ucdenver.edu/diweb/catalog/item?id=2284222

http://www.ucdenver.edu/academics/colleges/PublicHealth/research/centers/CHWE/Pages/TheCenter.aspx#

https://www.cdc.gov/niosh/topics/opioids/extramuralresearch.html

https://www.cdc.gov/niosh/topics/opioids/default.html

New Assessment Tool Evaluates Effectiveness of Workplace Safety and Health Programs

As more organizations offer increasingly comprehensive programs for workplace safety and health, researchers and organizations alike look for the best examples and tools to measure their effectiveness. With so many programs available, how do organizations know which one is best? Through a study, the Harvard Center for Work, Health, and Well-being designed a new tool to help. The Workplace Integrated Safety and Health (WISH) Assessment measures policies, programs, and practices that promote worker safety, health, and well-being.

The WISH Assessment is an expansion of a previous measurement tool, developed by the same researchers in this study. These scientists created this latest assessment tool based on an extensive review of published literature on workplace wellness programs, repeated cognitive testing, and semi-structured interviews. They tested and revised the WISH Assessment to ensure that its elements were clearly understood and effectively measured the intended concepts. The tool was finalized after identifying six factors for protecting and promoting worker safety, health, and well-being: (1) leadership commitment; (2) participation; (3) policies, programs, and practices that foster supportive working conditions; (4) comprehensive and collaborative strategies; (5) adherence to federal and state regulations and ethical norms; and (6) regular evaluations that guide safety, health, and well-being activities.

Ultimately, the assessment could help direct priorities among organizations and guide research in workplace policies, programs, and practices to improve worker well-being. Next steps include additional testing on the WISH Assessment to validate the tool across multiple samples and designing and testing a scoring system that organizations can use. Harvard researchers are planning to use the WISH Assessment in a future study focused on the association between TWH approaches and quality-of-care outcomes in 500 nursing homes.

Details:

https://www.ncbi.nlm.nih.gov/pubmed/29389812

https://www.cdc.gov/niosh/research-rounds/resroundsv4n3.html#d

http://centerforworkhealth.sph.harvard.edu/

Computer Simulation Helps Manufacturing Company Improve Safety and Health

How do manufacturing companies know the best and safest way to design workplaces and assign tasks? Ideally, injuries and illnesses should be prevented, but historically, companies have adjusted their workplace policies, practices, and procedures after an injury or illness occurred. The University of Iowa Healthier Workforce Center tested the role of computer simulation in promoting workers'

well-being by designing safer work. Known as digital human modeling, the simulation can help predict behavior and hazards and evaluate work design, without putting workers at risk or creating costly physical mock-ups.

Researchers collaborated for a year with a manufacturing company to examine digital human modeling in a real-world setting. Using a commercially available software, researchers simulated seven distinct work tasks to identify risks for musculoskeletal disorders and develop and evaluate workstation designs to reduce risks. They also looked at the connection between nonwork-related risks like body mass index and work-related tasks. The manufacturing company used the findings from this study to update its training procedures and cart-loading recommendations. It also used digital human modeling to redesign its workstations.

Researchers determined that digital human modeling could help identify work-related risks, especially in scenarios that are difficult to assess with traditional approaches. However, these scientists caution that more research is needed to understand additional uses and barriers for using digital human modeling to prevent work-related injuries and illnesses.

Details:

https://www.tandfonline.com/doi/abs/10.1080/24725838.2018.1491430?journalCode=uehf21

https://www.public-health.uiowa.edu/hwcmw/

https://www.cdc.gov/niosh/research-rounds/resroundsv4n9.html#c

SHIFT Project Leads to Increased Union Engagement in Workplace Health and Safety Committees

In the New England area, six healthcare facilities now have local labor unions more engaged with their health and safety initiatives. This move followed research from the Center for the Promotion of Health in the New England Workplace (CPH-NEW). In the study, a revised version of CPH-NEW's Healthy Workplace Participatory Program was put into place in these facilities. The Safety & Health through Integrated, Facilitated Teams (SHIFT) study evaluated this intervention's effectiveness in increasing the engagement and impact of combined, labor-management health and safety committees.

Prior to SHIFT, the six facilities had committees in place, but they did not meet regularly and had limited labor union involvement. Now, the committees' active membership includes labor unions, and committee cofacilitators are union bargaining unit members. The committees consist of 8–12 workers, with more than half of them in nonmanagement roles, and they now meet more frequently. Following SHIFT, organizational leaders are also more involved in workplace health and safety efforts, with one leader from each facility serving as a liaison between management, the committee, and the SHIFT research team.

Details:

https://www.uml.edu/Research/CPH-NEW/Research/Healthcare.aspx

https://www.uml.edu/Research/CPH-NEW/Healthy-Work-Participatory-Program/

Sleep and Workplace Safety Practices Among Construction Workers

The NIOSH TWH Program looks for ways that organizations can improve worker health and well-being, on and off the job. One aspect of home that overlaps into work is sleep. Healthy sleep is critical for worker safety and well-being, especially for work, such as construction, which requires following many safety procedures. Knowing how lack of sleep affects safety behaviors and how to design effective, organizational-level interventions can improve worker health and safety.

The Oregon Healthy Workforce Center looked at the relationship between self-reported sleep and lapses in attention, memory, and action at work that could impact safety. Researchers referred to these lapses as cognitive or thought failures. Sleep behavior included quantity or duration and quality, which is the feeling of being rested. Sleep behavior also includes the ability to fall asleep and stay asleep. To increase understanding of how these factors relate, the study looked at workers' sleep quantity and quality and workplace safety behaviors, including participation in safety procedures. The study also looked at reports of minor injuries, such as cuts, bruises, or sprains, which did not cause workers to miss work, whether the injury required first aid or not.

The study used information from three surveys conducted during 2012–2013, which were completed by more than 318 construction workers. Results suggest that workers with more insomnia symptoms are less likely to follow required and voluntary safety behaviors and are at higher risk for minor workplace injuries due to cognitive failures. In addition, workers who reported not feeling well rested upon waking, on average, also reported that they were less likely to follow safety procedures. These findings indicate that organizations can improve safety with tools to reduce insomnia symptoms and improve sleep. Researchers' next steps include studying how to reduce workers' insomnia symptoms and improve their ability to fall and stay asleep, as well as studying how sleep influences day-to-day safety behavior and more serious workplace injuries.

Details:

https://www2a.cdc.gov/nioshtic-2/BuildQyr.asp?s1=20054032&f1=NN&View=f

https://www.cdc.gov/niosh/research-rounds/resroundsv4n6.html#c

https://www.ohsu.edu/xd/research/centers-institutes/oregon-institute-occupational-health-sciences/oregon-healthy-workforce-center/about/index.cfm

Focusing on Community to Improve Worker Health

Workplaces can play a large role in improving worker health, resulting in improved community health. But how can workplaces and communities interact to influence the overall health of workers? Can workers in precarious work arrangements, often characterized by low wages and few or no benefits, rely on their communities to help them in protecting and promoting safer and healthier work?

The University of Illinois at Chicago (UIC) Center for Healthy Work is exploring how to implement safer and healthier approaches to work that extend into the community. Researchers at the Center are engaging with local neighborhoods, especially those with residents in precarious work, to find ways to improve worker health at the community level. To identify what works, they are using a community health survey, focus groups, interviews, and an approach called concept mapping. Concept mapping creates a visual representation of participants' thoughts about and priorities between health and work. By engaging directly with communities and their workers, researchers can continue to raise awareness of the relationship between communities, work, and health, as well as develop new TWH interventions. The Center's next steps include intervention mapping, which plots evidenced-based interventions to specific community needs.

Details:

http://publichealth.uic.edu/healthywork

https://healthywork.uic.edu/initiatives/greater-lawndale-healthy-work-project/

https://www.cdc.gov/niosh/research-rounds/resroundsv4n9.html#d

EDUCATION AND RESEARCH CENTERS

NIOSH supports professional training in occupational safety and health (OSH) through training programs in Education and Research Centers (ERCs). ERCs are university-based multidisciplinary centers that offer graduate, post-graduate, and research training in the core and allied fields of occupational safety and health. ERCs also supply continuing education and outreach to the OSH community throughout the federal health region they serve. ERCs are interdisciplinary programs and a major part of a network of training grants that help ensure an adequate supply of qualified professional practitioners and researchers. Essential ERC components are outreach and research-to-practice activities with other institutions, businesses, community groups, and agencies within their region, as well as academic programs. Programs respond to area needs and carry out new strategies and initiatives to meet those needs, with a focus on worker health and safety.

Public Health Relevance

The Occupational Safety and Health Act of 1970 (Public Law 91-596) directs NIOSH to ensure an adequate supply of qualified occupational safety and health personnel. NIOSH responded to this mandate by funding training programs to increase the number and competencies of the occupational safety and health workforce in the United States. NIOSH-funded ERCs are central to this response and serve a vital role in protecting the health and safety of the nation's workforce. Aligning with the goals of Healthy People 2020—to prevent diseases, injuries, and deaths due to working conditions—ERCs improve occupational safety and health through education, research, and collaboration. They serve as regional and national resources on these issues for business, labor, government, and the public.

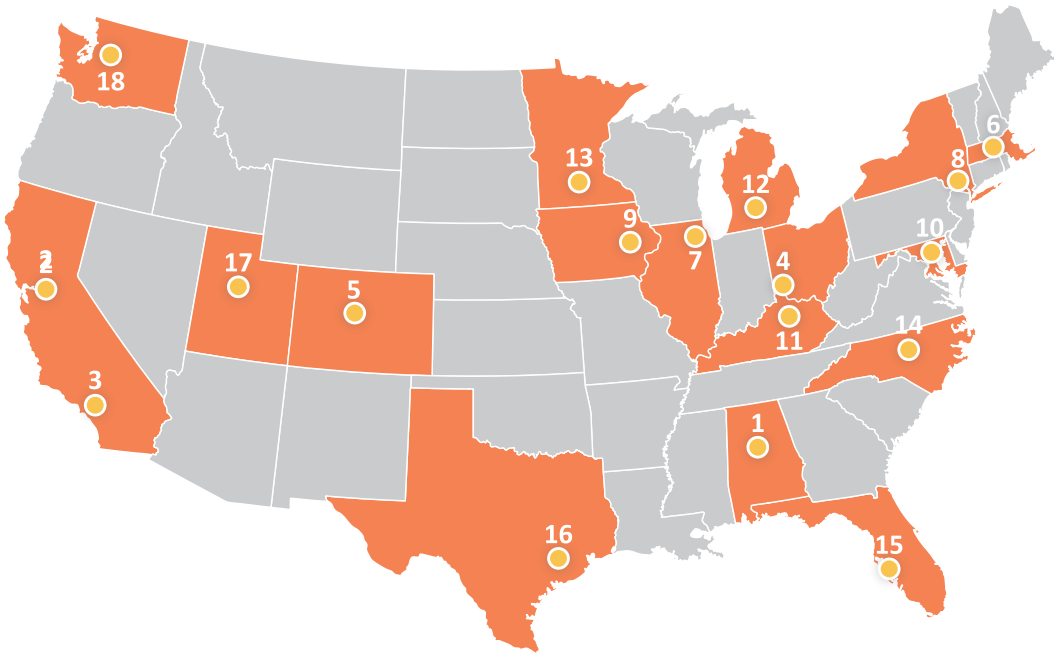
ERCs meet the critical need to produce researchers and practitioners—vital to maintaining workplace health and safety—and reduce the burden of preventable work-related injury, illness, and death by performing the following actions:

- Providing the necessary knowledge to the U.S. workforce to reduce the burden of work-related injury, illness, and death.
- Developing the major research advances needed to prevent occupational injuries, illnesses, and fatalities in the United States.
- Providing regional and industry-specific outreach and consultation to more than 5,000 small-, medium-, and large-sized U.S. businesses annually.
- Serving as the primary knowledge source for public and government leaders for job-related safety issues without duplicating other government programs.

Research Outputs: Publications in FY2018

ERC outputs are the products of research activities and include publications. We collected publications by NIOSH-funded extramural researchers from principal investigator reports to NIOSH, the NIH Reporter database, the NIOSHTIC-2 database, and the PubMed database. From October 1, 2017, to September 30, 2018, the ERCs published 259 articles in peer-reviewed journals. Find a searchable database of NIOSH publications, which includes grantee final reports and publications, by using the NIOSHTIC-2 publications search.

NIOSH Education and Research Centers



1. University of Alabama at Birmingham
2. University of California, Berkeley
3. University of California, Los Angeles
4. University of Cincinnati
5. University of Colorado Denver
6. Harvard University
7. University of Illinois at Chicago
8. Icahn Mount Sinai School of Medicine
9. University of Iowa
10. Johns Hopkins University
11. University of Kentucky
12. University of Michigan
13. University of Minnesota
14. University of North Carolina at Chapel Hill
15. University of South Florida
16. University of Texas Health and Science Center at Houston
17. University of Utah
18. University of Washington

Program Highlights FY2018

Trainees, Graduates, and Employment of Graduates

In academic year 2017–2018, more than 300 students graduated from ERC programs with specialized training in disciplines including industrial hygiene, occupational health nursing, occupational medicine, occupational safety, and other closely related occupational safety and health fields. The number of students enrolled increased from 732 in FY2017 to 993 in FY2018. Table 14 shows the number of students enrolled, graduates, and employment status during FY2018.

Table 14. ERC Trainees, Graduates, and Employment, FY2018

Program Area	Enrolled	Graduates	Employed or seeking occupational safety and health employment (%)
Industrial Hygiene	326	110	110 (100)
Occupational Health Nursing	128	41	35 (85)
Occupational Medicine	113	36	36 (100)
Occupational Safety	172	47	45 (96)
Other Related Disciplines	254	68	67 (99)
Total	**993**	**302**	**293 (97)**

Table 15 shows the placement of FY2018 graduates by program area and work setting. We consider graduates looking for occupational safety and health employment and not working outside their field as remaining in the field.

Table 15. ERC Graduate employment by work setting, FY2018

Work Setting/ Program Area	Industrial Hygiene (n=110)	Occupational Health Nursing (n=41)	Occupational Medicine (n=36)	Occupational Safety (n=47)	Other (n=68)	Total (n=302)
Private Industry	52	7	2	33	16	110
Federal/ State/Local Government	25	4	2	6	19	56
Academic Institution	15	5	4	2	19	45
Clinic/Hospital	3	12	22	0	2	39
Other OSH Employment	3	3	2	1	2	11
Seeking Advanced OSH Degree	7	2	2	1	6	18
Seeking OSH Employment	5	2	2	2	3	14
Total	**110**	**35**	**36**	**45**	**67**	**293**

Table 16. Continuing Education Courses by discipline, FY2018

Discipline	Number of Courses	Number of Trainees	Person-Hours of Training
Industrial Hygiene	196	4,457	39,215
Occupational Health Nursing	213	6,569	31,262
Occupational Medicine	204	5,757	32,402
Occupational Safety	903	21,398	166,882
Ag Safety and Health	0	0	0
Other	244	8,323	89,443
Total	**1,760**	**46,504**	**359,204**

Continuing Education Outputs

Continuing education of occupational safety and health professionals is a required part of ERC funding. Each year, NIOSH ERCs train thousands of these professionals around the United States through course offerings in the occupational safety and health core and related disciplines. The table above shows the continuing education activity by discipline. In FY2018, ERCs provided 359,204 person hours of training to 46,504 occupational safety and health professionals who took 1,760 courses.

ERC Program Achievements

Link Found Between Prescription Drug Use Before and After Injury

Workers taking opioids or benzodiazepines (anxiety medications) prior to a work-related injury were more likely than other workers to continue taking the drugs after the injury, according to a 2018 publication from the University of Washington ERC. Additionally, these workers were also more likely to receive workers' compensation, reports the study in the *Journal of Occupational and Environmental Medicine*. To better respond to the nationwide opioid crisis, NIOSH supports research on work-related factors on the use of these drugs.

In one of the first large studies of pre- and post-injury use of opioids and benzodiazepines, researchers wanted to understand whether taking either drug before a work-related injury affected later use. They also aimed to find if pre-injury use affected the likelihood of receiving workers' compensation. The study looked at 313,543 workers' compensation claims from the Washington State Department of Labor and Industries with dates of injury from January 2012 through December 2015. Researchers also reviewed records from the Washington State Prescription Monitoring Program for opioids and benzodiazepines.

The design of this study only shows a relationship, not cause and effect, between pre- and post-injury use of opioids and benzodiazepines. Nevertheless, the study's findings indicate that the risk for long-term disability after a work-related injury may be greater among workers already taking

opioids or benzodiazepines than among those who do not take them.

Details:

https://journals.lww.com/joem/Fulltext/2018/09000/Opioid_and_Benzodiazepine_Use_Before_Injury_Among.9.aspx

https://www.cdc.gov/niosh/research-rounds/resroundsv4n5.html#c

https://www.cdc.gov/niosh/topics/opioids/extramuralresearch.html

https://www.cdc.gov/niosh/topics/opioids/default.html

https://deohs.washington.edu/nwcohs

Trainees Help Improve Workplace Safety for Los Angeles Transit Workers

The Metropolitan Transportation Authority (MTA) of Los Angeles is now using engineering controls developed by ERC trainees at University of California, Los Angeles (UCLA). MTA is using these controls or strategies to protect its 260 workers from hazardous noise and welding fumes. This happened following a site visit where all the trainees completed a walk-through of the MTA maintenance facilities and identified occupational health and safety hazards. These included dangerous chemicals, hazardous noise levels, and risks of musculoskeletal disorders. After collecting this information, the ERC trainees and faculty discussed and recommended potential controls of these workplace hazards that the MTA could use to improve worker safety, health and well-being. UCLA planned this industrial site visit to educate its trainees and help them develop into effective occupational safety and health professionals.

Details:

https://erc.ucla.edu/

Effects of Shift Work on Police and Security Workers

For law enforcement officers, inadequate sleep can be a problem due to shift work, long work hours, and scheduling conflicts—all factors resulting in sleep deprivation and other sleep issues. Police officers who do not get adequate, quality sleep are at risk for motor vehicle crashes due to drowsy driving, as well as other health effects. To address this issue, a trainee at the New York and New Jersey ERC (Mount Sinai School of Medicine) led a study focused on how permanent or nonrotating shifts and extended work hours (12-hour) affect police and security workers. The research assessed alertness, sleep, and wellness among 39 police and security officers who had been working in 8- and 12-hour permanent shifts for at least five years.

Across the nation, police agencies are increasingly adopting these type of work arrangements. It has been widely assumed that extended hours benefit workers because they have more days off and that permanent shifts lead to more stable sleep patterns. However, according to this study's findings, these arrangements are associated with increased sleep problems and decreased mental attention. The scientists found that 12-hour shifts had more negative health effects than 8-hour shifts and presented these results at the 20th Congress of the International Ergonomics Association.

Details:

https://www.researchwithnj.com/en/publications/differential-effects-of-8-and-12-hour-non-rotating-shifts-on-aler

http://www.nynjerc.org/

https://blogs.cdc.gov/niosh-science-blog/2017/05/16/officer-safety-research/

Long-haul Trucking Survey Describes Common Injuries

The combination of long hours of sitting punctuated by periods of loading and unloading heavy goods makes long-haul trucking one of the highest-risk occupations for musculoskeletal injuries. These injuries occur nearly four times more often among long-haul truck drivers than among other workers, according to the Bureau of Labor Statistics. Despite the

higher risk, little information is available about the types of injuries that affect long-haul truck drivers. Which injuries are the most common? How do they occur?

To answer these questions, a study at the University of Alabama at Birmingham ERC analyzed information from the 2010 NIOSH National Survey on Long-haul Truck Drivers. The large-scale survey comprised 1,265 long-haul truck drivers in 32 truck stops in five regions nationwide: the South, Great Lakes, Central, West, and Northeast. Researchers required all survey participants to have worked as a driver on a large truck (three or more axles) for at least 12 months.

Of the truck drivers who completed the survey, 95 (7.5%) reported experiencing work-related injuries over the past year. The most common types of injuries were sprains and strains, accounting for 60% of injuries reported in the survey. The arms were the most commonly affected body part, making up 26% of all musculoskeletal injuries reported, followed by the back at 21%. Looking at cause, most of the musculoskeletal injuries reported (39%) stemmed from falls, followed by contact with an object or equipment (34%).

The findings from this large-scale survey underscore the importance of developing ways to prevent musculoskeletal injuries among long-haul truck drivers. In FY2018, this study appeared in the journal *Workplace Health & Safety*.

Details:

https://journals.sagepub.com/doi/full/10.1177/2165079917750935

https://www.soph.uab.edu/dsc/

https://www.cdc.gov/niosh/research-rounds/resroundsv4n5.html#d

INVESTIGATOR-INITIATED RESEARCH

The NIOSH extramural research program supports relevant, high-quality scientific investigations that help reduce work-related injuries, illnesses, and fatalities. These awards include funding for large projects (R01) as well as small projects (R03) and exploratory research grants (R21).

RESEARCH GRANTS

The R01 funding opportunity focuses on developing an understanding of the risks and conditions associated with job-related injuries, illnesses, and fatalities. These projects also explore methods to reduce risks and prevent or lessen exposure to hazardous workplace conditions. The R03 funding mechanism supports research projects that can be completed in 2 years with limited resources, including pilot and feasibility studies, secondary analysis of existing data, and small, self-contained research projects. The R21 mechanism encourages research to explore novel scientific ideas or develop new techniques, methods, model systems, tools, or other applications with the potential for significant impact on work-related safety and health.

The extramural research portfolio also includes mentored research scientist development (K01) awards that offer postdoctoral training for the next generation of occupational safety and health scientists. These highly competitive K01 awards give up to 3 years of funding and a scientific research focus designed to develop the skills and productivity of new research scientists as they transition between postdoctoral training and independent research careers.

NIOSH awards conference and scientific meeting grants under two research grant mechanisms: R13 and U13. Both grants support high quality, scientific conferences/meetings relevant to the safety and health of workers, including symposia, seminars, and workshops.

Public Health Relevance

The mission of NIOSH is to develop new knowledge in the field of occupational safety and health and then transfer it to practice. The extramural research program advances this mission through its research. This work helps in identifying workers at risk, developing methods for measuring hazard exposures, and detecting adverse health effects. The program also helps in determining the frequency of job-related hazards, increasing understanding of the causes of work-related diseases and injuries, and reducing or eliminating hazard exposures. Grantees share research results through diverse communication channels, including scientific meetings, conferences, and workshops.

Research Outputs: Publications in FY2018

Investigator-initiated research outputs are the products of research activities and include publications. We collected publications by NIOSH-funded extramural researchers from principal investigator reports to NIOSH, the NIH Reporter database, the NIOSHTIC-2 database, and the PubMed database. From October 1, 2017, to September 30, 2018, R01 grant-funded researchers published 117 articles in peer-reviewed journals. The numbers of peer-reviewed publications for the other investigator-initiated research mechanisms are 7 (R03), 31 (R21), and 17 (K01). Find a searchable database of NIOSH publications, which includes grantee final reports and publications, by using the NIOSHTIC-2 publications search.

Program Highlights FY2018

Award-winning Farm Dinner Theater Featured in National Magazine

Project Title: Farm Theater: A Novel Safety Strategy Approach for Agricultural Communities (R01 Grant).

Principal Investigator: D. Reed

Agriculture has an excessive worker injury rate. An estimated 58,385 work-related adult farm injuries (more than six every hour) occurred in 2014. In 2016, 417 farmers and farm workers died from a work-related injury. Additionally, senior farmers and adult farmers in the South experience some of the highest occupational injury and fatality rates in the United States. Reaching farmers with safety and health information can be challenging. They are rarely in the same place and used to working in isolation and taking care of their own safety. Additionally, they have little time to be away from the farm and their work. So what is the best way to break through to this high-risk group with safety and health information? This project at the University of Kentucky developed a new idea—a farm dinner theater.

This program works with established community-based Cooperative Extension Agents in Kentucky, Tennessee, and Mississippi to develop and test a theater intervention aimed at positively changing farm work culture and safety behavior. The theater uses a didactic reader format where participants read from scripts on topics relevant to their communities. Examples include falls, hearing conservation, skin cancer, intergenerational issues of work, equipment operation and reaction time, livestock handling, and virtually any topic related to the farming community. Local actors and farmers put on the plays. So far, each performance has a waiting list. The *Oprah Magazine* featured the program, along with the study's principal investigator, Deborah Reed, PhD, in an article. The program has received numerous awards including the American Academy of Nursing's Edge Runner Award and the Search for Excellence in Farm Health and Safety from the National County Extension Agriculture Agent Organization.

Details:

https://blogs.cdc.gov/niosh-science-blog/2019/05/10/farm-theater/

https://www.oprahmag.com/life/a27168740/nurses-saving-the-world/

http://www.uky.edu/nursing/about-us/news/dr-deborah-reed-named-among-five-nurses-who-just-might-save-world-o-oprah-magazine

http://grantome.com/grant/NIH/R01-OH010666-04

Link Found Between Cancer Risk and Exposure to Viruses in Poultry

Project Title: Case-cohort Study of Cancers in Excess in Poultry Workers (R01 Grant).

Principal Investigator: E. Johnson

Among the viruses that commonly infect chicken and turkeys are oncogenic viruses, which cause cancer. However, there is limited information on how these viruses may

influence humans' risk for cancer. Humans in the general population are widely exposed to these viruses through poultry and their by-products. This lack of knowledge is critical because there have not been enough studies about the cancer risk in exposed individuals.

To address this gap, this unique project studied workers who had been exposed to high levels of oncogenic viruses and other cancer-causing substances in poultry or chicken while working in slaughtering and processing plants. The latter exposure included substances these workers were around while smoking, curing, and wrapping meat on the job or exposed to while off work.

Researchers focused on connections between specific exposures and the development of cancers in varied areas, including the lungs, brain, pancreas, liver, ovary, buccal cavity, and pharynx. Published in the journal *Environmental Research*, study results showed potential links between lung cancer and oncogenic viruses from poultry, as well as from the other cancer-causing chemicals. In particular, the highest cancer risk was for workers who had job tasks that included washing, cutting, and removing parts of chickens, in addition to having direct contact with their blood. However, scientists did not find an increased cancer risk for office workers and those in the packing area of processing plants. Researchers highlight these and other study limitations in the publication, but do not provide genetic evidence that these oncogenic viruses cause cancer in humans. Because this study has potential public health implications, especially for poultry workers who have high fatality rates from cancer, researchers are continuing to conduct research in this area.

Details:

https://www.sciencedirect.com/science/article/pii/S0013935118304195?via%3Dihub

http://grantome.com/grant/NIH/R01-OH009572-06

Estimates of Farm Workers' Physical Activity Could Help Prevent Heat-related Illness

Project Title: Reducing the Risk of Heat-related Illness in Western Agricultural Workers (R01 Grant).

Principal Investigator: M. Schenker

Farm workers are at high risk for heat-related illness in hot temperatures, especially during summer crop production. Farming is also physically demanding, further increasing the likelihood of developing heat-related illness. An estimated 30%–40% of U.S. farm workers are employed in California. In the past, there was limited research on their physical activity and how it contributes to heat-related illness.

Focusing on this issue, researchers at the University of California, Davis, estimated the physical activity involved in common, strenuous farm tasks that could contribute to heat-related illness among these workers. Study participants included 575 Californian workers on 28 farms in the Central and Imperial Valleys. Researchers used devices called accelerometers, which are clipped onto a hip belt, to measure step counts per minute (cpm) during tasks over the course of a work shift. They then estimated the time spent in light, moderate, or vigorous activity. Researchers found the overall average step count for farm workers was 345 cpm, defined as light activity. Produce carriers had the highest average level of physical activity, with 700 cpm, and ground pruners, who remove or trim plants, had the lowest number at 150 cpm.

The scientists determined a strong link between higher environmental temperature and reduced physical activity. Other factors associated with decreased physical activity included increased age and tasks such as ground pruning, sorting or separating, and harvesting crops. In contrast, doing irrigation work and performing more than one

task at the same time were associated with increased physical activity, as well as when pay was based on work completed, rather than on time. These factors could increase the risk for heat-related illness. In FY2018, this study was published in the journal *Occupational and Environmental Hygiene*.

Details:

https://www.tandfonline.com/doi/full/10.1080/15459624.2018.1519319#aHR0cHM6Ly93d3cudGFuZGZvbmxpbmUuY29tL2RvaS9wZGYvMTAuMTA4MC8xNTQ1OTYyNC4yMDE4LjE1MTkzMTk/bmVlZEFjY2Vzcz10cnVlQEBAMA==

http://grantome.com/grant/NIH/R01-OH010243-04

https://www.cdc.gov/niosh/research-rounds/resroundsv4n10.html#b

Thirty-year Study on Exposure to Endotoxin and Respiratory Disease in Textile Workers

Project Title: Lung Disease in Chinese Textile Workers (R01 Grant).

Principal Investigator: D. Christiani

In the United States, at least five million workers across multiple industries are possibly exposed to airborne endotoxin—a dangerous substance released from bacterial cells. However, while research shows short-term exposure leads to respiratory problems like dynamic airflow obstruction, the health effects of chronic or long-term contact with endotoxin remains unknown. Limited studies exist related to this issue, and most of them focus on exposure for less than a decade. As a result, there is little knowledge on how chronic exposure affects the lungs, including the development of lung disease after a person is no longer exposed and the underlying causes for severe cases of the illness.

In a unique study, scientists at the Harvard T.H. Chan School of Public Health evaluated Chinese textile workers' exposure over three decades to endotoxin and cotton dust. Specifically, they looked into the pulmonary or lung-related impact of chronic exposure and how these workers' health was impacted after they were no longer around the substances.

This project is the longest running and largest prospective study involving a cohort of textile workers. Study participants included 919 Shanghai residents who were exposed to high levels of cotton dust and endotoxin while employed as cotton workers, and the majority of them having never smoked. Researchers determined the effects of long-term respiratory disease could actually be reversed after workers were no longer on the job and exposed. The scientists also looked into the role that smoking and genetics play related to this topic. The findings of this study are leading to a better understanding of how long-term contact with cotton dust and endotoxin influences chronic respiratory issues.

Details:

http://grantome.com/grant/NIH/R01-OH002421-23A1

Bolstering Nighttime Visibility in Roadway Work Zones

Project Title: Warning Beacons for Front Line Service Worker Safety (R01 Grant).

Principal Investigator: M. Rea

Roadway work zones can be dangerous both for motorists and for construction workers who build, repair, and maintain streets, bridges, and highways. In these areas, a variety of complicated road signs, barrels, and lane changes could increase the risk of motor vehicle crashes. To prevent this issue, safety equipment, such as flashing yellow warning beacons, is critical. These lights aim to get motorists' attention as they approach or drive through work zones and to alert them of potential hazards and nearby workers. However, current standards for warning beacons include a minimum light intensity to ensure risks are seen, but do not identify a maximum degree of light intensity to protect

against glare or distraction. The standards also do not differ between daytime and nighttime conditions despite research showing the need for less light intensity at night.

To address this issue, scientists at Rensselaer Polytechnic Institute explored the effect of various light intensities and other factors on motorists' ability to detect workers while approaching work zones and warning beacons. These other factors included how frequently the warning beacons flashed and whether or not workers wore high-visibility, reflective safety clothing.

Researchers conducted a nighttime field study on a test track with four life-sized, cardboard workers—two with and two without reflective vests—positioned alongside the track lit with warning beacons. Published in *Accident Analysis & Prevention*, the study showed visibility was greatest at night when the warning beacons had light intensities (max/min) of 25/2.5 candelas (cd) and 150/15 cd, and flash frequencies of either 1 hertz (Hz) or 4 Hz. Furthermore, the reflective vests allowed the drivers to see the simulated workers at the farthest distance tested, regardless of the frequency and intensity of the warning beacons. The findings of this study can help protect workers by increasing visibility in roadway work zones.

Details:

https://www.sciencedirect.com/science/article/pii/S000145751830263X?via%3Dihub

https://www.cdc.gov/niosh/research-rounds/resroundsv4n11.html#d

http://grantome.com/grant/NIH/R01-OH010165-04

Lighting Interventions to Improve Healthcare Workers' Sleep and Occupational Safety and Health

Project Title: Lighting Interventions to Reduce Circadian Disruption in Rotating Shift Workers (R01 Grant).

Principal Investigator: M. Figueiro

Healthcare workers can sometimes have sleep difficulties because of their circadian rhythm, or the internal biological clock that regulates sleep, being disturbed. Circadian rhythm disturbance is especially evident for those who do rotating or shift work. When individuals are exposed to a natural sunrise and sunset, the circadian rhythm is synchronized to a 24-hour cycle. However, a constant mismatch between a person's circadian rhythm and environment, including lighting, can disrupt normal sleep patterns, possibly leading to fatigue, injuries, mood changes, and other health problems. Lighting on the job that is either too intense or too low can disrupt healthcare workers' circadian rhythm, especially for nighttime employees, deceasing their alertness and productivity.

Researchers have been working to increase their understanding of circadian rhythms and how light of varying wavelengths can support or interrupt natural sleep cycles. Specifically, NIOSH-funded scientists at Rensselaer Polytechnic Institute investigated the effectiveness of using a red-frequency light in work settings to help with circadian disruption. As reported in the journal *Sleep Review*, initial results show the red light increases alertness without stifling melatonin, which can occur when people are exposed to certain light wavelengths. Decreased melatonin can hinder one's circadian rhythm, causing sleep and other health issues.

This project could significantly benefit shift workers by improving their sleep, as well as their mood and well-being. In FY2018,

researchers on this study collaborated with the Light and Health Alliance to develop and disseminate short videos on the science behind lighting and improved human health.

Details:

http://www.sleepreviewmag.com/2019/05/circadian-lighting/

https://www.lrc.rpi.edu/programs/lightHealth/index.asp

http://grantome.com/grant/NIH/R01-OH010668-03

Study Identifies Factors Linked to Healthcare Workers' Use of Patient Lift Equipment

Project Title: Crossover Study of Factors Associated With Patient Lift Equipment Use (R21 Grant).

Principal Investigator: K. Kucera

Lifting and other patient handling tasks account for more than half of workers' compensation costs related to musculoskeletal injuries among caregivers, including nurses and other healthcare workers. Patient lift equipment and other support devices designed to move patients have been recommended for safety in the healthcare field. However, according to past research, these equipment and devices are not regularly used despite their increased availability and the implementation of Safe Resident Handling policies, trainings, and programs. So what leads to the use or nonuse of patient lift devices? The answer to this question could result in better approaches, including policies and trainings, which increase their adoption in the workplace.

This study investigated factors that influence the utilization of patient lift equipment. Using a multilevel approach, researchers developed a survey related to lifting and transferring patients that was completed by more than 100 nurses and nursing assistants. The survey collected data on demographics, work experience, training, patient lifting, and lift equipment use, as well as on workers' exposure to factors possibly linked to lift equipment use. A smaller group of these workers participated in a lift assessment and a case crossover study. The crossover study allowed researchers to measure the relationship between the use of lift equipment and the factors influencing that use, along with the frequency of the use.

According to the study, the nursing staff used equipment to lift or transfer only 21% of patients. The use of equipment differed by the type of movement being performed. Factors influencing lift equipment use included its accessibility, available staff support, the extent to which patients are mobile, and whether equipment is required for the task. Researchers have presented their findings in peer-review journals and at national conferences. In addition, they shared the study results at nurse executive council meetings for hospitals involved in this project.

Details:

https://www.sciencedirect.com/science/article/pii/S0020748918302657

http://grantome.com/grant/NIH/R21-OH010542-02

Associations Between Heat Exposure, Injury, and Productivity in Agricultural Workers

Project Title: Heat Exposure, Injury Risk, and Productivity in Agricultural Workers (K01 Grant).

Principal Investigator: J. Spector

Farm workers die from heat-related illness at an annual rate 20 times that of other workers in the United States. According to past research, exposure to heat could increase the risk of traumatic injuries, but there is limited information on what is behind this association. To address this issue, University of Washington researchers investigated the relationship between the heat stress that

agricultural workers experience, their injury risk, and their job productivity. Study participants included more than 12,250 outdoor agricultural workers in Washington State.

Researchers collected various information including workers' compensation traumatic injury data, measures of workers' balance and vigilance along with other forms of productivity, and local weather reports. Data on injury and heat conditions for the majority of the workers reflected the period of 2000–2012. Weather and performance data for a smaller sample of 46 workers were collected during August and September 2015.

Through methods of statistical modeling, researchers estimated associations between these data. They found agricultural workers who work in warm temperatures are at risk for heat-related traumatic injuries. However, heat was not linked to decreased vigilance or balance. According to study findings, the relationship between heat exposure and worker productivity is complicated and likely impacted by work factors and economic demands, influencing physical labor and heat exposure.

Researchers partnered with the Pacific Northwest Agricultural Safety and Health Center (Ag Center) to share these findings through the media, community events, conference presentations, educational trainings in English and Spanish, community events, and peer-reviewed publications. As a result, they reached workers, occupational safety and health professionals and researchers, along with stakeholders in the community, industry and government.

Details:

https://www.ncbi.nlm.nih.gov/pubmed/29122180

http://grantome.com/grant/NIH/K01-OH010672-03

COOPERATIVE RESEARCH AGREEMENTS

Cooperative agreements allow NIOSH to partner with universities, state health departments, labor unions, and nonprofit organizations to address important public health problems. NIOSH funds a broad array of these agreements to develop knowledge in preventing job-related diseases, injuries, and fatalities.

In FY2018, NIOSH funded the state surveillance program to support states in monitoring occupational injuries, diseases, deaths, and hazards. Other cooperative agreements awarded in FY2018 included funding to monitor workers' compensation claims, funding for AFF to support forestry safety research, and National Mesothelioma Virtual Bank funding. Selected highlights from the state surveillance program are provided below.

STATE SURVEILLANCE PROGRAM

The state surveillance program helps expand the ability of states to monitor work-related health and safety issues. The program supports the role of states to conduct in-depth surveillance and follow-up investigations and interventions. These local state-based skills and abilities help NIOSH meet the mandate to ensure a safe workplace.

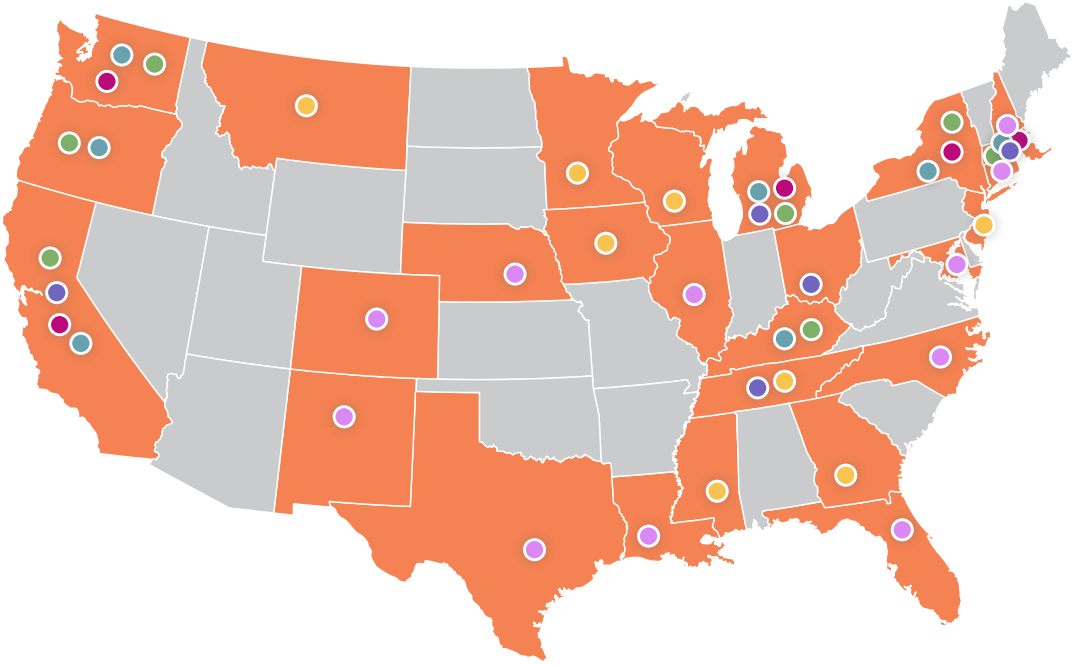
Public Health Relevance

NIOSH values state programs and gives financial and technical support to state health and labor agencies to develop and expand their occupational health surveillance programs. The NIOSH extramural surveillance portfolio includes 26 state recipients composed of 49 projects focusing on work-related injuries and death, exposures and hazards, and worker populations of interest. These programs use and distribute surveillance data to find the incidences of job-related injuries, illnesses, and fatalities. They help to discover trends, research opportunities, emerging issues, and high-risk worker populations. The programs also create and send out targeted educational and prevention materials, adapting materials to best protect workers. They often engage in outreach and involve partners in public health and safety to advance "data into action."

Research Outputs: Publications in FY2018

State surveillance program outputs are the products of research activities and include publications. We collected publications by NIOSH-funded extramural researchers from principal investigator reports to NIOSH, the NIH Reporter database, the NIOSHTIC-2 database, and the PubMed database. From October 1, 2017, to September 30, 2018, the state surveillance program published 29 articles in peer-reviewed journals. Find a searchable database of NIOSH publications, which includes grantee final reports and publications, by using the NIOSHTIC-2 publications search.

NIOSH Sponsored State Occupational Health & Safety Surveillance Program



Fundamental Programs

Georgia
Iowa
Minnesota
Mississippi
Montana
New Jersey
Tennessee
Wisconsin

Fundamental-Plus Programs

Colorado
Connecticut
Florida
Illinois
Louisiana
Maryland
Nebraska
New Hampshire
New Mexico
North Carolina
Texas

Expanded Programs

California
Kentucky
Massachusetts
Michigan
New York
Oregon
Washington

Fatality Assessment & Control Evaluation

California
Kentucky
Massachusetts
Michigan
New York
Oregon
Washington

Respiratory Diseases Projects

California
Massachusetts
Michigan
New York
Washington

Workers' Compensation

California
Massachusetts
Michigan
Ohio
Tennessee

Program Highlights FY2018

Opioid-related Deaths Vary by Job in Massachusetts, With Highest Rates in More Dangerous Jobs

According to a study by the Massachusetts Department of Public Health (MDPH), Massachusetts workers died of opioid overdoses at vastly different rates depending upon their job. The highest rates were seen in construction and extraction, including quarrying, mining, and oil and gas removal, followed by agriculture, forestry, and fishing. To understand which industries and occupations have the highest rate of opioid-related deaths, researchers looked at 4,302 publicly available death certificates filed in Massachusetts from 2011 through 2015. They also used data from four national surveys to explore occupational factors that may contribute to differences in rates of opioid-related deaths in different occupations and industries.

Along with focusing on opioid-related deaths by occupations, the study also found differences by gender. Overall, most of the opioid-related deaths were among males, which is similar to findings for all opioid-related overdose deaths in Massachusetts. The rate of opioid-related overdose deaths was higher among workers employed in industries and occupations that have high rates of work-related injuries and illness based on data from the Bureau of Labor Statistic Survey of Occupational Injuries and Illnesses. The rate of fatal opioid overdose was also higher among workers employed in occupations with lower availability of paid sick leave (data from the Bureau of Labor Statistics Employee Benefits Survey) and high job insecurity, or the worry of becoming unemployed (data from the National Health Interview Survey).

Although more research is needed to understand how injury, job insecurity, paid sick leave, and other work factors may contribute to opioid overdose deaths, this study's findings highlight the critical need for immediate interventions. Massachusetts Health & Human Services Secretary Marylou Sudders says the findings are important because they indicate occupations where interventions can prevent injuries. For example, educational programs and policies targeted toward occupations with a high rate of fatal opioid overdose should aim to decrease workplace hazards that could cause injury, resulting in opioid prescriptions. The MDPH is currently building on this initial work to conduct subsequent analyses using more years of death certificate data to analyze patterns by race and ethnicity, occupational subgroups within the construction sector, substate geography, and toxicology. The MDPH is also currently working to develop and implement an educational outreach strategy targeting high-risk worker groups.

Details:

https://www.mass.gov/files/documents/2018/08/15/opioid-industry-occupation.pdf

www.mass.gov/opioidresponse

https://www.cdc.gov/niosh/research-rounds/resroundsv4n2.html#c

Michigan and New York Raising Awareness and Changing Policy on Use of Methylene Chloride in the United States

In recent years, the Michigan Fatality Assessment and Control Evaluation (MIFACE) Program and the New York State (NYS) Department of Health aimed to increase awareness of health and safety risks related to methylene chloride in various products, including paint strippers. Workers, consumers, and others can be exposed to this liquid substance through inhalation or skin contact, and the exposure can cause heart, liver and nervous system problems, irritation of the skin and eyes, and cancer.

Based on information from MIFACE, the Environmental Protection Agency proceeded with a proposed rule to ban the manufacturing and sales of methylene chloride paint removers for consumers. The NYS Department of Health also kicked off a weeklong campaign to ban these paint removers in stores, sharing data on methylene chloride related fatalities with lawmakers, nongovernment workers, environmental health advocates, and Occupational Safety and Health (OSH) groups in New York and a dozen other states. Some New York legislators used this information to initiate and support a bill to ban the use of the chemical in the state. Additionally, because of the efforts in Michigan and New York, 13 major retailers, including Lowes, The Home Depot, Walmart, and Amazon, announced they would stop selling paint removal products containing methylene chloride, along with N-methylpyrrolidone (NMP) chemicals.

Details:

https://oem.msu.edu/index.php/work-related-injuries/work-related-fatalities

https://www.health.ny.gov/environmental/workplace/occupational_health_surveillance/

https://www.epa.gov/newsreleases/epa-bans-consumer-sales-methylene-chloride-paint-removers-protecting-public

New York State Workers' Compensation Board Uses Surveillance Data to Review Legionnaires' Disease Cases

Legionnaires' disease is a serious respiratory illness that often occurs in older adults and individuals with vulnerable immune systems. It has been associated with the use of hot tubs and air conditioners in large buildings. However, little information is available on the occupational settings linked to Legionnaires' disease, along with common sources of it found in young and healthy workers.

The New York State (NYS) Department of Health launched an investigation into an incident where a healthy utility construction worker died from the illness. Prior to the fatality, investigators found the outdoor worker was exposed to standing water daily and eventually became sick with respiratory symptoms that initially medical providers did not properly diagnose and treat. It was later diagnosed as a severe case of Legionnaires' disease and the worker subsequently succumbed to the disease.

The NYS Workers' Compensation Board first denied this case's claim as work-related. However, the NYS Department of Health provided the board with prior data that connected outdoor work and exposure to standing water contaminated with the legionella bacteria, which causes the lung disease. Some of the data resulted from joint work between the NYS Department of Health and NIOSH on a health hazard evaluation on Legionnaires' disease at an automobile and scrap metal shredding facility. The Board later reversed its decision related to the fatality and planned to use the NYS Department of Health's information to review pending cases involving Legionnaires' disease to assess possible occupational causes.

Details:

https://www.health.ny.gov/environmental/workplace/occupational_health_surveillance/

New Surveillance System Looks at Immediate Hospitalizations and Work-related Injury

The Washington State Safety and Health Assessment and Research for Prevention (SHARP) occupational safety and health surveillance program developed a new surveillance system that captures data on immediate work-related inpatient hospitalizations. The system links hospital discharge data with workers' compensations claims to identify workers with hospital admissions within a day or less of being injured on the job. It provides descriptive information on high-risk injuries, allowing SHARP to evaluate the completeness of mandated employer

reporting of these cases and informing its injury prevention efforts. A technical report was published in FY2018 based on the surveillance system data for 2015. This information focused on worker demographics, injury descriptions, industry and occupation, along with workers' compensation claims. SHARP presented these results at the 2018 Council of State and Territorial Epidemiologists Conference in West Palm Beach, Florida, along with two agriculture safety and health forums in Washington State. Recently, the state legislature appointed funds for SHARP to expand the surveillance system, ensuring its sustainability.

Details:

https://lni.wa.gov/safety-health/safety-research/ongoing-projects/immediate-inpatient-hospitalizations

Investigation Shows Limited Respirator Use Among Emergency Responders After Toxic Gas Exposure

Most of the emergency responders dispatched to a serious incident involving a toxic gas exposure did not use required respirators for breathing protection, according to a NIOSH-funded investigation from the Texas Department of State Health Services. The gas, phosphine, forms when pesticides containing aluminum phosphide mix with water. These pesticides are restricted to certified users because short-term exposure can cause respiratory and cardiovascular, or heart and blood vessel, complications, and can be fatal. Federal regulations require emergency crews on the scene with such hazardous substances wear personal protective equipment, including a respirator. Multiple studies, however, show this does not typically happen. Little information is currently available on how to increase emergency responders' compliance.

The Texas Department of State Health Services reviewed this case of phosphine exposure among 51 hazardous materials emergency responders who evacuated and treated residents at an Amarillo, Texas, home after an outdoor pesticide application. The scientists reviewed call records from the Texas Poison Control Network related to the exposure and the results of a standardized health questionnaire completed by the emergency responders afterwards. More than 78% (40) of the emergency responders did not wear a respirator during the response. Of these, 15 received medical treatment and 7 reported new or worse phosphine exposure symptoms within a day after the incident. Their symptoms included eye pain, headaches, dizziness, abdominal cramps, and nausea.

The majority of the 51 emergency responders reported being trained in emergency response and understood standard operating procedures within their agency for handling incidents with hazardous substances. They gave several reasons for not wearing a respirator, including being unaware that it was necessary, focusing on rescuing people, and being unaware of the chemical's presence.

These findings show that emergency responder trainings alone do not result in proper use of respirators during incidences with unknown hazardous substances. Few studies exist of behavioral interventions related to the use of respirators and other personal protective equipment among emergency responders. Methods for improving compliance with existing guidance and regulations are also not well understood. Scientists say more research is needed to evaluate effective interventions to ensure that emergency responders comply with current recommendations and regulations for personal protective equipment.

Details:

https://www.cdc.gov/mmwr/volumes/67/wr/mm6713a2.htm

https://www.cdc.gov/niosh/research-rounds/resroundsv4n7.html#d

https://www.dshs.texas.gov/epitox/default.shtm

SPECIALTY TRAINING PROGRAMS

NIOSH funds programs that provide education and training in occupational safety and health in a variety of ways. Along with the ERCs described under Multidisciplinary Centers, NIOSH supports professional training in occupational safety and health through Training Project Grants (TPGs).

The Institute also funds the Miner Safety and Health Training Program—Western United States cooperative agreement, which connects the mining community with relevant information, resources, and methods that increase the volume and ability of safety training for Western States' miners

TRAINING PROJECT GRANTS

NIOSH supports professional training in occupational safety and health through TPGs. Most TPGs are academic training programs that support undergraduate and graduate training. Located throughout the United States, these programs enrich the national network of graduate training the ERCs offer. Along with TPGs for traditional degree training programs, NIOSH supports TPGs that respond to the unique training needs of specialty groups. These include the Association of Occupational and Environmental Clinics (AOEC) Occupational Health Internship Program (OHIP). This program supplies specialty training and increases diversity among health and safety practitioners by recruiting and mentoring students from underrepresented and underserved minorities.

Through a TPG, the Alaska Marine Safety Education Association expands the network of port-based fishing safety instructors in Alaska and the United States. They achieve this through a train-the-trainer curriculum designed for the unique needs of the commercial fishing industry. NIOSH also provides funding for the Emergency Responder Training Program through the International Association of Fire Fighters (IAFF), which this report later discusses.

Public Health Relevance

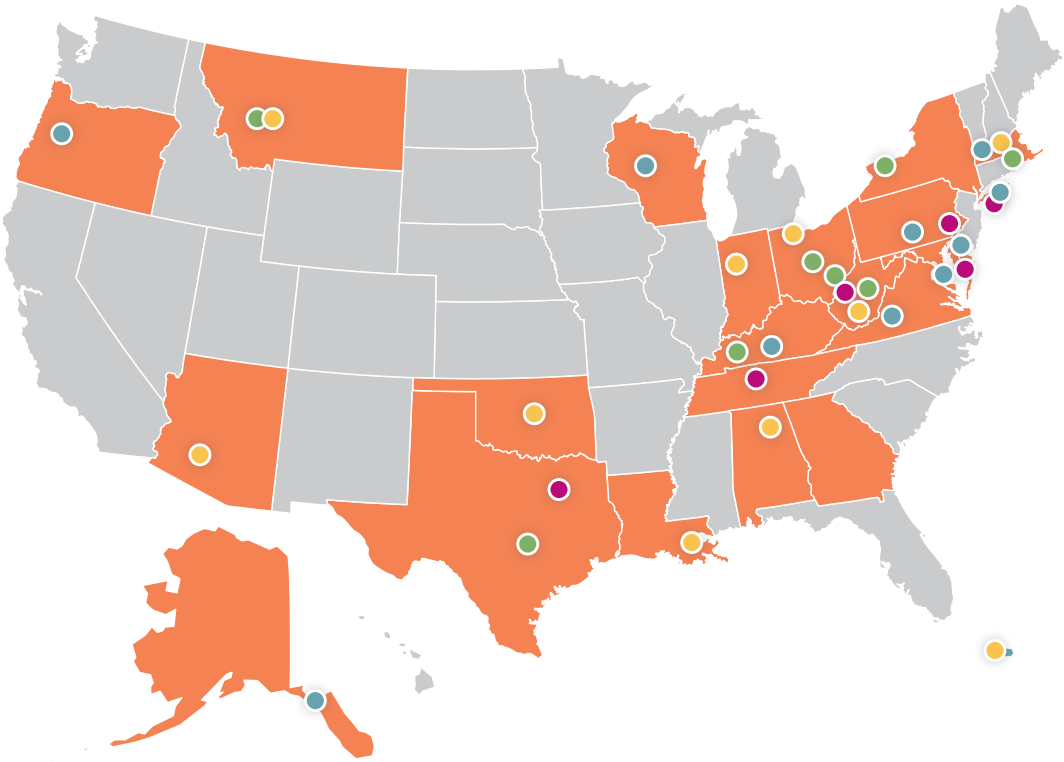
NIOSH uses TPGs as a principal means of providing enough qualified professionals to carry out the Occupational Health and Safety Act of 1970. TPGs help train in specific disciplines to meet the needs of a diverse workforce. The graduates of TPGs serve a vital role in protecting and promoting the health and safety of U.S. workers, aligning with the goals of Healthy People 2020—to prevent diseases, injuries, and deaths due to working conditions. TPGs also serve as important resources on job-related safety and health issues for business, labor, government, and the general public.

Research Outputs: Publications in FY2018

TPG research outputs are the products of research activities and include publications. We collected publications by NIOSH-funded

extramural researchers from principal investigator reports to NIOSH, the NIH Reporter database, the NIOSHTIC-2 database, and the PubMed database. From October 1, 2017, to September 30, 2018, the TPG researchers published 27 articles in peer-reviewed journals. Find a searchable database of NIOSH publications, which includes grantee final reports and publications, by using the NIOSHTIC-2 publications search.

NIOSH Training Project Grants by Discipline



Occupational Safety

- MA/Lowell
- Montana Tech
- Murray State
- Ohio State
- Ohio University
- SUNY/Buffalo
- Texas A&M
- West Virginia

Industrial Hygiene

- Arizona
- MA/Lowell
- Montana Tech
- North Alabama
- Oklahoma
- Puerto Rico
- Purdue
- Toledo
- Tulane
- West Virginia

Allied Occupational Safety & Health

- Alaska Marine
- Association of Occupational and Environmental Clinics
- Connecticut
- International Association of Fire Fighters
- MA/Lowell
- Millersville
- Portland State
- Virginia Tech
- Wisconsin/Stout
- Western Kentucky

Occupational Medicine

- Meharry
- Pennsylvania
- Texas/Tyler
- West Virginia
- Yale

Program Highlights FY2018

Training Project Grant Trainees, Graduates, and Employment by Discipline

In academic year 2017–2018, the TPG academic training programs graduated 238 trainees with specialized training in industrial hygiene, occupational safety and medicine, and allied disciplines. These allied disciplines included occupational health psychology, risk management, occupational ergonomics and engineering, environmental health, and occupational epidemiology.

Table 17. Training project grant trainees, graduates, and employment by discipline, FY2018

Program Area	Trainees	Graduates	Employed in occupational safety and health field or seeking advanced training (%)
Industrial Hygiene	304	64	64 (100)
Occupational Safety	240	79	77 (97)
Occupational Medicine	31	17	17 (100)
Allied Disciplines	281	78	75 (96)
Total	856	238	233 (98)

Training Project Grant (TPG) Program Achievements

The Positive Impact of an Innovative Train-in-Place Residency Program

In medicine and other fields that require years of education and training, fitting coursework into a busy work schedule may make a career change especially daunting. To address the issue, investigators at the University of Pennsylvania (UPenn) TPG tested a train-in-place program that brings training in occupational and environmental medicine (OEM) directly to the workplace. This approach enables midcareer doctors to continue their practices while preparing for certification in OEM. Because some doctors may be unaware of the OEM field until later in their careers, the program also could help relieve the shortage in this field.

During the 2-year program, physicians trained at clinical sites located at their workplaces. In addition, participants completed 18 visits to UPenn's primary training site. Participants received skills training that centered on patient visits or rotations. They completed individual projects with a mentor's guidance. UPenn faculty periodically visited and appraised the various train-in-place locations. From 1997 through 2015, 109 out of 110 midcareer physicians graduated from the program, scored competitively on the occupational medicine certifying examination, and achieved all training milestones. Five years after graduation, most participants continue to practice OEM throughout the United States. In addition to geographical diversity, work settings varied with program graduates joining academia, industry, and government, as well as hospitals and clinical settings. These findings show that train-in-place

programs can help increase the number of OEM specialists by overcoming some of the barriers faced by midcareer physicians seeking a career change.

Details:

https://www.jgme.org/doi/full/10.4300/JGME-D-16-00689.1#abstract

https://www.pennmedicine.org/departments-and-centers/emergency-medicine/education-and-training/oem-residency-program

https://www.cdc.gov/niosh/research-rounds/resroundsv4n2.html#d

Creating Cost Effective Interventions and Tackling Contemporary Challenges in Safety and Health

Combining classroom and real-world experiences, Ohio University gives TPG trainees impactful internships and practical and academic knowledge in varied occupational safety and health areas like human factors engineering, industrial ergonomics, and systems safety. Trainees who completed internships in Ohio University's safety department in FY2018 helped develop cost effective interventions to protect the university's workforce. For example, trainees recommended changing the table legs to those that are moveable to make workstations adjustable—a move that was more cost effective than purchasing new tables. The adjustable workstations allow workers to have a normal or erect posture on the job and reduce risk factors related to static loading or constantly staying in the same position. Ohio University trainees also completed internships at state agencies, medical facilities, and food processing facilities, as well as automobile and heavy equipment manufacturing plants. These types of learning opportunities produce graduates who are well equipped to take on contemporary challenges facing today's workforce.

Graduate Training Aims to Increase Diversity in Industrial Hygiene

Addressing a need for more minority occupational safety and health (OSH) professionals, the Tulane University TPG dedicates its resources and time to the recruitment of trainees in the field of industrial hygiene—students who are in minority groups, are disadvantaged, or at a midcareer point. The program focuses on raising the number of under-represented industrial hygiene professionals in government, labor, the private sector, and academia. It also allows early and midcareer OSH professionals to have more training opportunities in industrial hygiene. The structure of this Accreditation Board for Engineering and Technology accredited program in industrial hygiene allows graduate students a full-time campus experience or a distance learning opportunity for working professionals.

Developing Practitioners and Addressing Relevant Occupational Safety and Health Issues in Upper New York Region

The University at Buffalo, SUNY TPG aims to provide highly qualified occupational safety and health (OSH) practitioners in upper New York. The TPG's rigorous graduate program includes formal OSH research and real-world training, allowing students to gain both scientific and practical experience. During FY2018, trainees conducted research on varied topics relevant to vulnerable working populations. Trainees completed internships to gain valuable experiences on protecting workers' safety and health. Recent graduates of the SUNY TPG are working full time in OSH in federal government and private industry sectors with responsibilities in developing and conducting safety training, performing occupational safety surveys, inspections, and compliance audits, and assisting in effective hearing conservation programs.

EMERGENCY RESPONDER TRAINING PROGRAM

NIOSH funds a TPG in Emergency Responder Training Program through the International Association of Fire Fighters (IAFF). IAFF's mission through the program is to educate emergency responders about ways to stay safe and healthy. They strive to reduce on-the-job injuries, illnesses, and fatalities related to emergency response, so responders can better protect the communities they serve. Training takes place across the United States and its territories.

IAFF has a long working relationship with NIOSH. The association delivers training to firefighters and EMS personnel. IAFF's record emphasizes job-related safety and health as part of a complete first responder training plan. IAFF's teachings seek to improve knowledge, attitudes, and behaviors so that first responders adopt a safer approach to emergency response throughout their career. IAFF training is a resource that directly affects decisions firefighters make each day.

Public Health Relevance

This federally funded training program serves as an excellent model for an effective training program for first responders. With a team of instructors who are both certified fire service instructors and hazardous materials (HazMat) responders, IAFF provides real-world training in HazMat response. Furthermore, IAFF brings its training directly to the students in their own communities, developing training partnerships with thousands of fire departments throughout the United States. Because of this community-based learning, local responders receive training that addresses their unique concerns and challenges.

As 9-1-1 calls for opioid-associated emergencies continue to increase, all levels of EMS providers must be properly trained to handle these life-threatening events—including the administration of naloxone (NARCAN). In response, IAFF developed an Opioid Crisis Toolkit, which uses the protocols, state-of-the-art responses, and resources available to firefighters.

Program Highlights FY2018

In FY2018, IAFF delivered 73 classes to 1,370 students, totaling 28,664 contact hours.

Table 18. Emergency responder training classes, FY2018

Class Title	Class Length	Total Classes	Total Students	Total Contact Hours
Confined Space Operations	24 hours	3	49	1,176
Illicit Drug Labs	8 hours	8	132	1,056
First Responder Operations	24 hours	52	1,026	24,624
Emergency Response to Terrorism Operations: Refresher	8 hours	6	88	704
Train the Trainer	24 hours	1	19	456
Emergency Response to Terrorism: Operations	16 hours	1	25	400
Chemical Process Industries	8 hours	2	31	248

MINER SAFETY AND HEALTH TRAINING PROGRAM

Despite many technological and work environment advances, mining remains one of the most demanding occupations in the United States. Because of the many challenges in the mining industry, the focus areas for mining training must cover a wide range of hazards and risks.

The Mine Safety and Health Administration (MSHA) Training Academy in Beckley, West Virginia, serves the mining community in the Eastern United States. Because this training program is not easy for miners in the Western States to access and certain aspects of mining operations differ in eastern and western operations, NIOSH has supported miner safety and health training in the Western United States since 1999.

For FY2018, two programs were funded in the Western United States: the Colorado School of Mines and the University of Arizona. This training provides a joint approach to reducing injuries to miners and other workers in mining operations. It also aims to translate research into workplace practices that (1) improve mining safety, (2) advance the safety and health of miners, (3) enhance the safety and health of other workers involved in mining operations, and (4) increase the quantity of qualified mine safety and health trainers in the Western United States.

Several of the main objectives of the training program follow:

- To develop, deliver, and manage the training needs of miners in the Western United States.
- To provide qualified instructors and faculty.
- To start and carry out "train the trainer" courses.
- To evaluate training effectiveness and impact on reducing injuries and illnesses to miners.
- To coordinate with existing training programs, like those offered by MSHA and MSHA-funded state programs, and in partnerships with industry, miners, and other agencies.

NIOSH intends for the program's training to be consistent with OSHA and MSHA guidelines, without duplicating these agencies' existing trainings.

Public Health Relevance

The Miner Safety and Health Training Program provides critical safety and health training to protect workers in one of the most dangerous industry sectors in the United States. This program contributes to this overall goal by taking the following actions:

- Expanding the mission of NIOSH in protecting and promoting the health of mine workers. The trainings improved work practices, reduced work-related injury and illness, and increased the understanding of safety and health practices in Western mine worksites.
- Increasing the safety focus, total health awareness, and leadership competency of miners, frontline supervisors, superintendents, and managers representing operations throughout the United States, spanning all major commodity sectors in surface and underground mining.
- Directing the focus of mine-rescue training toward learning actual rescue skills, resulting in team members being better prepared to respond to all kinds of emergencies.

The Miner Safety and Health Training Program fills an important regional need. During FY2018, the program trained 1,280 mine

workers through 49 courses. It is critical for underserviced populations working on mine sites, including contractors, suppliers, consultants, equipment manufacturers, and small mine operators. The program designs and uses active learning strategies for mine safety training. It has taught trainers across all mining service sectors throughout the Western United States ways to improve safety training. These activities improve the transfer of best safety practices to the workplace while increasing the number of workers served.

Program Highlights FY2018

Development of Framework for Critical Control Management

In FY2018, the University of Arizona aimed to develop a framework in the Mining Sector to identify the most important critical controls or methods to control exposures to occupational hazards. To create the framework, university researchers used the critical control management approach from the International Council on Mining and Metals as a template. They then collected input from mining industry experts on which controls mining companies use to prevent or lessen potential risks from material unwanted events. These are defined as incidences with major negative effects in terms of materials, reputational cost, or worker impact.

A dozen experts, with an average of 22 years of experience, representing mining, geotechnical-equipment manufacturing, and consulting companies, along with university faculty, provided this input in a workshop. Researchers asked participants to identify the most important material unwanted events and the related critical controls that companies use. The highest priority events included rock falls, slope failures, and tailing failures, and 65 critical controls were identified to keep workers safe during these events. The control methods included varied types of monitoring, engineering controls, and training. Next steps include the University of Arizona developing a website and an online database to share their findings and collecting additional data on critical controls from others in the Mining Sector.

Colorado School of Mines Implements Underground Mine Experience Into New Miner Training

The Colorado School of Mines is one of only a few institutions in the Western United States that includes an underground mine experience in its MSHA Part 46 New Miner Training. During this course, trainees spend a half day inside the Edgar Experimental Mine learning how to prepare for working in an underground environment. This preparation includes appropriate use of personal protective equipment, along with identifying possible hazards related to underground mining, ventilation, and ground support and scaling.

APPENDIX: FY2018 NIOSH FUNDING OPPORTUNITY ANNOUNCEMENTS BY MECHANISM

Funding Opportunity	Mechanism	Title
		Investigator-initiated Research
PAR-13-245	K01	Mentored Research Scientist Development Award
PAR-13-129 PA99-143	R01	Occupational Safety and Health Research
PAR-12-200	R03	NIOSH Small Research Program
PAR-14-246	R13	NIOSH Support for Conferences and Scientific Meetings
PAR-12-252	R21	NIOSH Exploratory/Developmental Grant Program
PAR-14-229	U13	NIOSH Support for Conferences and Scientific Meetings
		Training Programs and Centers
PAR-15-352 PAR-10-288	T03	Occupational Safety and Health Training Project Grants
PAR-15-303 PAR-10-217	T42	Occupational Safety and Health Education and Research Centers
		Cooperative Agreements
PAR-14-175	U01	Agricultural, Forestry, and Fishing Safety and Health Research
PAR-15-361	U19	NIOSH Centers of Excellence for *Total Worker Health®*
RFA-OH-16-010	U24	National Mesothelioma Virtual Bank for Translational Research
PAR-15-353	U54	Centers for Agricultural Safety and Health
OH14-005	U54	National Center of Excellence for the Prevention of Childhood Agricultural Injury
PAR-14-227	U60	Workers' Compensation Surveillance
PAR-14-275	U60	State Occupational Health and Safety Surveillance Program
RFA-OH-13-001	U60	National Center for Construction Safety and Health Research and Translation
RFA-OH-17-001	U60	Miner Safety and Health Training Program—Western United States
RFA-OH-17-1701	E11	Cooperative Agreement on Global Occupational Health with the World Health Organization: Implementing "Global Plan of Action for Workers' Health 2008–2018"

(Continued)

Funding Opportunity	Mechanism	Title
Cosponsored Research With the National Institutes of Health		
PA-16-302	R43, R44	PHS 2015-02 Omnibus Solicitation of the NIH, CDC, FDA, and ACF for Small Business Innovation Research Grant Applications
PA-17-302	R43, R44	PHS 2017-02 Omnibus Solicitation of the NIH, CDC, FDA, and ACF for Small Business Innovation Research Grant Applications
RFA-TW-14-001	U01	Hubs of Interdisciplinary Research and Training in Global Environmental and Occupational Health (GEOHealth)—Research
RFA-TW-14-002	U2R	Hubs of Interdisciplinary Research and Training in Global Environmental and Occupational Health (GEOHealth)—Research Training

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DOI: https://doi.org/10.26616/NIOSHPUB2020108