

NIOSH EXTRAMURAL RESEARCH AND TRAINING PROGRAM

ANNUAL REPORT OF FISCAL YEAR 2017

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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FOREWORD

I am pleased to deliver the FY2017 annual report on the National Institute for Occupational Safety and Health (NIOSH) Extramural Research and Training Program, which marked the first fiscal year under the third decade of NORA (2016–2026). 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 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 integrated research across our intramural and extramural programs. 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 FY2017.

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 FY2017, the National Institute of Occupational Safety and Health (NIOSH) funded 151 extramural awards totaling \$91,489,747. Multidisciplinary centers received 36 awards totaling \$58,727,991 (64%) in these program areas:

- \$28.0 million for 18 Education and Research Centers
- \$18.0 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 45 awards totaling \$15,577,086 (17%). Cooperative agreements received 37 awards totaling \$10,196,771 (11%). Specialty training programs received 28 awards totaling \$5,172,179 (6%), and 5 small business innovation research projects received a total of \$1,815,720 (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 continued its long-standing support of global occupational health research and training by cosponsoring the National Institutes of Health (NIH) Fogarty International Center Global Environmental and Occupational Health Hubs. This program supports institutions in low- and middle-income countries that serve as regional hubs for joint research and training in responding to high-priority environmental and occupational health threats.

In FY2017, NIOSH extramural researchers wrote 557 peer-reviewed articles in 275 journals. Education and Research Centers had the most articles (223) published, followed by investigator-initiated (R01) research (127). 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
HCSA	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](#) web page 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 web page. [Appendix](#) of this report lists all the NIOSH funding opportunity announcements published in FY2017.

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 programs, 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 NIOSH. Research to Practice (r2p) is a central focus of NIOSH programs and NIOSH-funded research. The [r2p web page](#) 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 web page.

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 Technologies
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 FY2017

In FY2017, NIOSH awarded \$91,489,747 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 17% for [investigator-initiated and career development research grants](#). Other cooperative agreements made up 11% of the FY2017 grant distributions, followed by [specialty training programs](#) (6%), and [small business innovation research projects](#) (2%).

Extramural Awards (in millions of dollars), FY2017

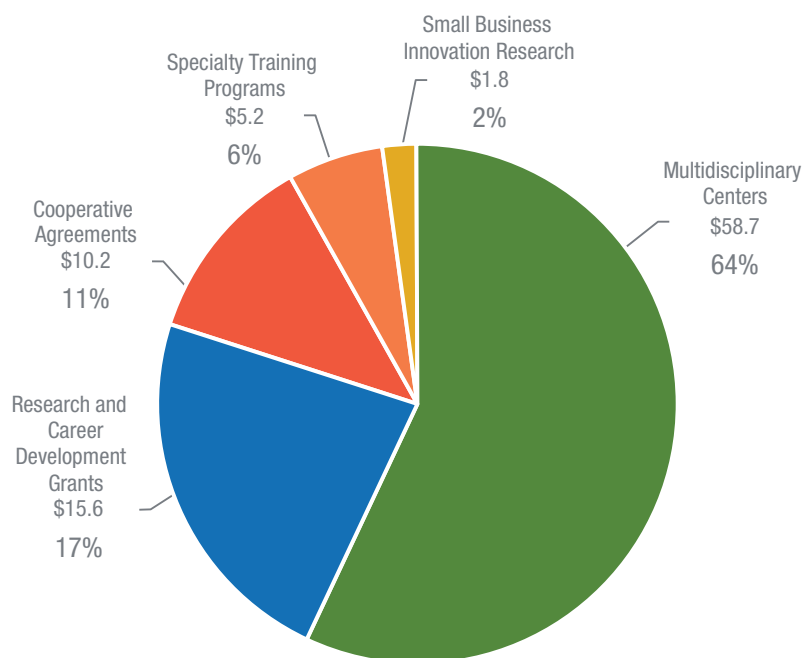


Figure 1. NIOSH extramural grant distribution (in millions of dollars), FY2017

In FY2017, NIOSH presented 151 awards: 15 (10%) for new projects and 136 (90%) for continuing awards. Table 2 summarizes all NIOSH extramural awards for FY2017. Of these awards,

- 45 (30%) funded investigator-initiated research and career development;
- 37 (25%) funded cooperative agreements;
- 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*[®];
- 28 (18%) funded training program grants; and
- 5 (3%) funded small business innovation research.

The Office of Extramural Programs (OEP) web page displays 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, FY2017

Award Category	Award Mechanism	Number of Awards	Funding
Multidisciplinary Centers		36	\$58,727,991
Education and Research Centers	Training Grant (T42)	18	\$28,351,166
Centers for Agricultural Safety and Health	Cooperative Agreement (U54)	11	\$18,281,750
National Center for Construction Research and Training	Cooperative Agreement (U60)	1	\$5,750,000
Centers of Excellence for <i>Total Worker Health</i> [®]	Cooperative Agreement (U19)	6	\$6,345,075
Investigator-initiated Research Grants		45	\$15,577,086
Research Grants	Investigator-initiated (R01, R03, R21, R13, U13)	38	\$14,821,134
Career Developmental Research	Mentored Career Scientist (K01)	7	\$755,952
Cooperative Agreements		37	\$10,196,771
State Surveillance Program	Cooperative Agreement (U60)	26	\$6,797,789
Workers' Compensation Surveillance	Cooperative Agreement (U60)	5	\$998,424
Agricultural, Forestry, and Fishing Safety and Health	Cooperative Agreement (U01)	4	\$1,099,164
National Mesothelioma Virtual Bank	Cooperative Agreement (U24)	1	\$1,076,394
World Health Organization	Cooperative Agreement (E11)	1	\$225,000
Specialty Training Programs		28	\$5,172,179
Training Project Grants	(T01) and (T03)	26	\$4,204,189
*Miner Safety and Health Training Program	Cooperative Agreement (U60)	2	\$967,990
Small Business Innovation Research		5	\$1,815,720
Small Business Innovation Research	Phase I (R43) & Phase II (R44)	5	\$1,815,720
Total Extramural Funding		151	\$91,489,747

*While no financial obligations were made to the Miner Safety and Health Training Program at University of Texas at Arlington in FY2017, significant work was accomplished during this time period. These accomplishments reflect work completed utilizing prior year funding. [Section IV](#) of this report lists all program achievements.

EXTRAMURAL RESEARCH PORTFOLIO FY2017

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, focusing on high-risk industries that contribute disproportionately to work-related injury and illness in the United States. A variety of grant mechanisms, including cooperative agreements and center training grants, fund these centers. First, the [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 \(ERCs\)](#) carry out multidisciplinary education and research activities. These university-based centers offer 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 \$58.7 million to 36 multidisciplinary centers in FY2017:

- 18 ERCs received \$28.4 million.
- 11 Ag Centers received \$18.3 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.

\$58.7 Million in Funding for Center Grants in FY2017

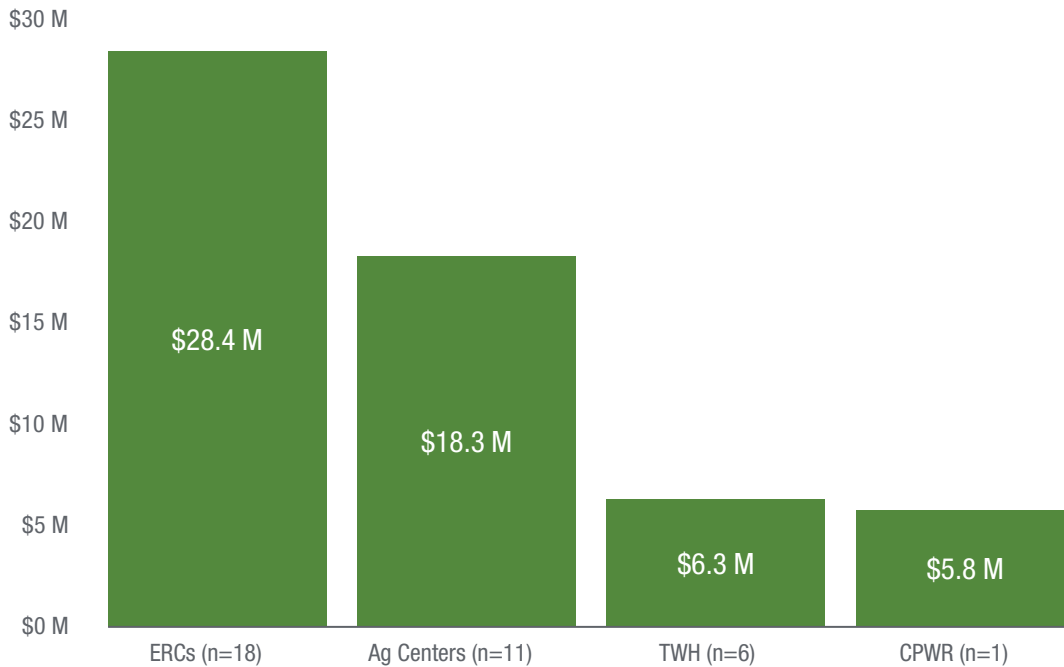


Figure 2. Multidisciplinary center awards, FY2017

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. NIOSH awarded \$15.5 million to new and continuing research projects and mentored scientist grants in FY2017 (see Table 3). [Section IV](#) describes investigator-initiated research outputs.

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 FY2017, 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, FY2017

Grant Type	New Awards	New Funding	Continuing Awards	Continuing Funding	Total Funding
R01	1	\$598,911	31	\$13,597,478	\$14,196,389
R21	0	\$0	2	\$437,748	\$437,748
K01	0	\$0	7	\$755,952	\$755,952
R03	0	\$0	1	\$76,997	\$76,997
R13	0	\$0	1	\$20,000	\$20,000
U13	1	\$60,000	1	\$30,000	\$90,000
Total	2	\$658,911	43	\$14,918,175	\$15,577,086

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 agreements funded in FY2017 totaled \$10.2 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 agreements received funding.

Cooperative Agreements: \$10.2 Million in FY2017

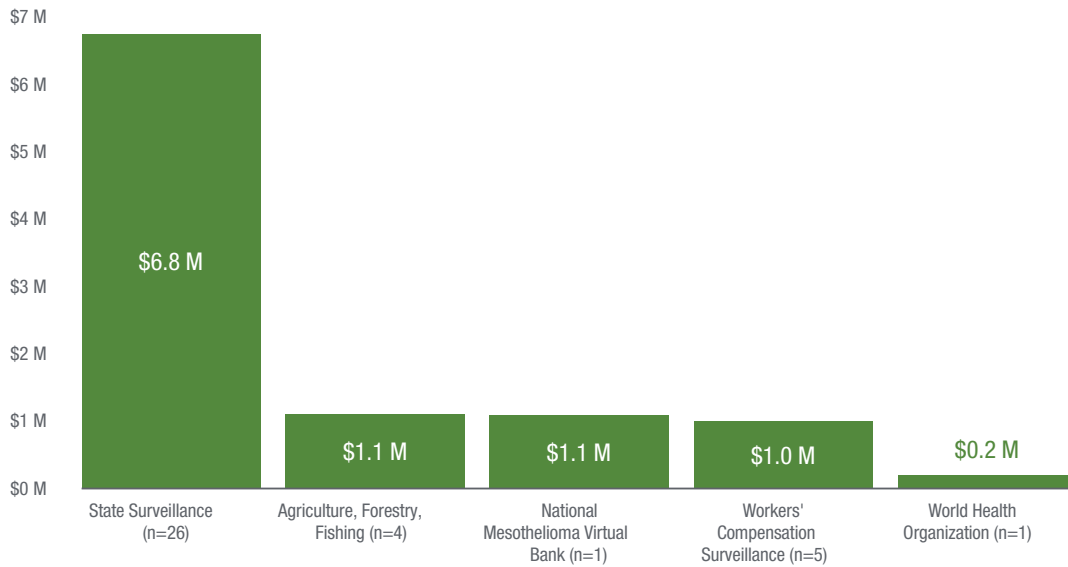


Figure 3. Cooperative agreements, FY2017

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 Portfolio Annual Performance Reports](#) focus on these state-based initiatives. Table 2 reports the total number and funding for all state surveillance awards (new and continuing) for FY2017.

Workers' Compensation Surveillance

The Workers' Compensation Surveillance 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 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 FY2017, NIOSH had five cooperative agreements related to workers' compensation surveillance. Table 2 shows the total funding amount for Workers' Compensation Surveillance.

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. 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.

Additional support of global health and safety activities included cosponsoring the National Institutes of Health (NIH) Fogarty International Center [Global Environmental and Occupational Health \(GEOHealth\) program](#). This interagency agreement supported dozens of global research training grants designed to prepare the next generation of scientists, researchers, and practitioners to effectively manage the increasing burden of work-related injury and illness. The program aims to support and catalyze a multi-national network of regional hubs led by institutions in low- or middle-income countries that partner with U.S. institutions. Their goals include conducting research and research training, developing relevant curricula, and supporting the science needed to inform nationally-relevant policy development. The [GEOHealth website](#) includes more information on the global health collaboration with NIH and other partners.

Specialty Training Programs

Along with the [ERCs](#) described under [Multidisciplinary Centers](#), NIOSH supports professional training in occupational safety and health in single disciplines through [Training Project Grants](#) (TPGs).

Most TPGs are academic training programs that support undergraduate and 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 substance training program for fire fighters, paramedics, and other emergency responders across the United States.

The Miner Safety and Health Training Program–Western United States cooperative agreement, 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, and the University of Texas at Arlington [Division for Enterprise Development](#).

Table 2 shows the number and funding of all specialty-training grants (new and continuing) awarded in FY2017.

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 FY2017 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 FY2017 funding for investigator-initiated research and career development research across the sectors. Extramural research in FY2017 took place across most of the NIOSH sector program areas except Mining (MIN) and Oil and Gas Extraction (OGE). Manufacturing (MNF) received the most funding, followed by All Sectors* (ALL) and Healthcare and Social Assistance (HCSA).

Investigator-initiated research and career development funding across sectors, FY2017



Figure 4. Research funding by sector program, FY2017

*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, FY2007–FY2017

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 FY2007–FY2017, the success rate remained fairly stable until FY2014 when it decreased from 17% to a historic low of 1% in FY2017. While the number of applications increased steadily during this period, funding shortages significantly constrained the number of new awards. For FY2007–FY2017, the mean annual success rate was 15%. Success rates for each research mechanism are shown in Figures 6–8.

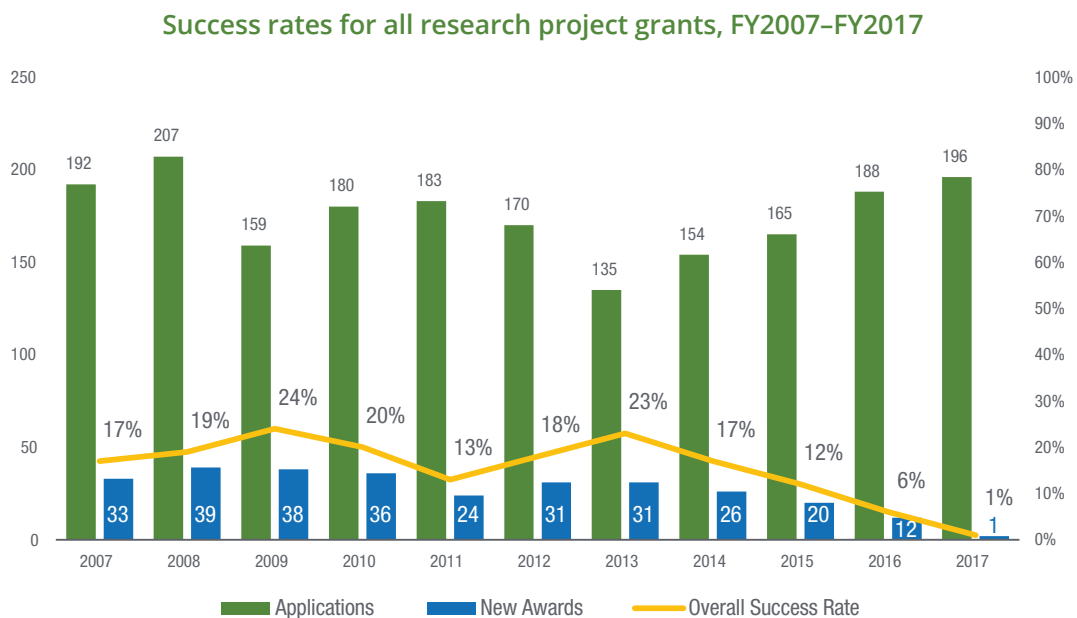


Figure 5. Overall success rates for research project grants

Success rates for R01 applications, FY2007–FY2017

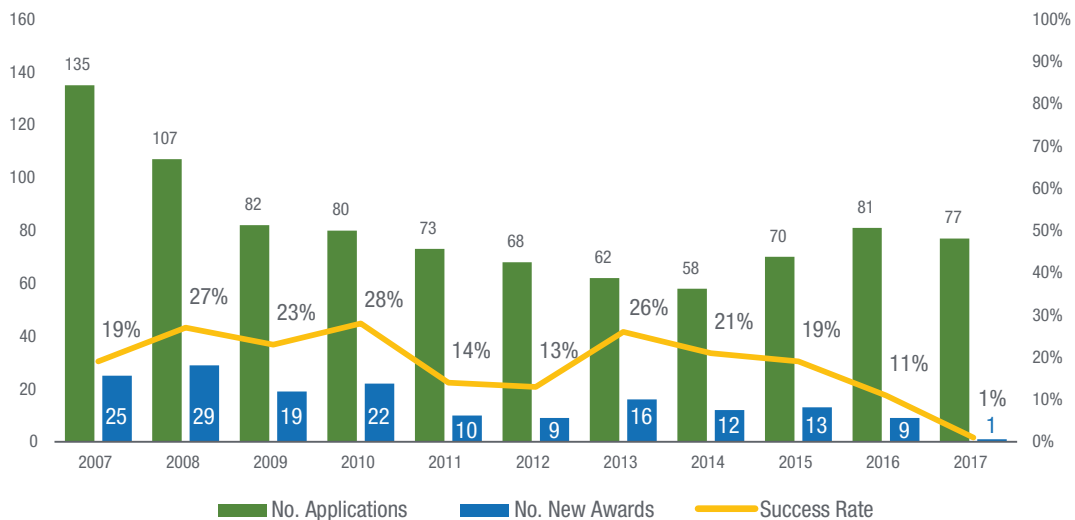


Figure 6. Success rates for R01 applications, FY2007–FY2017

Success rates for R03 applications, FY2007–FY2017

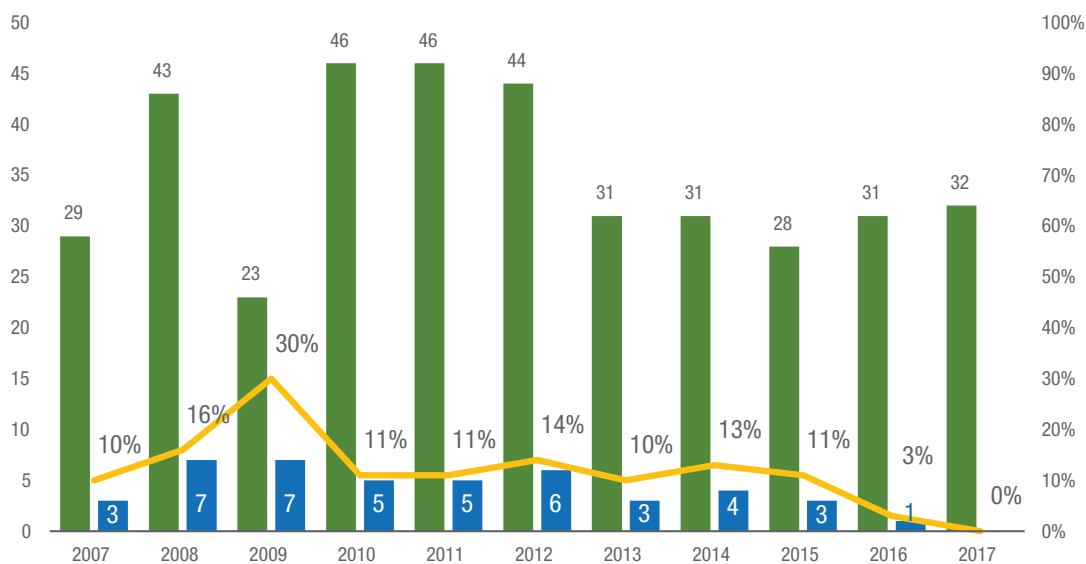


Figure 7. Success rates for R03 applications, FY2007–FY2017

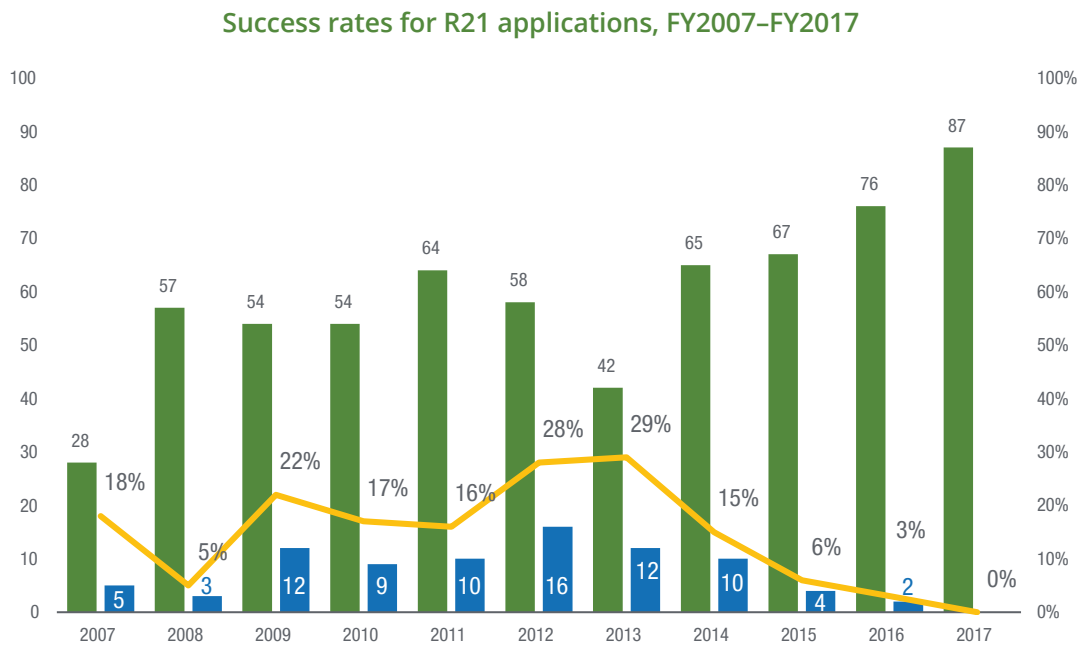


Figure 8. Success rates for R21 applications, FY2007–FY2017

III. RESEARCH INTEGRATION IN FY2017

Research integration at NIOSH aligns research to make it more productive through collaboration across intramural and extramural programs. In FY2017, NIOSH continued to use the same goals from the second decade of NORA while new goals were being developed for the third decade. Intramural and extramural researchers respond to these goals through research, service, and outreach.

Research integration was most evident in the AFF sector where intramural and extramural researchers addressed all strategic goals in this sector.



NIOSH annually assesses intramural and extramural projects that focus on strategic goals in the second decade [NORA Sector Agendas](#). One measurement of integrated research programs is the number of sector program goals that intramural and extramural research worked on.

97% of all strategic goals were addressed in FY2017. Extramural researchers addressed 48% of all strategic goals.

In FY2017, intramural research projects addressed 106 of the 109 (97%) NORA strategic goals. Extramural projects covered 52 (48%) of these goals. Extramural research in CON (Construction) worked on the most goals, followed by AFF, MNF, PSS (Public Safety), and SRV (Services). The AFF sector's intramural and extramural research responded to all strategic goals.

Figure 9 shows the number of strategic goals by sector and the number of goals addressed by intramural researchers, extramural researchers, or both. It also shows which goals were not worked on or were inactive in FY2017.

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 research in FY2017 is indicated. Some projects are both intramural and extramural. Please see the key below.



Figure 9. Integrating NIOSH research goals by sector, FY2017

INTEGRATED RESEARCH ACTIVITY BY SECTOR GOALS, FY2017

To describe NIOSH-funded research in FY2017, NIOSH reviewed the strategic goals by industry sectors that extramural and intramural projects addressed. Tables in the following sections show how extramural and intramural research projects focused on the NORA sector strategic goals. The [NORA Agendas](#) web page has a section on second decade agendas that contains each of the goals in use during FY2017.



Agriculture, Forestry, and Fishing

Table 4 shows how FY2017 extramural and intramural research projects addressed strategic goals in the Agriculture, Forestry, and Fishing (AFF) Sector. Both intramural and extramural research projects supported all nine strategic goals for this sector. Intramural and extramural projects most often addressed the SG1 (Surveillance) strategic goal (n=41). Four strategic goals (SG4, SG5, SG6, and SG7) were inactive in FY2017.

Table 4. Agriculture, Forestry, and Fishing research projects by strategic goal, FY2017

Strategic Goal (SG)	Extramural Projects	Intramural Projects
SG1: Surveillance	21	20
SG2: Vulnerable Workers	10	16
SG3: Outreach and Partnerships	10	5
SG4: Agricultural Safety (inactive after FY2016)	10	5
SG5: Agricultural Health (inactive after FY2016)	15	19
SG6: Forestry Injuries (inactive after FY2016)	2	6
SG7: Forestry Illness/Disease (inactive after FY2016)	2	5
SG8: Commercial Fishing Injuries	2	9
SG9: Commercial Fishing Illness/Disease	4	5



Construction

Table 5 shows how extramural and intramural FY2017 research projects addressed the Construction (CON) Sector's strategic goals. Both intramural and extramural research FY2017 projects supported 12 of 13 active strategic goals for this sector. Two strategic goals (SG2 and SG10) were inactive in FY2017. Surveillance, SG14, received the most projects in FY2017 (n=57).

Table 5. Construction research projects by strategic goal, FY2017

Strategic Goal (SG)	Extramural Projects	Intramural Projects
SG1: Falls Prevention	1	15
SG2: Electrocution (inactive after FY2011)	0	1
SG3: Struck-by Incident Prevention	1	11
SG4: Hearing Loss Prevention	1	6
SG5: Silica	1	18
SG6: Welding Fumes	1	15
SG7: Musculoskeletal Disorders	2	10
SG8: Safety and Health Cultures	1	10
SG9: Safety and Health Management	2	5
SG10: Industry and Work Organization (inactive after FY2011)	1	3
SG11: Training and Education	0	4
SG12: Health Disparities	1	22
SG13: Prevention through Design	1	9
SG14: Surveillance	35	22
SG15: Engaging Media	0	0



Healthcare and Social Assistance

Table 6 shows how FY2017 extramural and intramural research projects in the Healthcare and Social Assistance (HCSA) Sector addressed strategic goals. Both intramural and extramural research FY2017 projects worked on 5 of 11 strategic goals, while only intramural research supported goals SG7–SG11. Research projects did not address one strategic goal (SG6), added in FY2014. Extramural research (n=7) and intramural research (n=34) had the most projects in SG1, Safety Culture.

Table 6. Healthcare and Social Assistance research projects by strategic goal, FY2017

Strategic Goal (SG)	Extramural Projects	Intramural Projects
SG1: Safety Culture	7	34
SG2: Musculoskeletal Disorders	3	11
SG3: Hazardous Drugs and Chemicals	3	32
SG4: Sharp Injuries	1	6
SG5: Infectious Disease	4	31
SG6: Zoonotic Diseases In Veterinary Medicine and Animal Care	0	0
SG7: Injuries In Veterinary Medicine and Animal Care	0	1
SG8: Respiratory Hazards In Veterinary Medicine and Animal Care	0	3
SG9: Reproductive Hazards In Veterinary Medicine and Animal Care	0	1
SG10: Physical Hazards In Veterinary Medicine and Animal Care	0	1
SG11: Cross-cutting Issues	0	5



Manufacturing

Table 7 shows how FY2017 extramural and intramural research projects in the Manufacturing (MNF) Sector addressed their strategic goals. Both intramural and extramural research supported six projects in FY2017, while only intramural research projects covered goals SG4, SG6, SG8, and SG10. Intramural and extramural projects addressed the most projects in strategic goal SG5, Respiratory Diseases (n=79).

Table 7. Manufacturing research projects by strategic goal, FY2017

Strategic Goal (SG)	Extramural Projects	Intramural Projects
SG1: Contact with Objects and Equipment	1	12
SG2: Falls	1	5
SG3: Musculoskeletal Disorders	4	23
SG4: Hearing Loss	0	12
SG5: Respiratory Diseases	4	75
SG6: Cancer	0	25
SG7: Vulnerable Populations	2	20
SG8: Small Business	0	11
SG9: Emerging Risks	2	65
SG10: Catastrophic Incidents	0	2



Mining

Table 8 shows how FY2017 extramural and intramural research projects in the Mining (MIN) Sector addressed strategic goals. Projects supported all seven strategic goals for this sector. Both intramural and extramural research projects worked on three strategic goals for this sector, while only intramural research projects covered SG4–SG7. Respiratory Diseases, SG1, addressed the most projects (n=49).

Table 8. Mining research projects by strategic goal, FY2017

Strategic Goal (SG)	Extramural Projects	Intramural Projects
SG1: Respiratory Diseases	2	47
SG2: Noise-induced Hearing Loss	3	32
SG3: Musculoskeletal Disorders	2	31
SG4: Traumatic Injuries	0	22
SG5: Disaster Response and Prevention	0	24
SG6: Ground Failure Fatalities and Injuries	0	13
SG7: Interventions with New Technologies	0	22



Oil and Gas Extraction

Table 9 shows how FY2017 extramural and intramural research projects in the Oil and Gas Extraction (OGE) Sector addressed strategic goals. Only intramural research projects supported these goals, responding to all 10 active strategic goals in this sector. Three strategic goals (SG5, SG7, and SG11) are inactive, and research did not cover SG5. Intramural projects focused on strategic goal SG6, Chemical Exposures (n=20), most often.

Table 9. Oil and Gas Extraction research projects by strategic goal, FY2017

Strategic Goal (SG)	Extramural Projects	Intramural Projects
SG1: Transportation-related Injuries and Fatalities	0	11
SG2: Contact Injuries	0	2
SG3: Falls	0	4
SG4: Fires and Explosions	0	3
SG5: Improvement in Workplace Practices, Procedures, and Policies (inactive after FY2011)	0	0
SG6: Chemical Exposures	0	20
SG07: Develop Industry-specific Products (inactive after FY2014)	0	3
SG8: Fatigue	0	1
SG9: Vulnerable Workers	0	9
SG10: Small Businesses	0	3
SG11: Storage and Transportation (inactive after FY2016)	0	1



Public Safety

Table 10 shows how FY2017 extramural and intramural research projects in the Public Safety (PSS) Sector addressed strategic goals. Research projects addressed all 18 strategic goals within this sector. Intramural projects supported 12 strategic goals, while both intramural and extramural research projects worked on the other 6 goals. Intramural projects most often covered strategic goal SG1, Chronic Disease in Fire Fighters (n=37).

Table 10. Public Safety research projects by strategic goal, FY2017

Strategic Goal (SG)	Extramural Projects	Intramural Projects
SG1: Chronic Disease in Fire Fighters	0	37
SG2: Structural Firefighting Operations	0	16
SG3: Vehicle-related Injuries in Fire Fighters	0	10
SG4: Musculoskeletal Disorders	2	4
SG5: Surveillance in Law Enforcement	3	14
SG6: Vehicle-related Injuries in Law Enforcement	0	13
SG7: Criminal Assaults in Law Enforcement	0	3
SG8: Cardiovascular Disease in Law Enforcement	1	5
SG9: Traumatic Injury in Corrections	1	4
SG10: Infectious Disease in Corrections	0	8
SG11: Occupational Stress in Corrections	2	3
SG12: Vehicle-related Injuries in EMS (emergency medical services)	0	5
SG13: Patient- and Equipment-handling Injuries in EMS	0	2
SG14: Infectious Disease and Hazardous Exposures in EMS	0	24
SG15: Work Organization in EMS	1	2
SG16: Surveillance in EMS	0	6
SG17: Injuries and Illnesses in Wildland Firefighting	0	6
SG18: Health and Safety in Wildland Firefighting	0	2



Services

Table 11 shows how FY2017 extramural and intramural research projects in the Services (SRV) Sector addressed strategic goals. Projects supported all 18 strategic goals for this sector. Both intramural and extramural research projects worked on six strategic goals (SG3, SG10, SG14, SG16, SG17, and SG18), while only intramural research covered the other 13 goals. Projects most often focused on strategic goal SG17, Surveillance (n=54).

Table 11. Services research projects by strategic goal, FY2017

Strategic Goal (SG)	Extramural Projects	Intramural Projects
SG1: Illnesses and Fatal Injuries in Auto Repair	0	4
SG2: Illnesses and Injuries in Building Services	0	11
SG3: Health Disparities in Building Services	1	2
SG4: Illnesses and Injuries in Schools	0	14
SG5: Injuries in Hotel/Motel Industry	0	4
SG6: Illnesses in Hotel/Motel Industry	0	8
SG7: Health Disparities in Hotel/Motel Industry	0	2
SG8: Injuries/Illnesses in Government	0	7
SG9: Traumatic Injuries in Recreation and Entertainment Industries	0	2
SG10: Injuries in Food Services	1	4
SG11: Violence in Food Services	0	1
SG12: Injuries/Illnesses in Telecommunications	0	2
SG13: Traumatic Injuries in Telecommunications	0	1
SG14: Temporary Labor/Contractors/Contingent Workers	1	2
SG15: Injuries in Waste Collection, Disposal, and Recycling Industries	0	3
SG16: Musculoskeletal Disorders	2	5
SG17: Surveillance	30	24
SG18: Injuries/Illnesses in Nail and Hair Salons	1	3



Transportation, Warehousing, and Utilities

Table 12 shows how FY2017 extramural and intramural research projects in the Transportation, Warehousing, and Utilities (TWU) Sector addressed strategic goals. Both intramural and extramural research covered three of four strategic goals for this sector. The majority of projects came from strategic goal SG4, Chemical/Biological/Physical Hazards (n=25).

Table 12. Transportation, Warehousing, and Utilities research projects by strategic goal, FY2017

Strategic Goal (SG)	Extramural Projects	Intramural Projects
SG1: Traumatic Injuries	1	18
SG2: Musculoskeletal Disorders	2	14
SG3: Health and Wellness Programs	0	14
SG4: Chemical/Biological/Physical Hazards	1	24



Wholesale and Retail Trade

Table 13 shows how FY2017 extramural and intramural research projects in the Wholesale and Retail Trade (WRT) Sector addressed strategic goals. Projects addressed all six strategic goals within this sector. Both intramural and extramural research projects supported two strategic goals (SG1 and SG2), while only intramural research covered the other four goals. Intramural and extramural research most often focused on strategic goal SG1, Musculoskeletal Disorders (n=15).

Table 13. Wholesale and Retail Trade research projects by strategic goal, FY2017

Strategic Goal (SG)	Extramural Projects	Intramural Projects
SG1: Musculoskeletal Disorders	2	13
SG2: Traumatic Injuries	1	7
SG3: Violence	0	4
SG4: Vehicle-related Injuries	0	6
SG5: Small Business Outreach	0	3
SG6: Vulnerable Workers	0	11

IV. FY2017 EXTRAMURAL RESEARCH PROGRAM HIGHLIGHTS

Selected outputs, outcomes, and accomplishments of NIOSH-funded extramural research during FY2017 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, 2016, to September 30, 2017, NIOSH-funded extramural research led to 557 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 *American Journal of Industrial Medicine* (n=40), the *Journal of Agromedicine* (n=22), and the *Journal of Occupational and Environmental Hygiene* (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 FY2017 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 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.

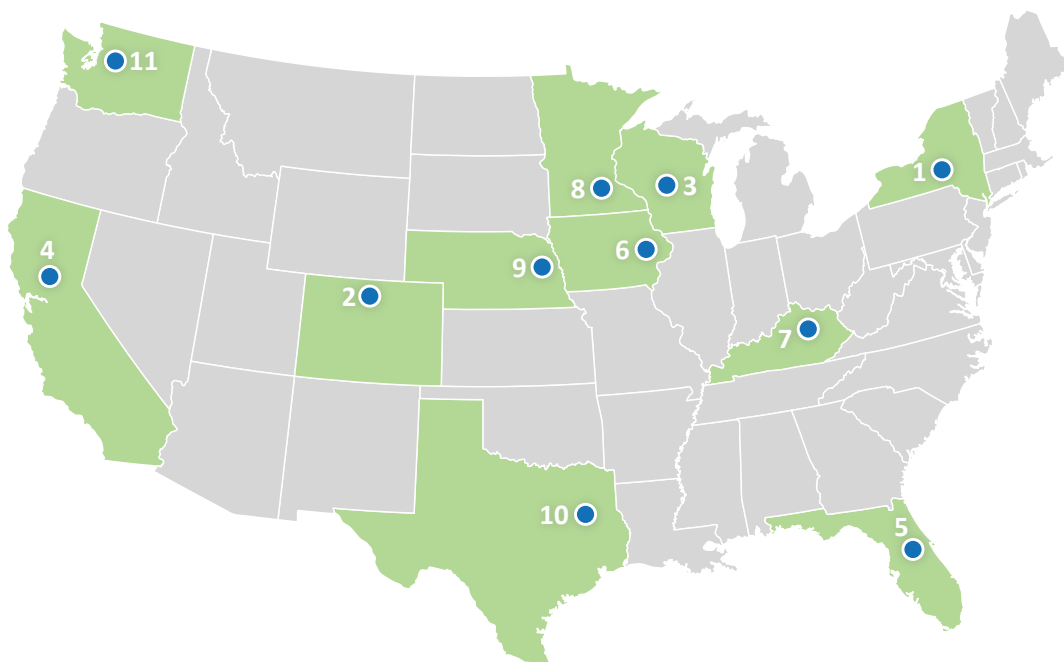
■ Public Health Relevance

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 measureable

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, significant decreases in injuries, illnesses, and death among farm workers occurred in the more than 25 years since the Act took effect. 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 | 6. University of Iowa |
| 2. Colorado State University | 7. University of Kentucky |
| 3. National Farm Medicine Center | 8. University of Minnesota |
| 4. University of California, Davis | 9. University of Nebraska Medical Center |
| 5. University of Florida, Gainesville | 10. University of Texas Health Science Center, Tyler |
| | 11. University of Washington |

The Ag Centers made significant contributions to public health in FY 2017:

- 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

obstacles 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 FY2017

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, 2016, to September 30, 2017, Ag Centers published 102 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 FY2017

Ag Centers Assisting Vulnerable and Immigrant Populations

Many U.S. workers in AFF industries are immigrants or in vulnerable populations. These workers are often described based on gender, race or ethnicity, nationality, age, social status, or access to care. Regardless of what descriptors subdivide them, these populations face increased risks due to their various backgrounds. These workers include immigrants experiencing cultural, social, and language barriers. Due to the economic demands and work cultures on small, family farms, often their children engage in risky behaviors. These workers also experience increased work-related morbidity and mortality. Because of the widespread participation of vulnerable populations in the AFF workforce, many Ag Centers engage in projects or outreach activities affecting these groups.

California: Translation of Economic, Socio-cultural, and Physiological Factors into Effective Interventions for Heat Illness in Farm Workers

Despite major campaigns to reduce heat-related illness (HRI) in agricultural workers, illnesses and fatalities still occur at a considerably higher rate compared with other workers exposed to hot environments. The complexity of contributing factors go beyond environment, work intensity, and physiology. They

also include cultural and socio-economic elements unique to the largely immigrant pool of farm workers. This project translates existing data from the center's first study on behavioral and physiological factors in California farm workers into multifaceted risk-reduction strategies. These strategies include developing alerts and sending real time information to supervisors in the fields using [mobile phone applications](#). These culturally relevant apps will prove more effective by bringing heat-related illness prevention into daily, rather than occasional, awareness.

Details:

[Western Center for Agricultural Health and Safety](#)

Florida: PISCA—Pesticide and Heat Stress Education for Latino Farmworkers

Chronic low-dose exposure to pesticides and extreme heat and humidity contribute to poor health effects among farmworkers—a group of mostly Mexican immigrants. Recent revisions to the U.S. Environmental Protection Agency's Worker Protection Standard and growing concern over heat-related illness made creating education curricula necessary. This education lessens workers' pesticide exposure and the harmful effects of exposure to heat and humidity.

The PISCA project strives to reduce pesticide and heat-related illness among Latino farmworkers through a community-advocate-university partnership. Researchers create reproducible, culturally, and contextually suitable curricula for Latino farmworkers, targeting pesticide exposure and heat-related illness. They also work to figure out the effectiveness of the developed curricula in promoting advocated safety behaviors.

Details:

[Southeastern Coastal Center for Agricultural Health and Safety](#)

[SCCAHS 2016/2017 Annual Report](#)

Minnesota: Promoting Safety and Worker Health in Immigrant Dairy Workers

Immigrant workers help sustain U.S. dairy production, however, they often lack adequate training due to cultural and language barriers. This project aims to improve the occupational health and safety of Minnesota's growing immigrant dairy workforce. It applies a community health worker model (e.g., Seguridad en Las Lecherfas: Immigrant Dairy Worker Health and Safety) and employs a team from various disciplines. These include clinicians, veterinarians, producers, workers, and community health centers. The project uses resources from previous center projects, building on past efforts to create a worker health and safety curriculum.

Investigators are enrolling 30 dairies in Minnesota to serve as industry leaders. They offer intensive training to 300 to 450 workers to serve as Community Health Workers (Promotores de Salud) in these dairies. These specially trained workers will incorporate available healthcare and train veterinarians to assess potential hazards and workers/producers in reducing those hazards.

Details:

[Upper Midwest Agricultural Safety and Health Center](#)

[UMASH Summary Annual Report 2016–2017](#)

Nebraska: Health and Safety Risks among Immigrant Cattle Feedyard Workers in the Central States Region

This project seeks to better understand Latino immigrant cattle feedlot worker health and safety in two top cattle producing states—Nebraska and Kansas. Researchers are interviewing 256 workers using a new Ecological Stress-based Model of Immigrant Health and Safety. They intend to test the model's properties with the information collected from the workers. With the results, they plan to

develop, evaluate, and distribute culturally tailored and industry-specific health and safety information for cattle feedlot workers in both English and Spanish.

Details:

[Central States Center for Agricultural Safety and Health](#)

[CS-CASH Annual Report - September 2016–August 2017](#)

Wisconsin: Child Ag Center Featured in National News Publications

The National Children's Center for Rural and Agricultural Safety and Health strives to protect the health and safety of all children exposed to hazards from working on farms and living in rural areas. It addresses this goal through research, education, intervention, prevention, translation, and outreach. The center mainly focuses on translating childhood agricultural safety research and knowledge into practice through partnerships with a range of stakeholders.

The center offers a wide variety of services related to children and teens in these rural settings. It serves as a leader in building partnerships, conducting research with practical implications, generating consensus on complex issues, and producing resources useful to multiple audiences. A [New York Times](#) article on farm safety for children featured the director of the National Children's Center for Rural and Agricultural Health and Safety. The online magazine, [New Food Economy](#), also recently featured the center's research on need for childcare in American agriculture.

Details:

[NIOSH eNews, April 2018](#)

[Marshfield Clinic National Children's Center for Rural and Agricultural Health and Safety](#)

[National Children's Center for Rural Agricultural Health and Safety Annual Report](#)

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 FY2017, 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 FY2017

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, 2016, to September 30, 2017, CPWR published 14 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 FY2017

CPWR's research and outreach activities in FY2017 received international recognition related to nanomaterials in construction. The Center also developed tools that over 1,000 workers, multiple companies, and a federal agency use. Examples of their work follow.

Nanotechnology in Construction

CPWR and the NIOSH Nanotechnology Research Center work together to create a valuable source of information related to engineered nanomaterials in construction. Recently, CPWR and NIOSH researchers cowrote a chapter in an upcoming European textbook on managing exposure to these nanomaterials. The book, *Occupational Exposure to Manufactured Nanomaterials in the Construction Industry: Strategy and Guidelines (SCAFFOLD Handbook)*, is a European guidance document. It gives practical guidelines for the safe use of manufactured nanomaterials in the construction industry.

Additionally, [eLCOSH Nano](#), CPWR's inventory of nanotechnology-related commercial construction products, now lists 576 items as either nano-enabled or nanostructured. The

inventory—the largest in the world—focuses on nano-enabled commercial construction products, serving as a resource on health and safety issues for workers who handle these products.

Details:

[CPWR's Nanotechnology Initiative](#)
[CPWR—Annual Summary Report—FY17](#)

U.S. Department of Energy Uses CWPR's Jobsite Safety Climate Tools

CPWR and researchers at Washington State University partnered to develop the Safety Climate Assessment Tool (S-CAT). The S-CAT is a free online tool for construction companies to conduct anonymous assessments of their safety climate maturity. Participants using the tool receive a tailored report with scores on eight leading indicators of jobsite safety climate. The report includes benchmark data so

companies can compare their level of climate maturity to other companies that took the S-CAT. So far, more than 30 companies took the S-CAT, with the S-CAT database holding over 2,500 individual responses.

The U.S. Department of Energy is conducting a pilot project using the S-CAT to measure safety climate maturity in several departments. Each department is using the new CPWR workbook, "Worksheet and a Rating Tool to Help You Strengthen Jobsite Safety Climate," to find possible interventions to improve low-scoring indicators. These departments plan to take the S-CAT one year after the application of the intervention to see how much the intervention affected their safety climate maturity.

Details:

[CPWR—Strengthening Jobsite Safety Climate by Using and Improving Leading Indicators](#)

CENTERS OF EXCELLENCE FOR TOTAL WORKER HEALTH®

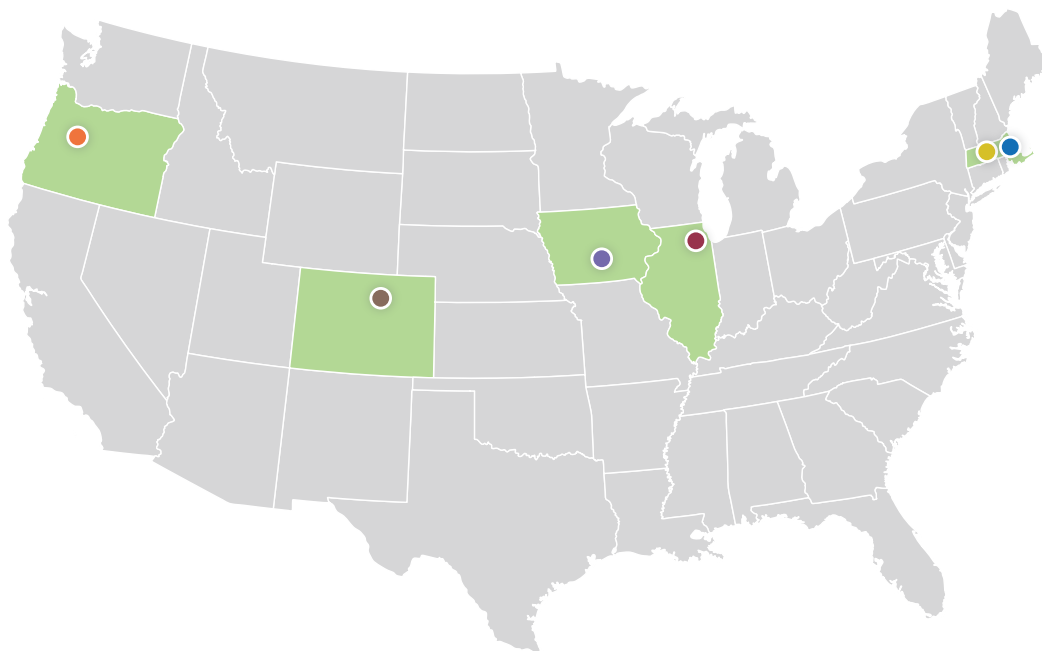
NIOSH funded six **Centers of Excellence**, located throughout the U.S., to explore and research the concepts of *Total Worker Health® (TWH)*. NIOSH defines TWH as policies, programs, and practices that integrate protection from work-related safety and health hazards with the promotion of injury and illness prevention efforts to advance worker well-being. They 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

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

- 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.

■ 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. 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 FY2017

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, 2016, to September 30, 2017, the Centers of Excellence published 24 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 FY2017 Center for Health, Work & Environment Reaches Nearly 85,000 Small Business Employees through Health Links™ Program

Small businesses with fewer than 500 workers made up 99.7% of U.S. employer firms in 2012, according to the [U.S. Small Business Administration](#). However, these companies are under-represented in terms of the adoption and implementation of TWH practices and research. The Center for Health, Work & Environment saw this as a chance to influence the health and safety outcomes of workers with targeted TWH outreach strategies through its Health Links™ program.

The center's Health Links™ program focuses on collaborations with employers to build a workplace culture of health and safety. Health Links™ include an online tool that the center uses to assess organizations' policies and programs, make evidence-based recommendations, and connect employees with local resources. The center partnered with multiple entities, including local public health agencies and several chambers of commerce, to give TWH information to small businesses. The center also recognizes businesses as Certified Healthy Businesses through Health Links™. In 2017, this effort resulted in engaging 199 small- and mid-sized employers, reaching nearly 85,000 employees.

Details:

[Center for Health, Work & Environment, Colorado School of Public Health](#)
[Health Links: Be the Health and Safety Champion Your Team Deserves](#)

Center for Work, Health, & Well-Being Implements Global TWH Training in South America

The Harvard Center for Work, Health, & Well-Being held two global trainings—one in Chile and the other in Brazil—on knowledge,

strategies, and tools for using a TWH integrated systems-level approach. The course, “Work, Health, and Well-Being: Making the Business Case for Integrated Approaches,” discussed the value of a TWH approach, focusing on work conditions to improve worker health, safety, and well-being. The April 2017 training in Chile built on a formal partnership between the center and Mutual de Seguridad—an occupational injury insurance company. Occupational safety and health managers, upper-level management, and personnel from Mutual de Seguridad attended the event. Additionally, some of their clients joined in the training.

In Brazil, the course took place in May 2017 at Serviço Social da Indústria (SESI)—a nonprofit that promotes social welfare to enhance the lives of workers, their families, and their communities. The training audience included SESI upper-level leadership, along with some of their clients, which included managers in occupational safety and health, worksite health promotion, and human resources.

Details: [Center for Work, Health, & Well-Being](#)

National Corrections Association Collaborates With CPH-NEW to Promote TWH Approach

Past research from the Center for the Promotion of Health in the New England Workplace (CPH-NEW) showed that correctional officers suffer serious health declines within the first three years on the job. The center’s study results also revealed that introducing preventive TWH interventions to new recruits help correctional officers avoid these health issues.

During FY2017, the Association of State Correctional Administrators (ASCA)—a key policy group in the field of U.S. corrections—endorsed the TWH approach. To help advocate for this approach of integrating working conditions with individual health,

ASCA launched a multi-part initiative. This initiative focused on workforce well-being to improve the corrections environment. This move came after the Co-Director of CPH-NEW spoke to their members at ASCA’s 2017 national conference. ASCA’s membership includes corrections commissioners and leaders in all 50 U.S. states, the District of Columbia, and U.S. territories.

ASCA also established a new executive committee focused on employee health and well-being. They work closely with CPH-NEW to learn from its study, “Health Improvement through Training & Employee Control (HITEC II).” HITEC II centers on peer health mentoring to target new cadet correctional officers to support healthier behavior. ASCA is also interested in CPH-NEW’s ability to develop and supply process evaluation tools and metrics to help corrections commissioners in justifying legislative support for TWH initiatives.

Details:

[Center for Promotion of Health in the New England Workplace \(CPH-NEW\)](#)

[Safety & Health in corrections History](#)

[Association of State Correctional Administrators \(ASCA\)](#)

Oregon Healthy Workforce Center Study Aims for Improved Sleep for Truckers

Long-distance truck drivers sometimes suffer from a lack of sleep. The fatigue that truck drivers experience can affect both work performance and health—a lack of sleep adds to chronic health problems like obesity and diabetes. To address this issue, some companies assign drivers in pairs so that one worker can sleep while the other drives. However, sleeping in a noisy, moving vehicle does not offer the same kind of restful sleep as a motionless bed in a quiet room. To deal with this problem, the Oregon Healthy Workforce Center is collaborating with the University of Washington on the Tech4Rest study.

In this study, researchers use a two-pronged approach to improve sleep quality for truck drivers. They examine the influence of an enhanced truck cab and a behavioral sleep health program on truck drivers' sleep habits. The enhanced truck cab involves testing the effects of a therapeutic mattress system and an active suspension seat to reduce whole body vibrations during driving and sleep periods. Fit4Sleep, the behavioral sleep health program, tests various interventions, including physical activity, sleep training, and health coaching.

Details:

[Tech4Rest](#)

[Tech4Rest Video](#)

[Research Rounds: New Study Aims for a Better Night's Sleep for Truck Drivers Long-Haul Truck Drivers](#)

[Oregon Healthy Workforce Center](#)

The Power of Partnership: TWH Approach Merged into Nebraska Governor's Wellness Award

WorkWell collaborates with the University of Iowa Healthier Workforce Center to integrate TWH concepts into its safety and wellness trainings and educational materials. WorkWell is a Nebraska Worksite Wellness Council, a division of the Nebraska Safety Council designated as a [NIOSH Total Worker Health® affiliate](#). A product of this collaboration includes a new health and safety risk and culture assessment tool that became available to all Nebraska Safety Council members in 2017. During the year, WorkWell also headed efforts to include a TWH standard into the Nebraska Governor's Wellness Award program, which recognizes state organizations of all sizes for their wellness efforts.

Details:

[University of Iowa Healthier Workforce Center of the Midwest](#)

[Governor's Wellness Award](#)

[Nebraska Safety Council/WorkWell](#)

Understanding Pathways to Precarious Jobs and Healthy Work

Precarious work describes jobs with dangerous conditions, long hours, and that are contingent or insecure with no paid benefits, advancement opportunities, or scheduling control. The UIC Center for Healthy Work at the University of Illinois in Chicago aims to understand how organizations perceive precarious work through its project, [Healthy Communities through Healthy Work](#). The program involves partners, including neighborhood groups, and regional, state, and national organizations in multiple occupational sectors to find ways to advance healthy work into precarious jobs.

During 2017, the center conducted 40 interviews with its partners to understand the cause of precarious work and its impact on health in America. It used a two-part process to analyze the data. Initial findings show that key partners know that employers hire temporary and contractual workers to cut costs—changing the culture of work. This shift led to people working multiple jobs, feeling overloaded, and developing bad health. However, researchers determined there exists limited understanding of how to work on the problem.

Through discussions with its partners, the center also collected a list of interventions—initiatives targeting multiple audiences and sectors—via a database. Literature reviews identified several interventions as best practices. As of October 2017, the database contained information on 103 interventions. These data include the intervention topic, evidence supporting the intervention, location, target population, and implementing sector.

Details:

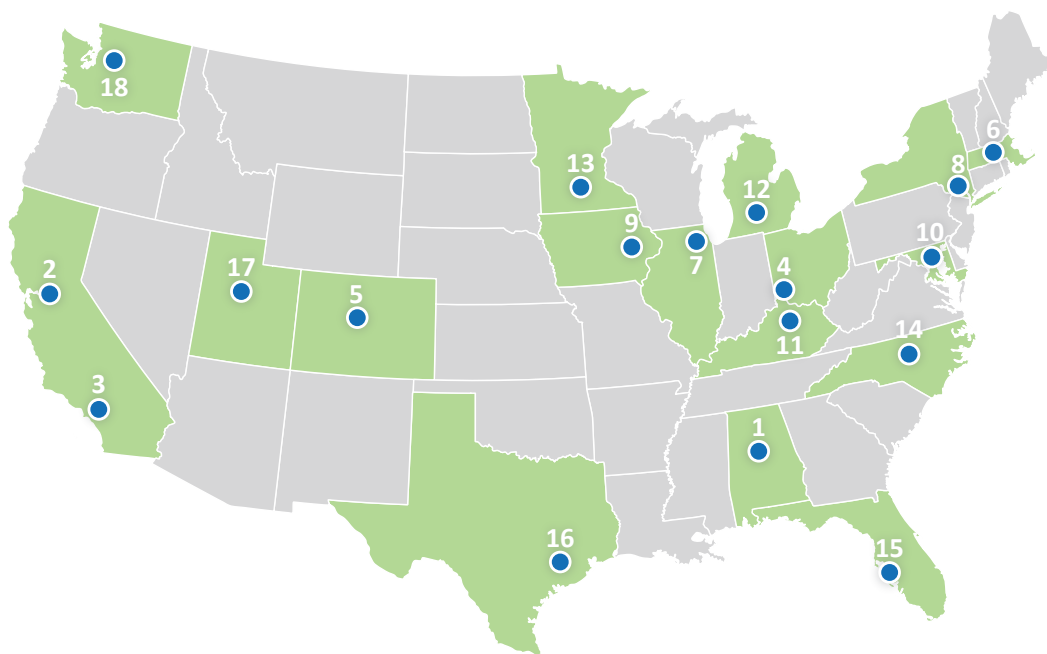
[UIC Center for Healthy Work](#)

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 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. Programs respond to area needs and carry out new strategies to meet those needs, with a focus on worker health and safety.

NIOSH Education and Research Centers



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

■ 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 FY2017

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, 2016, to September 30, 2017, the ERCs published 223 articles in peer-reviewed journals. Find a searchable database of NIOSH publications, which includes grantee final reports and publications, by using the [NIOSTIC-2 publications search](#).

■ Program Highlights FY2017 Trainees, Graduates, and Employment of Graduates

In academic year 2016–2017, 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 ERC graduates increased from 252 in FY2016 to 311 in FY2017. Table 14 shows the number of students who enrolled along with the number of graduates and their employment status during FY2017.

Table 15 shows the placement of FY2017 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 14. ERC Trainees, Graduates, and Employment, FY2017

Program Area	Enrolled	Graduates	Employed or seeking occupational safety and health employment (%)
Industrial Hygiene	174	88	87 (99)
Occupational Health Nursing	126	44	37 (84)
Occupational Medicine	79	42	42 (100)
Occupational Safety	68	62	61 (98)
Other Related Disciplines	285	75	71 (95)
Total	732	311	298 (96)

Table 15. ERC Graduate employment by work setting, FY2017

Work Setting/ Program Area	Industrial Hygiene (n=88)	Occupational Health Nursing (n=44)	Occupational Medicine (n=42)	Occupational Safety (n=62)	Other (n=75)	Total (n=311)
Private Industry	44	4	1	32	14	95
Federal/ State/Local Government	20	3	4	12	9	48
Academic Institution	10	0	5	9	18	42
Clinic/Hospital	3	20	23	2	5	53
Other OSH Employment	3	0	5	3	4	15
Seeking Advanced OSH Degree	5	1	0	2	15	23
Seeking OSH Employment	2	9	4	1	6	22
Total	87	37	42	61	71	298

Table 16. Continuing Education Courses by discipline, FY2017

Discipline	Number of Courses	Number of Trainees	Person-Hours of Training
Industrial Hygiene	209	5,884	58,705
Occupational Health Nursing	207	7,712	46,559
Occupational Medicine	196	6,349	18,052
Occupational Safety	793	21,685	187,644
Ag Safety and Health	8	1,317	315
Other	245	9,899	85,933
Total	1,658	52,846	397,208

Continuing Education Outputs

Continuing education of occupational safety and health professionals is a required part of ERCs 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 following table shows the continuing education activity by discipline. In FY2017, ERCs provided 397,208 person hours of training to 52,846 occupational safety and health professionals, who took 1,658 courses.

ERC Program Achievements

More than 100 U.S. Media Outlets Feature Harvard Airline Pilot Mental Health Study

In March 2015, Germanwings Flight 9525 crashed into the French Alps, killing all 150 people onboard. An investigation found that the copilot deliberately steered the plane into the mountainside. It also revealed that he had a history of depression, although the airline company was unaware of this crucial information. In one of the first studies of its

kind, faculty and trainees at the NIOSH-funded Harvard ERC looked at the prevalence of depression among commercial airline pilots.

Using an anonymous web-based survey of pilots recruited from unions, airline companies, pilot groups, and aviation safety organizations, researchers asked about depression and other health issues. Nearly 1,840 airline pilots completed the survey. More than 12% of the pilots who answered the survey's health questions met the criteria for depression, with 4% reporting suicidal thoughts within the prior two weeks. The *Environmental Health* journal published this study in FY2017. Since then, more than 100 national and local media outlets around the U.S. featured this research, including ABC News, Cable News Network, Newsweek, and Time Magazine.

Details:

[Airplane Pilot Mental Health and Suicidal Thoughts: a Cross-sectional Descriptive Study via Anonymous Web-based Survey](#)
[Research Rounds: Airline Pilot Survey Highlights Need for Mental Health Support](#)
[Harvard Education and Research Center](#)

Texas ERC Assists in Aftermath of Hurricane Harvey

Damaging winds and flooding from Hurricane Harvey devastated the city of Houston, Texas, and surrounding areas in August 2017. In response, ERC trainees and faculty at the University of Texas Health Science Center at Houston assisted with recovery efforts. They helped monitor soil and waters in flooded areas for chemical and biological contaminants, collecting more than 150 samples. The faculty and students also handed out more than 900 kits to help Houston residents and recovery volunteers with storm cleanup. The kits included personal protective equipment (N-95 respirator masks) and bilingual guidance on how to avoid flood-related hazards. This included recommendations on mold remediation. The University of Texas Health Science Center at Houston also offered education on proper respirator use and classes to large community groups focused on health risks associated with flooded homes.

Details:

[Volunteers key to Hurricane Harvey projects](#)
[Southwest Center for Occupational and Environmental Health \(SWCOEH\)](#)

Union Partners on Workload, Health, and Injury Study among Janitors

According to the [Occupational Safety and Health Administration Occupational Outlook Handbook](#), the employment rate for janitors and building cleaners is expected to increase by 10% from 2016 to 2026 to 2.6 million workers. This is faster than the average for all occupations. Because the work consists of

tasks like cleaning with chemicals, removing garbage, and heavy lifting, these workers are at risk for injuries and illnesses that include respiratory and infectious diseases and musculoskeletal disorders. However, few studies have examined the relationship between the workloads of janitors as it relates to injury.

The University of Minnesota ERC studied the health and workload factors contributing to injuries among this occupational group. The research involved a collaboration with the [Service Employees International Union Local 26](#), a property services union in Minnesota. Researchers collected survey data from 4,000 janitors, looking at their physical workload, health status, and rates of injury. Researchers administered the surveys during two separate 6-month timeframes.

Researchers also conducted two sub-studies using subsets of workers who completed the survey. In one year-long study, janitors wore activity trackers that monitored their physical activity (workload) on the job. In the second sub-study, ergonomists conducted on-the-job assessments on a different group of janitors to define their potential physical workload. Researchers plan to analyze and compare the workload, exposure, and injury data from the study to find associations between these factors. The research findings should contribute to the development and evaluation of interventions that enable safer work environments for janitors and other building cleaners.

Details: [Midwest Center for Occupational Health and Safety](#)

Center Collaborations Lead to Regional Joint Research Symposium in Occupational Health and Safety

Three ERCs at the University of Illinois at Chicago, the University of Cincinnati, and the University of Michigan collaborated to hold their first Joint Research Symposium in Occupational Health and Safety. The day-long Symposium kicked off in March 2017 in Ann Arbor, Michigan, with more than 120 attendees. The meeting included two panel

discussions focusing on themes of underserved workers and global work-related health. Participants presented 23 posters, featuring a wide range of topics related to occupational safety and health and engineering. These presentations included health and safety hazards assessments, job-related inhalation exposures, and improving postures in microsurgery.

Details:

[Education and Research Center \(ERC\) Regional Research Symposium](#)

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 provide 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 FY2017

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, 2016, to September 30, 2017, R01 grant-funded researchers published 127 articles in peer-reviewed journals. The numbers of peer-reviewed publications for the other investigator-initiated research mechanisms are 13 (R03), 34 (R21), and 19 (K01). Find a searchable database of NIOSH publications, which includes grantee final reports and publications, by using the [NIOSHTIC-2](#) publications search.

PROGRAM HIGHLIGHTS FY2017

■ Highlights from R01 Grants

Global Impact of Novel Interventions to Protect Workers from Airborne Diseases

Project Title: Testing Novel Interventions to Protect Workers from Airborne Infections.
Principal Investigator: E. Nardell

Tuberculosis (TB) is one of the world's deadliest diseases. One-fourth of the global population is infected with this airborne spread illness. Concerns about the transmission of airborne infections, like SARS (severe acute respiratory syndrome), pandemic influenza, bioterrorism agents, TB, and other diseases in the workplace led to this study. While this project initially focused on interventions to reduce the risk of airborne infections

to workers, significant findings and outcomes emerged related to TB.

Researchers tested several methods to reduce the contagion of patients with multidrug-resistant TB. The methods included wearing a surgical mask and using upper-room germicidal ultraviolet (GUV) air disinfection. Through human-to-guinea pig transmission studies, researchers discovered long-sought evidence for upper room GUV efficacy. They found that upper room GUV (254 nm) resulted in patients with multidrug-resistant TB becoming more than 80% less infectious. Investigators found surgical masks 53% effective in reducing patient contagion.

Researchers also developed and tested a new, more efficient approach to the upper room GUV, called the "eggcrate ceiling" GUV. This study also led to new dosing guidance for GUV application, including new guidelines issued in South Africa. The World Health Organization is also considering data from the study in its upcoming revised TB infection control guidelines.

Furthermore, scientists developed a new approach to the TB transmission control strategy named Find cases Actively, Separate temporarily, and Treat effectively or FAST. The FAST method rapidly diagnoses TB via molecular diagnostic testing. It also tests to see if a person has a drug resistant form of TB. FAST has been tested and implemented in hospital settings globally, including in Bangladesh, Russia, and Vietnam. The World Health Organization also included information on FAST in its publication, *Implementing the End TB Strategy: the Essentials*.

Details:

[Tuberculosis: Data and Statistics](#)
[Grantome: Testing Novel Interventions to Protect Workers from Airborne Infections](#)

New Guidelines Developed for the Design of Hospital Patient Rooms to Reduce Musculoskeletal Disorders in Healthcare Workers

Project Title: A Participatory Design Process Addressing Ergonomics in Hospital Patient Rooms. Principal Investigator: S. Lavender

Musculoskeletal disorders are soft-tissue injuries caused by sudden or sustained exposure to repeated motion, force, vibration, and awkward positions. They are a major source of injury to healthcare workers. According to the Occupational Safety and Health Administration (OSHA), nursing aides, orderlies, and attendants had the highest rates of musculoskeletal disorders in 2010. The awkward postures and motions of healthcare workers, along with the physical effort required to complete their tasks, are often related to the structure of their workspace. For many healthcare workers, the hospital patient room is a common work setting that leads to significant physical demands for employees due to room design.

This study aimed to reduce healthcare workers' musculoskeletal injuries in the patient room setting. Using a design process that actively involves users, researchers obtained information from employees working in patient rooms to develop an improved room design. Researchers conducted interviews and focus groups with these workers across multiple occupations. They gathered details on the workers' job tasks and challenges faced because of patient room design, collecting worker input on ideal designs for patient rooms. Scientists also received feedback from hospital patients and visitors on multiple room design layouts. The findings from this study led to 66 new guidelines that define the design needs of patient rooms. These recommendations will allow building designers,

hospital administrators, and others interested in patient room design to make informed decisions when building or remodeling hospitals.

Details:

[Grantome: A participatory Design Process Addressing Ergonomics of Hospital Patient Rooms](#)

[OSHA: Healthcare, Safe Patient Handling](#)

The Revised Strain Index: An Enhanced Job Exposure Assessment Method for Musculoskeletal Issues

Project Title: Exposure Response Relationships for CTS and Epicondylitis from Pooled Data. Principal Investigator: A. Garg

As shown by 2014 National Safety Council data, work-related sprains, strains, and tears were twice as likely to result in workers' compensation claims as fractures, cuts, lacerations, amputations, bruises, contusions, burns, and chemical burns altogether. These musculoskeletal injuries negatively impact both workers and employers. This NIOSH-funded project focused on the relationship between biomechanical stressors—physical job demands like frequent bending, heavy lifting, and lengthy standing—and upper limb injuries—carpal tunnel syndrome (CTS), tennis elbow (lateral epicondylitis), and golfer's elbow (medial epicondylitis).

To measure biomechanical stressors, researchers used analytical methods to find which physical factors on the job exposed workers to increased risk of musculoskeletal disorders. These methods include a new risk assessment model, developed during this study, called the Revised Strain Index. This index quantifies physical exposures to musculoskeletal problems that impact the upper body. The Revised Strain Index builds on the 1995 Strain Index—one of the most common methods in North America to measure distal upper extremity exposures on the job.

The Revised Strain Index focuses on each physical exertion in a task and each task within the overall job. Its calculations are also sensitive to minor improvements in tasks over time. Researchers think that the Revised Strain Index will supply more reliable data than established surveillance based assessment models: the 1995 Strain Index and American Conference of Governmental Industrial Hygienists (ACGIH®) Threshold Limit Value for Hand-Activity Level.

Details:

[Grantome: Exposure Response Relationships for CTS and Epicondylitis from Pooled Data](#)
[The Revised Strain Index: An Improved Upper Extremity Exposure Assessment Model](#)
[NIOSH Musculoskeletal Health Program](#)

■ Highlights from R21 Grants

Novel Blood Test Quickly and Accurately Detects Pesticide Exposure

Project Title: Integrated Approach for Environmental Health Monitoring: Exposure Signatures of Pesticides. Principal Investigator: D. Du

Pesticides are a common agricultural tool to increase harvests. But over-exposure to some pesticides leads to serious health problems, including nerve damage. So worker protection, including exposure monitoring, is critical. At NIOSH, the Pesticide Surveillance Program monitors work-related illness and injury from exposure to pesticides. Tests available right now for exposure monitoring are expensive, time-consuming, and involve special equipment and trained personnel.

Researchers at Washington State University collaborated with the NIOSH-funded Ag Center, Pacific Northwest Agricultural Safety

and Health Center, on a study to work on this issue. They developed a simple, fast, and inexpensive blood test that accurately detects the level of exposure to potentially harmful pesticides among farm workers. The so-called sandwich ELISA (enzyme-linked immunosorbent assay) test is unique in its ability to measure the level of immune response-triggering molecules, or antigens.

Much like commercially available pregnancy tests, this test consists of a treated strip that reacts in the presence of specific protein molecules, or enzymes. The treated strip changes color in the presence of enzymes produced by the liver after exposure to phosphorus-based pesticides. To verify the test's accuracy, scientists measured the level of pesticide exposure in 124 blood samples from study participants who worked with pesticides in orchards or on cotton farms in Washington State or Pakistan. They found that the test accurately and quickly measured pesticide exposure by detecting pesticide-related enzyme activity and the total amount of enzyme in the blood. This study appeared in the journal, *Biosensors and Bioelectronics*. With the goal of making the test commercially available, scientists are now verifying its accuracy and developing software to enable its use in the field.

Details:

[Grantome: Integrated Approach for Environmental Health Monitoring: Exposure Signatures of Pesticides](#)

[Simultaneous detection Of Dual Biomarkers From Humans Exposed To Organophosphorus Pesticides By Combination Of Immunochromatographic Test Strip And Ellman Assay](#)

[Research Rounds: Novel Blood Test Quickly and Accurately Detects Pesticide Exposure](#)
[NIOSH Pesticide Illness & Injury Surveillance](#)

■ Highlights from K01 Grants

Maker of PURELL® Sanitizer Brand Produces Video Featuring NIOSH-funded Healthcare Infection Prevention Study

Project Title: Impact of Patient Safety Climate on Infection Prevention Practices and Healthcare Worker and Patient Outcomes. Principal Investigator: A. Hessels

During FY2017, the inventor of the PURELL® sanitizer product brand, GOJO Industries Inc., developed a video featuring the work of NIOSH-funded researcher Amanda Hessels, PhD, MPH, RN. Her study focused on understanding whether healthcare workers' perceptions of a positive job safety climate relate to improved adherence to standard precautions, resulting in lower levels of healthcare worker exposures and hospital patient infections. GOJO Industries Inc. posted the video on their YouTube channel and shared it with their staff and 900 others who work to prevent infection nationwide.

Hessels also conducted a webinar on her study as part of a Teleclass Education program by Webber Training Inc. More than 1,000 people attended the webinar and more than 6,000 accessed the webinar recording.

Details:

[YouTube: the Relationship between Patient Safety Climate and Adherence to Standard Precautions](#)

[Grantome: Impact of Patient Safety Climate on Infection Prevention Practices and Healthcare Worker and Patient Outcomes](#)

Preventing Respiratory Infections in Healthcare Workers Using Math Models

Project Title: Preventing Occupational Infections in Healthcare Professionals Using Risk Models. Principal Investigator: L. Casanova

Healthcare workers face a high risk of developing infectious diseases, such as respiratory infections. This is because of their job tasks and their high likelihood of coming in contact with bacteria and viruses. This study strives to reduce the spread of respiratory illnesses in healthcare settings. Researchers are developing complex mathematical models that describe how respiratory infections spread from patients to healthcare professionals. The models aim to find the various ways that healthcare workers face exposure to these illnesses and calculate their risks of becoming infected in multiple settings. Researchers plan to use the study findings to develop strategies to lessen healthcare workers' risk of contracting respiratory illnesses.

Details:

[Grantome: Preventing Occupational Infections in Healthcare Professionals Using Risk Models NIOSH Healthcare Workers](#)

COOPERATIVE 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 and injury.

In FY2017, NIOSH funded the state surveillance program to support states in monitoring occupational injuries, diseases, deaths, and hazards. Other cooperative agreements awarded in FY2017 included new funding to monitor workers' compensation claims, funding for AFF to support forestry safety research, and the National Mesothelioma Virtual Bank. 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 helps expand the role of states to conduct in-depth surveillance and follow-up investigations and interventions. These local state-based skills and abilities help meet the NIOSH mandate to ensure a safe workplace. See the annual reports on the [State Surveillance Program](#) web page for more information on these state-based initiatives.

■ Public Health Relevance

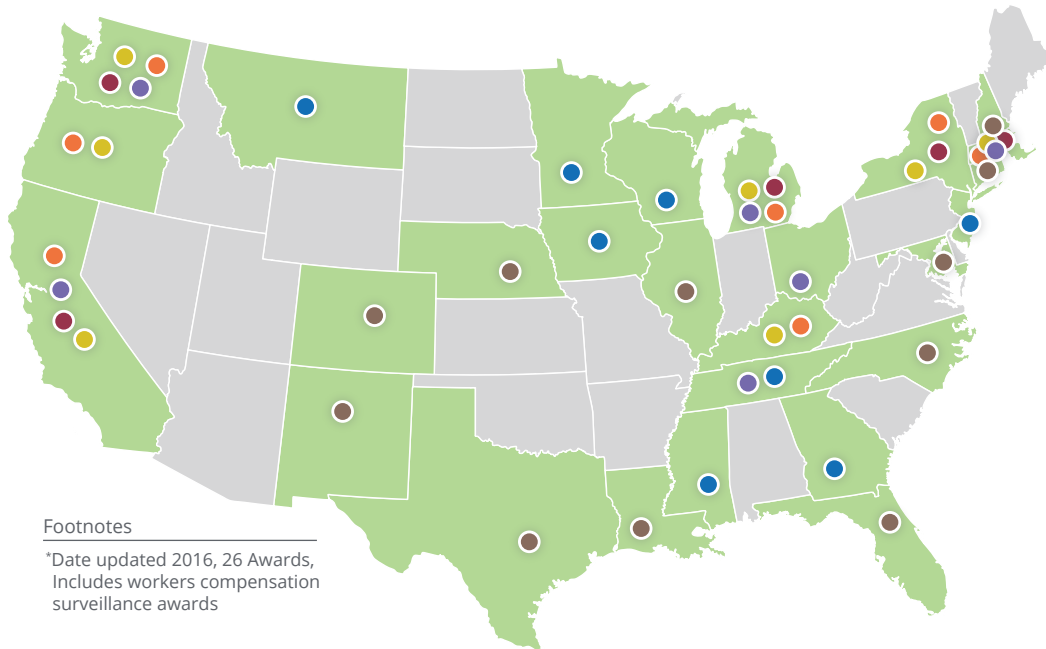
NIOSH values state programs and gives financial and technical support to state health and labor agencies to develop and expand their occupational health surveillance programs.

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 FY2017

NIOSH 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, 2016, to September 30, 2017, the NIOSH state surveillance program published 23 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



Footnotes

*Date updated 2016, 26 Awards,
Includes workers compensation
surveillance awards

● 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 and Other Surveillance

*California
*Massachusetts
*Michigan
*Ohio
*Tennessee
Washington

■ Program Highlights FY2017

Carbon Monoxide Poisoning Added to List of Reportable Workplace Occupational Health Illnesses and Injuries in North Carolina

The North Carolina General Assembly passed an amendment to an occupational surveillance rule (10A NCAC 41C.0702 under North Carolina General Statute 130A) by adding carbon monoxide poisoning to the list of state-reportable work-related incidents. This move came from the joint efforts between the North Carolina Occupational Health Surveillance Program (OHSP), North Carolina Division of Public Health Occupational and Environmental Branch (OEEB) that OHSP operates under, and North Carolina Commission for Public Health.

The rule amendment requires workplaces to report all cases of carbon monoxide poisoning to OEEB. The Carolinas Poison Center agreed to report case data each week to OEEB and OHSP. Before the rule amendment took effect in July 2017, about five incidents of carbon monoxide poisonings were reported over a period of six months, on average. Between July and October 2017, OEEB received 28 reported incidents of work-related carbon monoxide poisonings from the Carolinas Poison Center. This total included a low of one reported incident and a high of seven reported incidents per week. The rule amendment allows OEEB to conduct follow-up investigations on poisoning cases to get further information. It also allows OEEB to make at least two referrals to the North Carolina Occupational Safety and Health Administration for more employer site visits and investigations.

Details:

[NCDHHS \(NC Department of Health and Human Services\)](#)

[NCAC Occupational Health Rule](#)

Multiple State Health Departments Use Louisiana's Guide on Lead Prevention and Firing Ranges

Over the past two years, the Louisiana Occupational Health and Injury Surveillance Program received information on 34 cases of elevated blood lead levels (BLLs) from shooting range workers. These cases involved BLLs equal to or more than 10 µg/dL. Healthy People 2020 aims to lower BLLs to below 10 µg/dL. In response, the program emailed about 800 firearm instructors with general information about lead exposure, including health effects and protection from exposure. They also presented information about elevated BLLs cases at a workplace safety conference sponsored by the OSHA, recommending that OSHA increase enforcement at indoor firing ranges.

The Louisiana Occupational Health and Injury Surveillance Program also developed a two-page guide entitled *Prevent Lead Exposure in Indoor Shooting and Firing Ranges*. The guide informs shooting ranges on prevention measures and employer requirements. The program broadcast the guide via the [Adult Blood Lead Epidemiology and Surveillance \(ABLES\) Program](#) listserv. Two other state health departments tailored the guide for their use—New York's Oneida County Childhood Lead Poisoning Prevention Program and the Kentucky Department of Public Health.

Details: [Louisiana Department of Health, Occupational Health Surveillance](#)

NY FACE Data Contribute to New York State Revising the Move Over Act

In recent years, the New York Fatality Assessment and Control Evaluation (NY FACE) Program presented occupational fatality data at Workers' Memorial Day events across the state. This data show that Hispanic sanitation workers face a high risk for severe injuries,

especially while working on the road. These presentations led a state lawmaker and a group of advocates for Hispanic workers to collaborate with NY FACE in 2017 to help prevent these deaths.

With NY FACE providing the data on sanitation worker fatalities across the state, the New York State Legislature voted to expand the Ambrose-Searles Move Over Act. The original Act requires drivers to use due care to avoid hitting emergency vehicles parked on the side of the road or highway. The expanded law now includes tow trucks, construction and highway maintenance vehicles, and sanitation and recycling trucks.

Details:

[New York Fatality Assessment and Control Evaluation \(NY FACE\)](#)
[Governor Cuomo Announces New Campaign to Raise Awareness of New York's Move Over Law](#)

Release of First Guide for Worker Safety and Health in Marijuana Industry

Colorado's Occupational Health and Safety Surveillance Program published the *Guide for Worker Safety and Health in Marijuana Industry*; the first guide of its kind for worker safety in the marijuana industry. The publication gives employers an overview of current federal, state, and local regulations to use in developing workplace safety programs. The guide generated a lot of attention in both the cannabis industry and occupational safety and health.

Throughout FY2017, various groups shared information about the guide through webinars, trainings, and conferences—events sponsored by academic institutions and industrial hygiene, safety-related, and health organizations. For example, the Colorado program presented to the 2017 Canadian Agricultural Safety Association. The program also partnered with two NIOSH-funded

multidisciplinary centers—the Mountain and Plains Education Research Center and the Center for Work, Health, & Environment—to host the first safety and health training for the marijuana industry. More than 200 workers in the industry attended the trainings in 2017. Also, occupational health and safety professionals in areas like Oregon, California, and the Canadian Province of Alberta contacted the Colorado program for workplace safety guidance in the marijuana industry.

Details:

[Colorado Department of Public Health & Environment Health Department Publishes First "Guide for Worker Safety and Health in Marijuana Industry"](#)

State Agency Partnerships Produce Policy Changes and Award Winning PSA for Transportation Safety

For the Iowa Occupational Health & Safety Surveillance Program (OHSSP), working with other state agencies improved transportation safety and reduced job-related motor vehicle injuries and fatalities. OHSSP partnered with the state Governor's Traffic Safety Bureau (GTSB) and the Iowa Department of Transportation (IDOT) to develop three influential documents in FY2017: the Highway Safety Plan—FFY 2017, the Iowa Fatality Reduction Strategies Report, and the Iowa 2016 Impaired Driving Coalition Final Plan. The Iowa Legislature signed two bills into law based on information from these reports and focused on reducing traffic fatalities due to distracted and drunk drivers.

One law (Senate File 234), which went into effect July 1, 2017, improved Iowa's ban on using hand-held electronic devices while driving—including texting. The new bill changes this action from a secondary to a primary offense. This law allows police to pull drivers over for using a hand-held electronic device and issue a \$30 dollar fine. In the past, police

could only stop and ticket drivers if they committed a primary offense like speeding.

According to the Iowa Safety Patrol, the new law helped reduce traffic-related fatalities from 398 in 2016 to 329 in 2017. Under a second new law (Senate 444), a driver using a hand-held electronic device who is involved in a traffic-related death will face a charge of homicide by vehicle. The legislation also established a statewide sobriety and drug

monitoring program. OHSSP's partnership with GTSB and IDOT also led to a public service announcement on drowsy driving, "Don't Wake Up to a Nightmare." The video received a 2017 Telly Award, which recognizes outstanding video content.

Details:

[Iowa Department of Public Health, Occupational Health & Safety Surveillance](#)
[Iowa Highway Safety Plan - FFY 2017](#)
[Iowa Legislature, Bill SF 444](#)
[Iowa Legislature, Bill SF 234](#)

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 in single disciplines 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 in single disciplines through TPGs. Most TPGs are academic training programs that support undergraduate and graduate training. Located throughout the U.S., 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 workers by

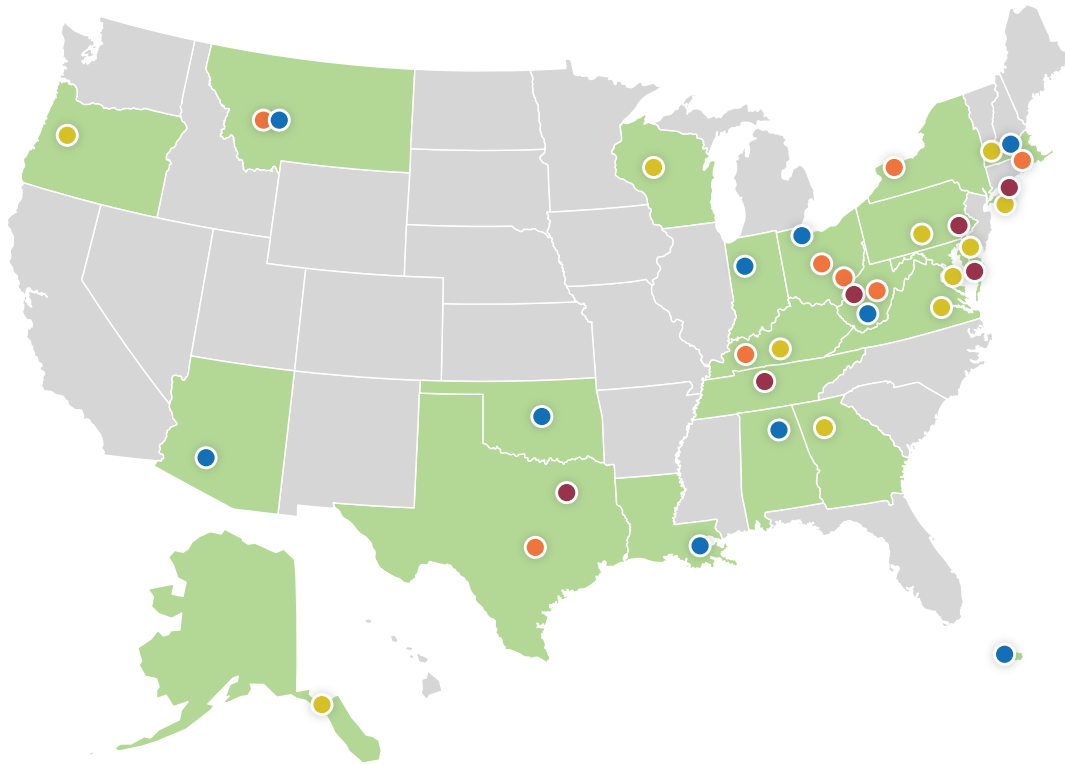
recruiting and mentoring students from minority and immigrant backgrounds, including underrepresented minorities.

Through a TPG, the Alaska Marine Safety Education Association expands the network of port-based fishing safety instructors in Alaska and the U.S. 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.

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
- Emory
- 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

Table 17. Training project grant trainees, graduates, and employment by discipline, FY2017

Program Area	Trainees	Graduates	Employed in occupational safety and health field or seeking advanced training (%)
Industrial Hygiene	315	55	53 (96)
Occupational Safety	341	125	117 (94)
Occupational Medicine	42	23	23 (100)
Allied Disciplines	288	77	73 (95)
Total	986	280	266 (95)

■ Research Outputs: Publications in FY2017

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, 2016, to September 30, 2017, the TPG researchers published 23 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 FY2017

Training Project Grant Trainees, Graduates, and Employment by Discipline

In academic year 2016–2017, the TPG academic training programs graduated 280 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.

TPG Program Achievements

Saving Lives: Alaska Marine Safety Education Association Instructor Training

Commercial fishing is one of the most hazardous jobs in America, with a fatality rate 29 times higher than the national occupational average. The Alaska Marine Safety Education Association (AMSEA) tackles this issue by training safety instructors through a Marine Safety Instructor-Training to teach fishing safety workshops. These are credible instructors who know both their local areas and the risky work environment that fishermen face.

By building a national network of safety instructors, this unique TPG targets saving lives by increasing the number of commercial fishing safety workshops available. These workshops, offered in Alaska and around the U.S., meet federal safety training requirements.

AMSEA shared the following testimonial from a fisherman. The man completed a safety workshop just five days before a potentially fatal incident. An AMSEA trained instructor led that workshop. The fisherman survived going overboard from a vessel, and he offered his appreciation:

"I was knocked into the water (by some fishing gear) and inflated my lifejacket, regulated my

breathing, and grabbed onto the boat. With a clear mind, the other crewmember sprang into action, took the boat out of gear, and spotted me. He then grabbed me and got me onboard as we had been trained. Even though it was a disaster, it couldn't have gone any better. Who knows what would have happened if we didn't go to the (safety) course. Thank you for all that you do for us fishermen."

Details:

[Alaska Marine Safety Education Association \(AMSEA\)](#)
[NIOSH Commercial Fishing Safety](#)

Exposure Assessment of Tattoo Artists

A 2017 publication from researchers at the Ohio State University reported that 40% of Americans in the millennial age group have one or more tattoos. Because tattoo artists' jobs consist of sitting and holding small vibrating tools in awkward positions for long periods of time, they face a potential risk for musculoskeletal disorders. However, researchers rarely study tattoo artists for work-related musculoskeletal problems and associated risk factors.

A TPG trainee at the Ohio State University led a study focusing on tattoo artists' exposure to work factors that resulted in musculoskeletal discomfort. The results showed that tattoo artists experience musculoskeletal discomfort in multiple areas, including the neck, shoulders, hands/wrists, lower back, and legs/feet. In many cases, their work movements made their pain worse. Researchers concluded that while working, these artists spend most of their time in awkward positions, which could increase the risk of musculoskeletal disorders.

To measure muscle response and electrical activity following nerve stimulation,

researchers innovatively applied electromyography (EMG). Specifically, they sampled muscle activity during tattoo sessions with a wireless EMG system. The manufacturer of the EMG system nominated the study for an award recognizing this innovative use of the EMG.

Details:

[Investigation of Musculoskeletal Discomfort, Work Postures, and Muscle Activation among Practicing Tattoo Artists](#)
[OSU Safety Ergonomics Program](#)

Meharry Medical College Builds Competency in Occupational Medicine through Total Worker Health®

The Meharry Medical College TPG supports trainees in the Occupational Medicine Residency program, a 2-year program supporting the completion of residency requirements in occupational medicine. During FY2017, *Total Worker Health* (TWH) content, in the form of TWH-related lectures, became part of the Meharry academic curriculum. These lectures focus on policies, programs, and practices that blend protection from work-related safety and health hazards with promotion of injury and illness prevention efforts to increase worker well-being.

Through this change, medical residents will have a more holistic approach to caring for workers in underserved groups. For example, the TPG trainees now work with Worker's Dignity—a Nashville, Tennessee, outreach group—on improving the care, safety, and workplace conditions of economically disadvantaged employees.

Details: [Meharry Medical College, Occupational Medicine](#)
[NIOSH Total Worker Health®](#)

EMERGENCY RESPONDER TRAINING PROGRAM

NIOSH funds a TPG in Emergency Responder Training Program through the International Association of Fire Fighters (IAFF). The 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.

The IAFF has had a long working relationship with NIOSH. The association delivers training to all kinds of emergency response workers: fire fighters, emergency medical personnel, law enforcement, and public health workers. The 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 fire fighters 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, the IAFF provides real-world training in HazMat response. Furthermore, the 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, the IAFF developed an Opioid Crisis Toolkit that uses the protocols, state-of-the-art responses, and resources available to fire fighters.

■ Program Highlights FY2017

In FY2017, the IAFF delivered 96 classes to 2,152 students, totaling 47,328 contact hours.

Table 18. Emergency responder training classes, FY2017

Class Title	Class Length	Total Classes	Total Students	Total Contact Hours
Confined Space Operations	16 hours	8	170	2,720
Illicit Drug Labs	8 hours	8	185	1,480
First Responder Operations	24 hours	80	1,797	43,128

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 U.S. since 1999.

For FY2017, two programs were funded in the Western U.S.: the Colorado School of Mines and the University of Arizona. And although no funding was given to the Mine Safety and Health Training Program at the University of Texas at Arlington in FY2017, they made significant progress. Their efforts show work that the training program completed with prior year grant funding and are captured in the program highlights section next.

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. It is critical for underserved 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 on how to improve safety training. These activities improve the transfer of best safety practices to the workplace while increasing the number of workers served.

■ Program Highlight FY2017

Harry's Hard Choice Gaming Software

Several years ago, the University of Arizona developed MineSAFE (Software Architecture for Mine Safety Education)—a platform to produce “serious games” in mine safety education. The goal of MineSAFE is to create realistic and engaging training through gaming software that leads to increased knowledge transfer. Specifically, the university created the NIOSH training exercise, “Harry's Hard Choices,” as a serious game that holds nearly all of the content required for the MSHA annual refresher training.

The University of Arizona is working on a second version of the MineSAFE platform. The goal is to increase its flexibility, allow for faster game development, improve functions, and allow multiplayer. The first serious game in the new platform, “Harry's Hazardous Day,” is now under development. The University plans to test it in 2018. The new game focuses on inspecting job sites and finding hazards for stone, gravel, and cement facilities. It will also include evaluation dashboards that trainers can use to make improvement plans for each worker based on evaluations of his or her game use.

Details:

[University of Arizona, Western Mining Safety and Health Training Resource Center](#)
[NIOSH Extramural Research and Training Program—Annual Report of Fiscal Year 2014](#)

Premiere of “Remember Wilberg” Documentary

The University of Texas at Arlington developed a documentary film about the 1984 fire at the Wilberg Mine in Utah that killed 27 coal miners. The one hour film, “Remember Wilberg,” includes live reenactments and features 31 personal interviews, including an interview from the lone survivor. Fifteen hundred people attended the February 2017 premiere for the documentary in Castle Dale, Utah. The Society of Mining, Metallurgy, and Exploration also featured the film at its 2017 annual meeting. The 2017 American Society of Safety Engineers (ASSE) Conference and Exposition in Denver, Colorado also showed the film.

Details:

[Mining Documentary, “Remembering Wilberg,” UTA](#)

CSM Partners With Fire Rescue Organizations for Training

The Colorado School of Mines (CSM) developed partnerships with organizations involved with rescue training during FY2017. These groups included the Colorado Division of Fire Prevention and Control and Colorado Fire Training Officer's Association. Together, this collaboration developed a nationally accredited technical certification program for tunnel rescue, as specified in the National Fire Protection Association standards.

Because CSM's mine rescue training focuses on advanced technical rescue skills, the program teamed up with local fire departments to help with the training. These included the Black Hawk, Golden, West Metro, Golden Gate, Hyland Rescue, and Denver Fire Departments.

APPENDIX: FY2017 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	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	T03	Occupational Safety and Health Training Project Grants
PAR-15-303	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 <i>Total Worker Health</i> [®]
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-14-002	E11	Cooperative Agreement on Global Occupational Health with the World Health Organization: Implementing “Global Plan of Action for Workers’ Health 2008–2017”

(Continued)

Funding Opportunity	Mechanism	Title
Cosponsored Research with the National Institutes of Health		
PA-15-269	R43, R44	PHS 2014-02 Omnibus Solicitation of the NIH, CDC, FDA, and ACF for Small Business Innovation Research Grant Applications
PA-16-302	R43, R44	PHS 2015-02 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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